D6.4: Stakeholder engagement

Regional committees

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2. List of Abbreviations

CCS	Carbon Capture and Storage
ENGO	Environmental non-governmental organisations
F2f	face-to-face
GDPR	General Data Protection Regulation
GR AT	Reflection Group "Adaptations and Territory" / Groupe de Réflexion “Adaptations et Territoire”
MMV	Monitoring, Measurement and Verification
RSC	Regional Stakeholder Committee
SSH	Social Sciences and Humanities
VRSC	Virtual Regional Stakeholder Committee Meetings
WP	Work Package

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3. Executive Summary

This deliverable provides an overview of the engagement workshops which were conducted by the Horizon 2020 PilotSTRATEGY project with various stakeholders in Portugal, Spain, France, Greece and Poland between 2023 and 2026. In each region two face-to-face or hybrid "regional stakeholder committee" (RSC) meetings were conducted. In the focus countries (Portugal, Spain and France), additionally two to four virtual stakeholder meetings were carried out. The RSC meetings followed a country-specific design to consider the specific situation in each region of PilotSTRATEGY as well as the stakeholders' needs, concerns and expectations. Across regions, a total of 20 RSC meetings were conducted in which about 300 stakeholders in total participated (double count if stakeholders attended two meetings). Thus, on average, 15 stakeholders participated in each RSC meeting. The stakeholders came from various parts of society (industry, research, policy, interest associations) and were selected and invited based on their relevance for CCS in the regions and to reflect the range of different views on CCS. A focus was set on local actors; however, national actors were also invited to participate. The RSC meetings were implemented by regional teams combining social scientists and technical partners – following the trans- and interdisciplinary approach of the PilotSTRATEGY project – to ensure appropriate methods for stakeholder engagement and at the same time include expertise on technical information from the project. Detailed reports of each RSC meeting are included in the annex.

Overall, the RSC meetings were successful in keeping stakeholders informed about the progress of the diverse regional study activities and, more importantly, to engage them and consider their views, concerns and needs early on in the process of assessing the future potential of pilot sites. The meetings were welcomed by the stakeholders. Especially, bringing together different views and perspectives from various stakeholders relevant to CCS technology and pilots was an asset of the meetings. The RSC meetings also highlighted stakeholders' need for reliable information (e.g., replies to many questions and experiences from already operating CCS sites) and to adjust to the local dynamics and potentially changing context (e.g., the impact of project-independent economic, political decisions, or upcoming elections).

After reflections on stakeholder composition (among other aspects), we conclude this report with recommendations for stakeholder engagement in CCS projects such as interdisciplinary project teams building lasting relationships and trust with stakeholders through reliable information, transparent communication, as well as continuous and serious consideration of concerns, questions and stakeholder information around CCS. We also acknowledge uncertainties inherent to local contexts, which cannot be controlled and further underline the need for transparency and trust.

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4. Table of Contents

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5. Aim of the Deliverable

This deliverable reports on the activities and results of Task 6.5 Stakeholder Engagement in the EU-funded Horizon 2020 project PilotSTRATEGY. The goal of this task was to develop regional stakeholder committees (RSC) as a central actor in the PilotSTRATEGY regions (e.g., building on relationships with stakeholders established in the project StrategyCCUS). These RSC were to be engaged in the discussions around a strategic development regarding Carbon Capture and Storage (CCS) in each region in all five countries assessed in PilotSTRATEGY, specifically in Portugal (Lusitanian Basin), Spain (Ebro Basin), France (Paris Basin), Greece (Western Macedonia), and Poland (Upper Silesia).

There were seven goals for the RSC: (1) to bring together various local actors from different areas of society, including relevant representatives from industry, universities, research centres, policy, public administrations, business associations, interest associations, and civil society (2) to explore the different points of view, expectations and concerns within the community regarding the PilotSTRATEGY project, and effectively (3) co-examine the conditions for implementing a CCS pilot in each region. It was hoped that these activities would (4) develop a network of stakeholders that can extend beyond this project, (5) eventually work together to build a realistic proposal for a CCS project in the region, and – in any case – (6) equip the participating stakeholders to act as informants in the region about the project and possible CCS plans. The RSC also provided a forum for (7) disseminating and elaborating the work of the PilotSTRATEGY project and its final results. While the term “committee” was used to name these discussion groups, it was not suggested that the RSC would constitute a regional or project-based decision-making body. The mission was clearly presented as one of mutual information and reflection.

In the following we report on the applied methodologies, the invited stakeholders as well as the results of the RSC meetings for each country. The RSC meetings were implemented in local languages and adjusted to match the local needs.

The present deliverable is structured as follows: First, we present overarching themes, materials and the structure developed for the RSC meetings across countries. Considering country-specific aspects, this part also includes a summarising table for each region (e.g., highlighting the main objectives of each RSC). Second, we zoom in on the regions, presenting an overview of the stakeholders and situation in each region followed by a short summary of each RSC meeting held. This second part is organized by country (beginning with Portugal, Spain and France as the focus countries in PilotSTRATEGY, followed by Greece and Poland). Finally, we zoom out again to provide reflections, conclusions and recommendations gathered across the RSC meetings in view of stakeholder engagement beyond the project PilotSTRATEGY.

6. Overview and General Structure of the RSC Meetings

Across regions, a total of 20 RSC meetings were conducted in which about 300 stakeholders in total participated (double count if stakeholders attended several meetings). Hence, on average, 15 stakeholders participated in each RSC meeting. Initially, it was planned to organize two personal RSC meetings in each of the five regions during the project’s lifetime. The first face-to-face RSC meeting was conducted towards the middle of the project; the second towards the project’s end (end of

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2025/beginning of 2026). To increase the level of interaction and to establish enduring relationships, in the three focus regions (in Portugal, Spain and France), additional virtual meetings were held once a year. These additional five virtual meetings helped to keep stakeholders updated on the project's progress in the focus countries. Due to local dynamics and changes, the structure was slightly adjusted when necessary.

Given the temporal overlap with the previous project StrategyCCUS (ending shortly after the start of PilotSTRATEGY), the final RSC meeting of StrategyCCUS was used to inform stakeholders about the extension of the activities. Figure 1 displays the initially planned framework of the conducted RSC meetings (face-to-face and virtual) and the distribution across regions. As mentioned, this was adjusted to local needs and the reality when implementing stakeholder engagement meetings.

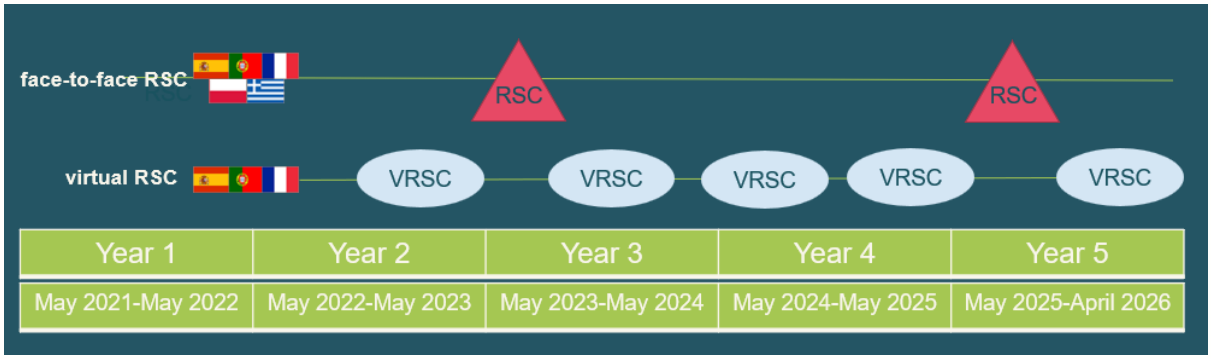

Figure 1 Initial framework of the RSC meetings

The closing RSC meetings in the focus regions will be held in 2026 after this deliverable has been completed. The project social and technical partners are already discussing their content and planning. In principle, these meetings may be conducted as broader regional stakeholder events. This closing RSC meeting will inform stakeholders about the final project outcomes, invite them for further interactions (also among each other) and thank them for their valuable insights and participation throughout the project lifetime.

Detailed reports of all the RSC meetings including all material and details of the PilotSTRATEGY dynamic are included in the annex, for deepening insight into CCS perception, stakeholders' questions and (critical) remarks, and/or conducting co-creation meetings.

6.1 Relevant people: The stakeholders and responsibilities between project partners

To establish sustainable committees, stakeholders relevant for the local context and the CCS pilots were briefly mapped and contacted. A focus was set on local actors, however, national actors were also invited to participate. We aimed at having a group of diverse and relevant stakeholders, not exceeding 20 people to ensure engaging interactions with and between stakeholders. Moreover, the group was to include members of different genders. We aimed to have representatives from the following stakeholder types: (1) local and regional communities such as local associations, civil society representatives, fishermen, farmers, (2) interest groups and NGOs such as CO_2 clubs, intermediary platforms, labour unions, industry interest groups, (3) politicians from local or regional administration as well as from national governments such as mayors, ministries, members of the

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government, and (4) representatives from regional / local industry regarding supply, demand and storage such as from heavy industry and energy generation.

Stakeholders were contacted via email based on established contacts from the previous project StrategyCCUS (implementing also RSC and regional events) and included also stakeholders who participated in the interviews conducted in Task 6.2 (see Duetschke et al., 2022) as well as contacts via further project activities in PilotSTRATEGY (e.g., local people met during the seismic data acquisition in France). Moreover, the invitation list was extended to further colleagues from stakeholders or associates recruited by stakeholders already registered for the first RSC meeting.

Before the first RSC, stakeholders were also called via phone or video conference (upon agreement) to establish relationships, outline the expected activity, and introduce key representatives of the PilotSTRATEGY partners. This also served the purpose of responding to questions and of gathering ideas and expectations. In some cases, the technical partners of the project and region participated in these calls to provide detailed technical information about CCS and the project.

Responsibilities within the project's consortium were distributed as follows: Fraunhofer ISI as **WP6 lead** developed draft agendas as well as goals for the meetings and provided methodological ideas as well as guidelines for selecting stakeholders, when needed. More importantly, the **social science teams** in each focus region (i.e., ICS University of Lisbon CIEMAT and Symlog) analysed the regional situation, adapted the agenda and methods to match the regional context, selected participants and conducted the RSC meetings in the local language. Moreover, they also documented meetings in English (see Annex) as well as often in the local language for the stakeholders. The "**technical partners**" (i.e., UEvora, IGME and BRGM – among others) supported the implementation of the RSC meeting strongly by providing relevant technical input about the project as well as assisting in the selection of stakeholders where needed. RSC meetings in the PilotSTRATEGY regions in Greece and Poland were conducted by CERTH and GIG-PIB with assistance of Fraunhofer ISI. In each region, one or two local representatives from one of the partners (most of the time from the social sciences partners in the focus regions) were established for the lifetime of the project. They served as a central entry point to provide information and as the main contact person for stakeholders.

6.2 Content and Material

The content of the RSC meetings varied across regions to account for local specificities – especially between the focus regions in Portugal, Spain and France on the one hand and the regions in Greece and Poland on the other hand. Similarly, the mode of conducting RSC meetings was partly adjusted as in some regions a hybrid event appeared more beneficial (than a fully face-to-face meeting; e.g. in Portugal, hybrid meetings have been in place to ensure the participation of national stakeholders). To match the region-specific needs, also the timing of the RSC workshops differed between countries – not only considering country-specific holidays and vacation times but also based on the content included from other work packages (WPs) and its availability.

What was common across RSC meetings was the overall format: We applied a **2–3-hour workshop format** to enable interactions with and between stakeholders, to hear their thoughts, concerns and needs, answer their questions and also to establish a durable network (among them). The general structure of the RSC workshops was the following: After a short welcome and round of

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introductions, the general objective of the RSC and the agenda were presented. Then, usually accessible presentations of scientific background and of PilotSTRATEGY project work were provided, followed by structured or free-form discussion. Moreover, established **social sciences and humanities (SSH) techniques** were used to ensure active engagement. This ranged from mentimeter polls in online meetings, brainstorming in subgroups (e.g., with post-its on white boards) and workshop formats including world cafés and active moderated stakeholder reflection. The applied SSH methods were adjusted per country to match the selected scientific content as well as the country-specific aspects of each RSC meeting. The RSC meeting then typically closed with a wrap-up including a summary of the main take-home messages.

Another common element of the RSC meetings was the use of consent forms prior to the workshop: To apply the project's ethical guidelines and GDPR requirements, all stakeholders participating for the first time in an RSC meeting received an **informed consent form** and signed it. The form requested agreement with the project's personal data protection and handling. It also presented the Chatham House Rule as a binding agreement of mutual confidentiality, intended to ensure that every participant could freely express themselves without fear of public citation. In some cases, stakeholders registered for the RSC workshops via a registration platform for this particular meeting including informed consent forms. For instance, all RSC meetings in Portugal employed a registration to the RSC through a Microsoft Office form which included information regarding participation, video recording, and data protection. In this case, all participants who registered confirmed being informed and gave permission for the video recording. If stakeholders did not complete the registration form (e.g., because they received the meeting link from their colleagues), the information regarding video recording and confidentiality was verbally reiterated at the beginning of the meeting. Implementing informed consent forms created a safe space for open exchanges[1].

After the meeting or toward the end of an RSC meeting, stakeholders were invited to complete an **evaluation questionnaire** to capture their experiences and perceptions of the workshop. The evaluation questionnaires applied were short (six questions max) and completing them was fully voluntary (as was the overall attendance in the RSC meetings).

Regarding **scientific dissemination content**, the RSC meetings and discussions were supported by carefully composed, highly accessible presentations. These were developed by the technical partners with feedback from the SSH partners. They reflected the multidisciplinary planning process that built up each agenda in light of both the questions and interests expressed by stakeholders, and the progression of the scientific work of the project. Such PowerPoint or text materials were made available to the stakeholders directly after the meeting and sometimes published in the regional section of the PilotSTRATEGY website.

In addition, **high quality dissemination material** was produced by the project's dissemination partner in consultation with the established WP7 Editorial Board, including WP6 partners. General documents produced upstream of the RSC included informational leaflets and posters about the project in the respective languages as well as a video and detailed FAQ sheets. Downstream,

[1] Notably, in some contexts, the widely known and applied Chatham House Rule is unfamiliar and was challenged in single cases. Some stakeholders regarded it not as a shared tool to create a safe space, but as potentially enabling incorrect information without accountability. The true character of the Chatham House Rule was explained in each meeting but in one case, in France, was not respected by those who chose to misinterpret it.

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partners provided text and photos for open newsletter articles, which further gave rise to editorial blogs about engaging the public. These diverse materials were available throughout the project lifetime enabling a common knowledge base, and also remain available beyond the RSC's lifetime on the project's website ensuring easy access for the stakeholders and any other interested parties. After all RSC meetings, reports developed by the country teams (consisting of technical and SSH partners) summarised meeting results (see Annex). In some cases, these reports are made available in local language on the project website. According to local needs and initiatives, additional material was developed by country partners, highlighting essential developments within the project. All stakeholders participating for the first time received the project's leaflet in the respective language (besides the informed consent form) and potentially further material. This ensured that participating stakeholders were familiar with the project and its progress.

6.3 RSC overview per region

In the following, we present an overview of the date and place, the number of stakeholders and the general topic or objective of each RSC meeting – separately for each country (see Figure 2).

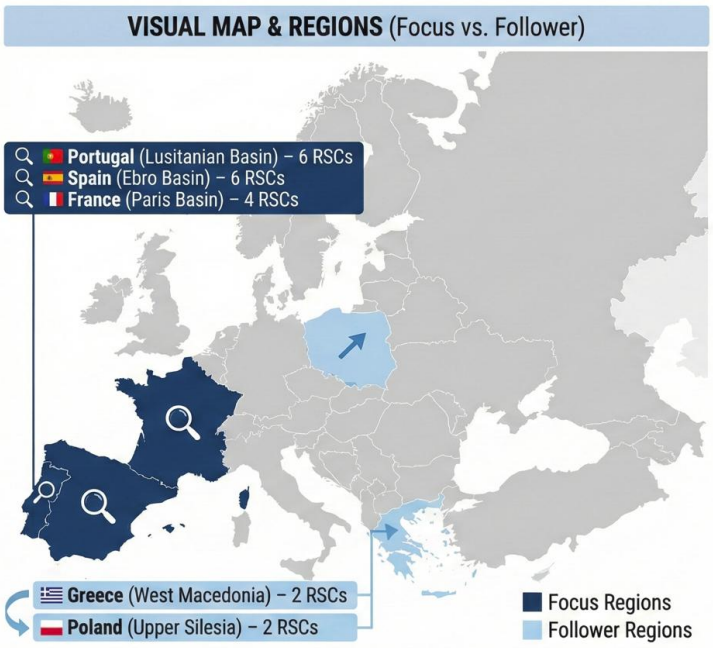

Figure 2 Overview of RSC meetings conducted per PilotSTRATEGY region.

In Portugal, six RSC meetings were conducted between February 2023 and December 2025 with a total of 108 stakeholders (including double-count, see Table 1). Of these six RSC meetings, four were pure online meetings and another two were realised as hybrid meetings. Besides the focus on local stakeholders and their relevant participation, the hybrid mode was justified by the fact that Figueira da Foz is not easily accessible for stakeholders from larger Portuguese cities (including Lisbon for national stakeholders).

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Table 1 Overview of RSCs in the Portuguese region

	RSC I	RSC II	RSC III	RSC IV	RSC V	RSC VI
Date	07.02.23	17.10.23	20.03.24	03.12.24	29.05.25	18.11.25
Place	online	hybrid at Figueira da Foz	online	online	online	hybrid at Figueira da Foz
No. of stakeholders	17	19	16	14	15	27
Main topic / theme	(1) impressions and doubts regarding the project; (2) perceived initial benefits and costs regarding the project	(1) updates about the project; (2) options for citizen engagement	(1) results of citizen engagement in Figueira da Foz; (2) collecting views, expectations and concerns related to a CO_2 storage pilot	(1) discussion on survey content; (2) presentation of existing CCS projects	(1) preliminary analysis of storage risks; (2) next phase of citizen engagement	(1) Results of the citizen engagement event and of the second survey; (2) detailed plan for CO2 transport solution during the pilot phase; (3) Monitoring, measurement and verification (MMV) plan

In the Spanish region, the project team conducted six RSC meetings, as initially planned, between January 2023 and October 2025. Three of the meetings were held in a face-to-face (f2f) format, three as online meetings. Since face-to-face meetings have been perceived as more interactive and valuable with the stakeholders relevant for the Spanish region, one of the RSC meetings in Spain foreseen as an online meeting was realised in face-to-face format. This responds to the fact that everyone involved in the first face-to-face RSC meeting in Spain experienced it as very valuable to meet in person. Between eight and 17 stakeholders participated actively in the stakeholder engagement format (see Table 2).

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Table 2 Overview of RSCs in the Spanish region

	RSC I	RSC II	RSC III	RSC IV	RSC V	RSC VI
Date	24.01.23	19.09.23	06.03.24	03.10.24	03.04.25	29.10.25
Place	online	f2f in Zaragoza	online	f2f in Belchite	online	f2f in Zaragoza
No. of stakeholders	14	11	17	13	8	9
Main topic / theme	Benefits and costs map	Perceived risks	Perceived trust	Community compensation	Lessons learned: The Hontomin case	Co-creation of a community engagement plan

In France, a total of four RSC meetings were conducted with 11 to 19 participants each. Two RSC meetings took place in a face-to-face format and two online (see Table 3). The reason for fewer RSC meetings than initially planned was significant changes in the context of the region and beyond. For instance, after summer 2025, campaign preparations started for municipal elections to be held in March 2026. Elected officials (a major stakeholder category represented in earlier RSC meetings) were reluctant to participate in meetings related to land-use topics. Nonetheless, the relationship between the project and stakeholders was kept constant and was further nurtured through bilateral exchanges with the key representatives of the project for the French region (including team members from BRGM and Symlog).

Table 3 Overview of RSCs in the French region

	RSC I	RSC II	RSC III	RSC IV
Date	10.03.23	26.09.23	18.11.24	20.02.25
Place	online	f2f in Grandpuits-Bailly-Carrois	f2f in Grandpuits-Bailly-Carrois	online
No. of stakeholders	19	15	18	11
Main topic / theme	(1) discussion on central points of the project and CCS, (2) identification of questions, other relevant stakeholders and sectors	(1) knowledge of the underground, (2) safety and risk assessment	(1) review of existing CCS policies and practices; (2) technical and stakeholder criteria to screen options for siting a pilot injection wellhead; (3) information and support needed over the next and final 18 months of the project	preparing the 2025 edition of the public perceptions survey

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As planned, in the regions in Greece and Poland two face-to-face RSC meetings were conducted to ensure stakeholder engagement. They were conducted in fall 2023 and end of 2025 or beginning of 2026. For more details regarding the place, mode (face-to-face or hybrid), number of participants and main topic in the regions in Greece and Poland, please see Table 4 and Table 5.

Table 4 Overview of RSCs in the Greek region

	RSC I	RSC II
Date	25.09.23	20.11.25
Place	f2f in Ptolemaida	hybrid in Ptolemaida
No. of stakeholders	19	26
Main topic / theme	discussion of survey results	(1) social acceptance and (2) risks of CCS

Table 5 Overview of RSCs in the Polish region

	RSC I	RSC II
Date	05.10.23	14.01.26
Place	f2f in Katowice	f2f in Katowice
No. of stakeholders	7	4
Main topic / theme	(1) development of CCS technology in the region - transformation paths and strategies	(1) potential deployment of CCS technology in Poland, with particular attention to regulatory, economic, geological, and social aspects

7. Zooming-in on the RSC meetings per Region

After presenting a short summary of the situation per region and the stakeholders that attended the RSC, we describe below the aim or main objective of each RSC, the applied methodology and the results – separately by country starting with the focus countries. The subchapters end with a short country-specific reflection.

7.1 Portugal

The chosen study region in Portugal is the Lusitanian Basin. The pilot was designed for implementation on an offshore storage prospect approximately 20 kilometres from the coast of Figueira da Foz, within a NATURA 2000 site. Thus, the marine ecosystem represents one of the key topics for discussions. Before the first RSC meeting a research-based decision was made for focusing

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on the offshore instead of focusing on the onshore site in Portugal. Prior to the decision, both options were assessed in detail by the project consortium. Duetschke et al. (2022, 2025) provide further insights into regional characteristics with regard to public acceptance in this region.

Based on the regional characteristics the Portuguese project team consisted of researchers from ICS University of Lisbon, UEvora and GALP, who planned and conducted the six RSC meetings, which are shortly described in the following subchapters. Table 6 displays the total number and distribution of stakeholder types, along with the gender distribution, that participated in the RSC meetings.

Table 6 Participants by type of stakeholder (Portugal)

Stakeholder type	RSC I	RSC II	RSC III	RSC IV	RSC V	RSC VI
National/regional government agencies	3	2	4	2	5	6
Local authorities	2	4	4	2	1	3
Companies/Business associations	8	6	6	7	6	13
ENGO	2	3	1	2	2	3
Other CSO (fishermen associations)	2	1	0	0	0	0
Academia	0	3	1	1	1	2
Total	**17**	**19**	**16**	**14**	**15**	**27**
Thereof women	*5*	*9*	*7*	*4*	*2*	*8*
Thereof men	*12*	*10*	*9*	*10*	*13*	*19*

7.1.1 Short summary of RSC 1

The first RSC in Portugal was held on February 7, 2023, in form of a two-hour online meeting. The main objectives of this meeting were (1) introducing and presenting the committee members, (2) presenting the PilotSTRATEGY project and the research on which the choice for the location of the CCS pilot in Portugal was based, (3) discussing first impressions and doubts about the project, and (4) exploring the perceived initial benefits and costs of the project.

After a round of introductions for all participants, presentations about the PilotSTRATEGY project followed, including details on why, where and how the project is being developed in the offshore area of Figueira da Foz. Also, the significance of CCS within the mix of technologies to mitigate climate change was explained. A discussion was held to fulfil the third objective, i.e. to gather stakeholders' first impressions about the PilotSTRATEGY project and CCS. The stakeholders took the opportunity to ask many detailed questions, which were answered by the project team. To explore

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the perceived initial benefits and costs of the project, participants were asked to share their thoughts by responding to a Mentimeter poll. Finally, participants were invited to use a Mentimeter poll once more to propose topics to be discussed in upcoming RSC meetings.

In this RSC, 17 stakeholders from 14 organisations participated (see Table 6). Since almost all participants were interviewed before the meeting (see Duetschke et al., 2022) and received both a leaflet about the project and a summary of the results of the first stage of the project, they were already fairly familiar with the project. At the end of the meeting participants were asked to fill in an evaluation questionnaire. Of the 17 stakeholders, 7 answered the questions. The stakeholders' feedback is shown in Table 7. Replies were possible on a scale ranging between 1 (strongly disagree) to 5 (strongly agree). Overall, the evaluation of the meeting by the stakeholders was very positive (almost the scale's maximum).

Table 7 Assessment of evaluation questions in RSC1 in Portugal (responses from 7 stakeholders)

Question	The presentations at the meeting were informative and allowed me to learn more about the technology and the project	The way the meeting was conducted allowed me to freely express my opinion	The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage
Average score / maximum score	4.71 / 5	4.86 / 5	5 / 5

The **discussion of stakeholders' first impressions about the PilotSTRATEGY project** revealed that CCS business representatives mainly mentioned concerns about technical issues and the advantages for the private sector. Environmental non-governmental organisations (ENGOs) inquired about climate change mitigation and risks. The fishermen's association expressed particular concern about the effects on fishing activities. Furthermore, participants provided valuable feedback for the project's next phases, including concerns from government agency representatives about the alignment of offshore CCS with maritime policies, the need for collaboration between the two different administrative regions, the importance of involving the Environmental Agency, and a concern from CSO of the fishermen association expressed his belief that this technology would not be applicable in rough sea conditions.

The stakeholders mentioned the following **potential benefits** of a carbon storage for the project:

- Job creation
- Economic development
- New industries
- Uses of the sea (in line with the national strategy)
- Sustainability, environmental image of the region; community engagement with environmental issues, regional role in climate change mitigation
- International visibility of the region

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- Scientific knowledge, technological development

As **potential risks** of a CO_2 storage site for the community the stakeholders mentioned the following:

- Conflicts between uses and activities in the sea
- Mistrusts and negative reactions from the population, NIMBY, accidents that can cause "antibodies" in a population that already feels punished by the sea
- Failure of the solution
- Environmental impacts, impacts on biodiversity, impacts in Natura 2000 sites
- Lack of knowledge
- Not involving the community
- Decrease in tourism activity
- Impacts in the construction stage (pipelines), expropriations

As topics **to be discussed in upcoming RSC meetings** the stakeholders mentioned the following:

- Public participation, non-technical communication, public presentation of the project
- Contribution to the blue economy
- Evolution of long-term CO_2 storage
- Examples of successful cases of carbon storage and transportation

This feedback on future topics was mostly implemented in the next RSC meetings.

7.1.2 Short summary of RSC 2

On October 17, 2023, the second RSC was held in Portugal as a hybrid meeting, face-to-face at Quartel da Imagem (a municipal building at Figueira da Foz) and lasted 2.5 hours. The two main objectives of this session were (1) to provide stakeholders with updates about the project and (2) to discuss options for citizen engagement (taking into account the feedback from the last RSC meeting).

Following an introduction round of all participants, an update of the technical work developed for the project was presented. This included the geological suitability of the geological storage formations to safely store CO_2, an animation of the preliminary model of the CO_2 plume dispersion over time, for both pilot and commercial scales and an explanation of the particular challenges posed by offshore storage as well as how some challenges will be addressed in a forthcoming research project. After the presentation, stakeholders were invited to ask questions or make comments. This led to a high number of questions from the stakeholders and required extensive replies by the project team. In addition to the verbal presentations, posters and a roll-up were displayed to inform the stakeholders about the PilotSTRATEGY project and other CCS projects conducted in Portugal. A brief presentation of the survey results regarding public opinion on CCS in the region followed (see Duetschke et al., 2022). To fulfil the second objective of this RSC, stakeholders were asked to share their recommendations for citizen engagement (see Duetschke et al., 2025) with coloured post-its on a whiteboard. Online participants were asked to write in the chat box. Specifically, the following questions were asked: (a) which members of the community should

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be invited to discuss the project, (b) what topics should be discussed and (c) how the discussion should take place.

19 stakeholders from 12 organisations attended the RSC meeting (see Table 6). Thereof 14 persons participated for the first time. However, stakeholders from 7 organisations attended both meetings. 5 persons joined online via Zoom. On the following day, participants were asked to fill in an evaluation questionnaire by email which was completed by 6 out of 19 stakeholders. The results of the evaluation questionnaire are shown in Table 8. Overall, the evaluations were again very positive.

Table 8 Assessment of evaluation questions in RSC2 in Portugal (responses from 6 stakeholders)

Question	The presentations at the meeting were informative and allowed me to learn more about the technology and the project	The way the meeting was conducted allowed me to freely express my opinion	The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage
Average score / maximum score	4.33 / 5	4.83 / 5	4.83 / 5

Regarding outcomes, stakeholders mentioned the following **questions and comments** after the presentations on geological suitability and challenges. Government agencies/authorities, ENGOs and the fishermen association expressed concerns in particular with leakage risks and monitoring procedures. Business representatives asked questions especially about government support to CCS and licensing but also had doubts about the conditions for using the Figueira da Foz port. The academics present raised attention to the particular conditions of the sea near Figueira da Foz (far rougher in autumn and winter than other locations where offshore CCS is carried out).

As **suggestions for citizen engagement** RSC members emphasised the need to reach citizens through intermediate structures of the community (authorities, associations, business, schools, journalists) rather than inviting random residents. They stressed that the topics should include both technical information about CCS (e.g. definitions of storage, explanation of the technology) but also an assessment of benefits, risks and impacts (e.g. impacts on fishing, the environment, the society, benefits of the technology). They recommended face-to-face meetings but relying on support materials (such as videos, leaflets, models, demonstrations).

After this second RSC meeting, all stakeholders (also from the first meeting) received a summary of the meeting results.

7.1.3 Short summary of RSC 3

The third RSC was conducted on March 20, 2024, as an online meeting which lasted 2 hours. The main objectives of this RSC were (1) to present and gather feedback about the latest findings and advancements related to the projects, particularly, the results from the citizen engagement event in Figueira da Foz, (2) to update the stakeholders on the general progress of the project and (3) to collecting their points of view, expectations and concerns related to a CO_2 storage pilot.

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After a round of introductions, a concise overview of the results obtained from the citizen engagement event (see Duetschke et al., 2025) held in Figueira da Foz was provided. Specifically, citizens' views focussing on their concerns about the proposed technology and its implementation in Figueira da Foz was outlined. The project team explained why it is important to receive these insights to understand the specific concerns related to the pilot area. Stakeholders had the chance to ask questions. Then, the technical work developed for WP3 was presented, focusing on the geological model and optimising the location for the injection borehole. In addition, the progress and strategic plans including the development of the pilot and its implementation strategies were explained (related to WP4). After the presentations, the stakeholders asked many questions which were answered by the project team. Finally, RSC members were asked to suggest topics for future meetings by using a Mentimeter poll.

16 stakeholders of 14 organisations participated in this RSC (see Table 6). Only two stakeholders participated for the first time, the others had attended previous RSC meetings. At the end of the meeting, stakeholders were asked to fill in an evaluation questionnaire. 11 (of 16) replies were received (see Table 9). Overall, the evaluation of the meeting was very positive (although the average scores are slightly below the averages of the last two RSC meetings). Two respondents left additional comments in the form. One mentioned that the presentation was excellent and the clarification timely. The second respondent expressed concerns about the project's objectives and the potential acceptance of CCS.

Table 9 Assessment of evaluation questions in RSC3 in Portugal (responses from 11 stakeholders)

Question	The presentations at the meeting were informative and allowed me to learn more about the technology and the project	The way the meeting was conducted allowed me to freely express my opinion	The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage
Average score / maximum score	4.45 / 5	4.64 / 5	4.55 / 5

The feedback of the stakeholders regarding the first **citizen engagement** activity included a suggestion to consider ongoing mobilisation agendas for decarbonisation, citing examples from the ceramic and glass sectors. Another stakeholder from an ENGO highlighted the significant knowledge gap which could contribute to a disconnection from the issue and may hinder citizens to participate in climate change solutions. Moreover, this representative also emphasised the need to consider citizens' views and the need for broader ecological approaches to climate change (e.g., ecosystem restoration) instead of focusing primarily on technological solutions. This led to a discussion on exploring a range of methods for carbon capture due to the critical nature of the climate situation and the importance of using various approaches in tandem, rather than relying solely on a single method. The challenge of engaging stakeholders was also highlighted. Specifically, it was mentioned that a project involving the CCDR Center and the OECD saw limited political participation from municipalities despite the urgency of the subject matter.

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Stakeholders' questions related to a CO_2 storage pilot are summarised in Table 10 indicating their expectations and concerns.

Table 10 Stakeholders' questions by types of stakeholders on a potential CO_2 storage pilot in RSC3 in Portugal.

Government agencies/authorities	▪ What Technology Readiness Levels (TRLs) are expected to be achieved with this project? ▪ Could the regulation of the technological free zone be relevant in terms of licensing?
Business representatives	▪ Will storage cost estimates include charges from the reservoir holders? ▪ Is there any information available from reservoirs that are further along in this process? ▪ How is the ownership of stored CO_2 managed? Does the CO_2 supplier rent storage space or trade the CO_2? ▪ In the event of a CO_2 leak, how are financial responsibilities handled? Is there a loss of carbon credits, and are there insurances available for this? ▪ Is seismic monitoring planned for the project?
ENGO/CSO	▪ Is biological, environmental, and ecological monitoring planned? ▪ Will the University of Évora lead this monitoring? ▪ What are the plans for the environmental impact assessment of the project? Who is designated to conduct this assessment? ▪ In terms of licensing, will the project follow the normal procedures for a project of this kind?

As **topics for future RSC meetings** the stakeholders suggested the following:

- environmental risks and impacts of CCS
- alternatives to CCS and their economic viability, and integration into the regional economic and social context
- more information on other case studies and experiences from other countries, especially real projects from northern Europe
- debating a life cycle analysis of the CCS process, comparing existing alternative solutions in Portugal, understanding emissions associated with CO_2 capture, transport, and storage, and clarifying the importance of CCS in long-term carbon cycles and its role in CO_2 removal

These topics were taken into consideration in the planning of the following RSC meeting.

7.1.4 Short summary of RSC 4

On December 3, 2024, the fourth RSC in Portugal was held online. It lasted 2 hours. The meeting aimed to (1) update national and local stakeholders on the latest developments of the project,

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particularly regarding technical aspects, (2) to discuss the content of the second survey and (3) to introduce presentations by two international specialists on offshore CCS projects.

The meeting started with an update on the progress of technical tasks of WP3, outlining key activities such as risk analysis, dynamic and static simulations, pilot design, environmental impact assessment, and seismicity monitoring. In the second presentation, an update of WP4 on pilot development and implementation plans was included. The design of two project phases was outlined: the pilot phase (3–5 years) and the commercial phase (scaling up with a pipeline). After each presentation a question-and-answer session followed. Then, after a short presentation on the survey, the stakeholders were invited to provide additional questions for inclusion in the second regional survey on social acceptance of CCS (see Duetschke et al., 2025). The next part of the meeting included presentations by two international specialists on offshore CCS projects currently operating in Norway and Italy. This was included in response to the feedback from previous RSC meetings, where stakeholders expressed interest in learning about existing CCS projects. A question-and-answer session followed.

In this RSC, 14 stakeholders from ten organisations attended (*Table 11*). All participants represented organisations that had participated in previous meetings. An evaluation questionnaire was shared with the stakeholders at the end of the meeting. The results of the 12 (of 14) responses are presented in Table 11. Overall, these stakeholders perceived the RSC meeting as very positive. Three respondents provided additional comments in the form. Of these, two praised the project team and the completed work and one posed a specific question on CCS.

Table 11 Assessment of evaluation questions in RSC4 in Portugal

Question	The presentations at the meeting were informative and allowed me to learn more about the technology and the project	The way the meeting was conducted allowed me to freely express my opinion	The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage
Average score / maximum score	4.67 / 5	4.5 / 5	4.67 / 5

During the **questions-and-answer session on the presentation of WP3,** a representative of an ENGO, who had not been present in the previous meeting, took the opportunity to raise some doubts regarding the technology. In particular, the stakeholder asked whether the studies conducted on the reactivity of CO_2 with the surrounding rock assumed that the CO_2 was already dissolved in water and in contact with the porous rock. This question was answered by the project team.

A representative from the Port of Figueira da Foz commented on the ships mentioned in the **update on WP4**. This stakeholder addressed potential misunderstandings regarding navigation and port infrastructure and provided valuable insights regarding port capacity. An ENGO representative sought clarification on the logistics of CO_2 transportation, specifically asking if the short-term plan involves using ships for transport one to two times per month before transitioning to pipelines, and whether the Port of Figueira da Foz can accommodate these ships given its current activities. This

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stakeholder also inquired if CO_2 would be stored on land before being transferred to the pipeline or ship for injection. The representative of the Port of Figueira da Foz clarified that ships are docked at the quay only while they are being loaded.

Regarding the next survey, stakeholders suggested the following topics and questions for the **survey** (see Table 12).

Table 12: Participants suggestions for the survey by stakeholder type

Local authority	▪ Include a question asking about alternative solutions the population considers safer, more feasible, or economically viable, should they oppose the CCS project.
ENGO	▪ Add an open-ended question about specific community concerns, such as impacts on the landscape, fishing, and other coastal activities.

An ENGO representative asked after the **presentation of the CCS project in Norway** why most of the companies participating in this project (e.g., cement and fertilizer companies) are not from the oil and gas sector. The expert explained that this stems from a decision by the Norwegian government to prioritize industrial carbon capture over oil and gas sector initiatives.

7.1.5 Short summary of RSC 5

The fifth RSC took place on March 29, 2025, as a 2-hour online meeting. The main objectives of this meeting were presenting (1) the final concept for the pilot, (2) the techno-economic assessment of the surface facilities, and (3) the preliminary analysis of storage risks. Another aim was (4) to gather feedback and input from participants to inform the next phase of citizen engagement in Figueira da Foz (see Duetschke et al., 2025) to help ensure that future activities reflect local perspectives and are aligned with community concerns.

After each of the three presentations mentioned above, stakeholders had the chance to ask questions to the project team and to make comments. The questions were answered and some comments clarified by the project team. The meeting was closed by a summary of the next steps for citizen engagement. Due to time constraints, stakeholders were asked to share their ideas for citizen engagement with the team by email.

15 stakeholder representatives from eleven organisations participated in this meeting (see Table 6). The group included stakeholders operating at the national and local levels, and represented the public, private, and third sectors. All participants represented organisations that had taken part in previous meetings. Represented national government agencies included the Directorate-General for Energy and Geology (DGEG), the Directorate-General for Natural Resources, Safety and Maritime Services (DGRM) and the Commission for Coordination and Regional Development of the Centre (CCDRC). Of the 15 stakeholders, 12 responded to the evaluation questionnaire which was shared at the end of the meeting. The stakeholders' feedback is shown in Table 13. No additional comments were left in the form. The overall evaluation by the stakeholders was positive, however, the average scores are slightly lower than in previous RSC meetings – most likely due to the time constraints toward the end of the meeting.

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Table 13 Assessment of evaluation questions in RSC5 in Portugal

Question	The presentations at the meeting were informative and allowed me to learn more about the technology and the project	The way the meeting was conducted allowed me to freely express my opinion	The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage
Average score / maximum score	4.63 / 5	4.38 / 5	4.5 / 5

Stakeholders' questions/ comments regarding the final concept for the pilot

- A representative of the Port of Figueira da Foz noted that the areas being considered for CO_2 offloading are currently unavailable and stressed the need to formalize site viability studies and specify operational requirements (e.g., ship type, storage area).
- The DGEG representative raised a regulatory issue regarding the storage limit defined in Decree-Law 60/2012 for pilot storage, which must be lower than 100 kt.
- The DGRM representative reiterated that no commitments can be made at this stage and formal processes are needed; this stakeholder expressed openness for a dialogue

Stakeholders' questions/ comments regarding the techno-economic assessment of the surface facilities

- A new representative from an ENGO (who had participated in previous meetings) expressed concern about long-term risks, referencing Norwegian NGO partners who question the guarantees of geological CO_2 retention. This stakeholder asked whether mineral carbonation (e.g., CarbFix) had been considered as a safer alternative.
- Another ENGO representative asked for clarity on the boundary between the research project and future commercial phases.
- The CCDRC representative reinforced that the current project's goal is purely scientific and preparatory, with any future implementation depending on external promoters and a full environmental impact assessment process.

Stakeholders' questions/ comments regarding the preliminary analysis of storage risks

- An ENGO representative welcomed the thorough technical approach but emphasised the critical role of active pressure management during injection. This stakeholder noted that while the geological seal is not inherently a weakness, it must be treated as a top priority to ensure system integrity. In addition, this person raised concerns about undetected faults, pointing out that international experience has shown these to be among the most difficult risks to anticipate and control. The stakeholder advocated for conservative injection rates and questioned the robustness of post-closure monitoring frameworks, given the long geological timescales involved and potential institutional discontinuity.

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- Another ENGO representative asked whether the project also considered risks associated with transport and harbour infrastructure.
- The DGEG representative mentioned that the European Union is preparing a directly applicable regulation on the transport of CO_2, which will facilitate the licensing process and require all Member States to implement it immediately.
- The DGRM representative raised concerns about the legal and institutional framework for long-term liability after site closure.
- The DGEG representative confirmed that this process is outlined in Decree-Law 60/2012.

The questions were answered by the project team. For details see more detailed report in the annex. A summary of the session, including links to relevant materials, was shared with all stakeholders.

7.1.6 Short summary of RSC 6

The sixth RSC in the Portuguese region took place in a hybrid mode at Quartel da Imagem in Figueira da Foz on November 18, 2025, and lasted 2 hours. The session focused on three main topics: (1) results of the citizen engagement event and of the second survey (see Duetschke et al., 2025), (2) detailed plan for CO_2 transport solution during the pilot phase and (3) Monitoring, Measurement and Verification (MMV) plan.

After the presentations mentioned above, the costs of drilling the injection well and seismic monitoring were shortly explained. All presentations were followed by a discussion. Questions and comments from the stakeholders were answered by the project team.

In total 27 stakeholders representing 18 organisations participated in this meeting (see Table 6). 14 took part in presence and 13 online. The group included stakeholders operating at the national (14) and local (13) levels, and represented the public (9), private (13), third (3) sectors and universities (2). Stakeholders from three new companies took part in the meeting due to contacts via the University of Évora. On the following day, stakeholders were asked to fill in an evaluation questionnaire by email. Overall, the feedback of 12 stakeholders who answered the questionnaire was very positive (see Table 14). Two additional comments were left on the form, one suggested conducting more technical sessions due to the project's importance. The other highlighted the presentations as "excellent".

Table 14 Assessment of evaluation questions in RSC6 in Portugal

Question	The presentations at the meeting were informative and allowed me to learn more about the technology and the project	The way the meeting was conducted allowed me to freely express my opinion	The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage
Average score / maximum score	4.5 / 5	4.75 / 5	4.67 / 5

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Stakeholders' questions/ comments regarding the results of the citizen engagement event and of the second survey

- Business stakeholders were mildly surprised by the high levels of acceptance of CCS, linking it to the absence of conflicting economic interests. They cautioned that one-third of indecisive respondents might turn into opponents as the project progresses. In response, a project team member explained that some opposition comes from people who believe that there should be other solutions to climate change, whereas sessions in schools show that young people are more in favour of technological solutions that mimic the natural process through which oil and gas are formed underground.
- Another stakeholder asked about the negative reactions to the project that were found in social media when the citizen engagement session was advertised.
- Stakeholders showed interest in more detailed results on the survey (e.g., understanding the reasons for acceptance/rejection). Thus, the project team will create and share a summary of the survey with more detailed results.

Stakeholders' questions/ comments regarding the detailed plan for CO_2 transport solution during the pilot phase

- Stakeholders first asked about the restrictions to direct injection caused by wave height, then about the amount of CO_2 to be inject and the impact it would have on emissions, considering that transportation also emits CO_2. One stakeholder clarified that most trains in Portugal are electric reducing transport emissions. The stakeholder then asked if trains would be necessary on the commercial phase or if all CO_2 will be transported via pipelines.
- Another business stakeholder pointed out that the estimation of costs does not consider the revenues that could exist from certified storage of CO_2 in a future market which could compensate the costs for ship rental.
- Further questions concerned the estimation of emissions caused throughout the process of capture, pressurisation, transport and injection (NGO representative), capture and injection costs (business stakeholder), the capacity of the reservoir and details of the monitoring process (another business stakeholder).
- Finally, a government agency stakeholder asked about the possibility to leave the ship on the injection site and use another ship to transport the CO_2 containers from the port to the injection site.

Stakeholders' questions/ comments regarding the Monitoring, Measurement and Verification (MMV) plan

- A business stakeholder started by asking whether the monitoring procedures were different from those used in oil extraction wells. A geologist from the municipal authority questioned the use of denominations of the geological formations that were not quite accurate.
- Another business representative asked whether the pilot stage was mean to start in 2030, with a first injection of CO_2 and asked about the commercial phase, when would it start and with how much CO_2 would be stored. A business stakeholder then asked about when a second well would

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be drilled. The discussion then moved to biogenic carbon and carbon from fossil fuels. Another stakeholder asked about the mineralisation of CO_2.

- An NGO representative asked whether the need for synthetic fuels was taken into account in the calculations of CO_2 to be stored.
- A business representative made a question about the costs of different uses of carbon would make it more or less appealing to industries, depending on regulation. Another stakeholder intervened to explain that synthetic fuels need electricity, and not all biogenic CO_2 can be used to produce fuels, since it would require huge amounts of renewable energy, so some need for sequestration will remain.
- A representative from a government agency talked about negative emissions and how they came to realise that CCS was essential to achieve carbon neutrality and European targets. That marks a change from the previous roadmap that did not consider CCS and it is based on studies that are currently being made. Natural carbon sinks are not sufficient for reaching neutrality in 2045, so studies such as PilotStrategy are necessary to implement climate policies. An NGO representative then questioned the intervention of the government agency representative, pointing out that that CCS is a policy option, not an inevitability, and that there are other actions that can be done to promote decarbonisation.

7.1.7 Country-specific reflection and evaluation

Due to the offshore location of the pilot, the number of representatives from organisations related to maritime activities was high (especially in RSC 1), although representatives from fishermen's associations decline to participate in meetings after RSC 2. In all RSC meetings, stakeholders had many (detailed) questions, for instance, on CCS and on the project's progress but mainly on technical issues. To adequately react to the questions, it was essential to combine technical partners and social scientists in the RSC meetings and its preparation. Besides their questions, stakeholders also provided information relevant for the projects. For instance, in RSC3, they provided valuable insights regarding their concerns and expectations, particularly about monitoring and licensing, whereas in RSC5 they offered valuable input on topics such as harbour capacity and regulation frameworks for CCS. Due to high interest, we included the presentations on examples of ongoing European offshore CCS projects providing context and practical references for stakeholders and, thus, fostering deeper understanding of CCS and its development. An overall positive aspect was that the events brought together local and national actors and stakeholders from various sectors. As indicated by the very positive results of the evaluation questionnaires across the RSC meetings in Portugal, stakeholders enjoyed the meetings – also highlighted by their active engagement in the discussions. RSC 5 marked an important milestone in the PilotSTRATEGY project. Notably, the engagement from environmental NGOs and national agencies increased in the last two RSC meetings. Hence, RSC 6 was the meeting with the highest number of participants, regarding individuals and represented organisations. This can be due to an increased attention from government stakeholders to CCS, as shown in the Talk with authorities' activity (WP1).

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7.2 Spain

In Spain's Ebro Basin, the focus has been on two small, historically depopulated rural municipalities—Belchite and Quinto in Zaragoza province. The proposed storage site at Lopín is situated a considerable distance from any major industrial CO_2 emitters. Before the first RSC meeting a research-based decision was made for focusing on the mentioned onshore site instead of focusing on an offshore site in Spain. Prior to the decision, both options were assessed in detail by the project consortium. Duetschke et al. (2022, 2025) provide further insights into regional characteristics with regard to public acceptance in this region.

The Spanish project team, consisting of members from CIEMAT and IGME, planned and conducted six RSC meetings based on the regional characteristics. Table 15 displays the total number and distribution of various stakeholder types, along with the gender distribution during the RSC meetings.

Table 15 Participants by type of stakeholder (Spain)

Stakeholder type	RSC I	RSC II	RSC III	RSC IV	RSC V	RSC VI
Industry	4	4	7	3	4	2
Research and education	1	1	2	0	0	0
Public Administrations	4	5	3	7	3	5
Support organisations	4	1	1	2	0	2
Influencers	1	0	4	1	1	0
Total	**14**	**11**	**17**	**13**	**8**	**9**
Thereof women	*8*	*4*	*10*	*4*	*3*	*3*
Thereof men	*6*	*7*	*7*	*9*	*5*	*6*

7.2.1 Short summary of RSC 1

On January 24, 2023, the first RSC meeting of Spain was organized as an online meeting, planned for 90 minutes. The main objectives of the meeting were (1) presenting the PilotSTRATEGY project and the study in the Ebro Basin, (2) discussing first impressions and doubts about the project, and (3) exploring the perceived initial benefits and costs of the project.

Following an introduction round, the PilotSTRATEGY project and its application in the Ebro Basin region was presented, including details on why, where and how the project is being developed in the selected region (Lopín). Furthermore, the significance of CCS within the technological mix for addressing the effects of climate change was explained. A discussion on the presentations followed. The PilotSTRATEGY project team answered stakeholders' questions. Afterwards the local community's perspective on the geological storage of CO_2 was presented. Hence, the stakeholders

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were provided with the results of the first survey of local citizens and interviews of key actors which were conducted in Tasks 6.3 and 6.2 (see for details Duetschke et al., 2022). A Mentimeter poll was used to learn about the stakeholders' perspectives on the perceived initial benefits and costs of the project.

In this RSC, 14 stakeholders participated (see Table 15). An evaluation questionnaire was shared with the stakeholders and completed by 6 participants after the RSC. Table 16 shows the results. Replies could be given on a scale of 1 (strongly disagree) to 5 (strongly agree).

Table 16 Assessment of evaluation questions in RSC1 in Spain

Question	I think the workshop discussions have been interesting	The way in which the workshop / committee has been carried out has allowed me to express my opinion	The people who have moderated the workshop / committee have not prompted any specific point of view about CCS technologies
Average score / maximum score	4.8 / 5	4.8 / 5	4.7 / 5

Initial impressions and questions by the stakeholders regarding the **project presentations** covered the following topics.

- Question about the probability of Lopín being selected as storage site
- Role of private companies in capturing and storing CO_2 in the study area
- Potential economic compensations for the local municipalities
- Potential interest in CCS technologies in the local industry
- Landscape, visual, agricultural and environmental impacts
- Need for information and engagement. Overall, participants in the session were quite receptive and expressed satisfaction with the opportunity to voice their concerns about the project.

As **potential benefits** of a carbon storage for the region the stakeholders mentioned the following aspects:

- Contribution to the reduction of CO_2 emissions from sources with dispersed emissions, including transportation, economic activities, and domestic use
- The possibility of generating economic and social benefits to encourage population settlement in rural areas (e.g. through generation of new infrastructures, employment opportunities, compensations with a positive socioeconomic impact)
- Public-private partnerships, such as the establishment of companies; economic advantages for municipalities, which in turn benefit local residents; the opportunity for companies in Aragon to access storage was emphasised as a significant factor

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The stakeholders named the following **potential risks**:

- Fear that too many storage projects will be implemented in the region (due to its favourable geological characteristics) and a significant amount of money will be invested without any benefit for the community
- Direct or indirect environmental and socioeconomic effects on the region (e.g. interference with existing forms of life, risks concerning economic, touristic and agricultural activities)
- Risks related to perception and social acceptance (e.g. the vision of being perceived as a "simple CO_2 dump", fear of living near a CO_2 deposit, conflicts between detractors and defenders)
- Perceived risks associated with the technology (e.g. lack of infrastructure for CO_2 transport, long and complex authorisation processes, the possible installation of polluting companies in the surrounding area)

7.2.2 Short summary of RSC 2

The second RSC meeting took place face-to-face at the Mayor's Office of Quinto (Zaragoza) on September 19, 2023, and lasted 3 hours. The specific objectives proposed for the session were (1) the presentation of the PilotSTRATEGY project, (2) the update on the work conducted regarding the Ebro Basin, and (3) the discussion on the perceived risks associated with the geological storage of CO_2. The objective of this committee was planned in response to Task 5.5 (Stakeholder Dialogue) of WP5 with the specific aim of understanding how stakeholders view the risks associated to CCS technologies.

After the presentation of the PilotSTRATEGY project updates in the Ebro basin region, stakeholders had the opportunity to ask questions. Then, a group activity was carried out. First, each participant had to identify different risks in relation to a possible carbon store in the region. Then, participants were grouped into three small groups to discuss the risks perceived by each of them. Subsequently, they had to rank the identified risks in a matrix considering two criteria: the importance and the controllability of the risk. To conclude the activity, a representative from each group had to present their results to all participants and place their risks in a joint matrix, which included the analysis of the risks from a global view including all three groups. After the group discussion, the Ebro Basin team presented the possible risks associated with carbon storage, an overview of the preliminary risk assessment in the region and possible control and mitigation actions. Finally, an interesting debate arose on this topic and discussion points were established for subsequent committee meetings. Questions were answered by the project team.

11 stakeholders participated in the meeting (see Table 15). Five new stakeholders (2 from industry and 3 from public administrations) attended the meeting, the others had already participated in the first meeting. At the end of the meeting, an evaluation questionnaire was completed by all stakeholders attending. The results are shown in Table 17. In addition, participants made several comments, mainly in relation to the importance of addressing the specific benefits of CCS technology for the region. Further comments were economic validation, real appeal to the industry, provide legal certainty, importance to study the socio-economic benefits and that a discussion of risks is needed. Some stakeholders praised the interesting meeting, others mentioned they would need more information to evaluate everything better.

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Table 17 Assessment of evaluation questions in RSC2 in Spain

Question	I think the workshop discussions have been interesting	The way in which the workshop / committee has been carried out has allowed me to express my opinion	The people who have moderated the workshop / committee have not prompted any specific point of view about CCS technologies
Average score / maximum score	4.8 / 5	4.9 / 5	3.8 / 5

The following section presents the results of the **integrated analysis of risks of all stakeholders**. The results of the three groups are described in the Annex.

- The stakeholders consensually identified a large number of risks in all three groups. The first of these refers to induced seismicity or earth movements. Participants used different terminologies to refer to the same risk, but they agreed to classify it as being of greater importance and less controllable. In fact, in two of the groups, was mentioned Castor as an event that is still present in people.
- The potential leakage of CO_2, as well as other polluting substances, is another commonly identified risk, although its perception of importance and controllability varied in different groups. Likewise, with respect to the contamination of other aquifers and hydrology in the region. The participants also mentioned the impact on flora, fauna and people, as well as on activities such as agriculture, livestock and industry. These risks were generally perceived as significant and more controllable.
- In the middle of the two criteria, in terms of importance and controllability, some participants mentioned the risk of geochemical alteration of the carbon storage and the seal. As well as uncertainties about monitoring and even the paradox of incentivising the use of fossil fuels versus CO_2 reduction.
- Finally, other risks that were also mentioned as less important and with different perceptions of controllability were: the possibility of attracting "only" polluting companies, the identification as a "contaminated" area, which could affect population fixation, and uncertainties about the real technical and economic advantages for the region.

After the presentation of the risk mitigation actions by the Ebro Basin technical team, participants discussed the following topics:

Seismic Risk	▪ Questions arose whether the seismographs will be removed when the base seismicity is determined.
Land Ownership	▪ The question was raised as to whether the land where the technology could be implemented is public.
Economic Viability	▪ The question arose as to whether, apart from the technical analysis, an economic analysis of the cost will also be carried out, which a priori seems to be going to be high. *"Capture, transport, injection, operation, maintenance, security control. Is this financially sustainable?"*

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Benefits for the local municipalities	▪ Key questions raised regarding the socio-economic benefits of CO_2 injection include the specific advantages for the region, potential financial compensation from the managing company, and the clarity of information provided to the public about risks and benefits. Additionally, there is interest in how the project could create jobs, compare economically to other energy projects, and help stabilize populations in depopulating areas.
Lack of regulatory development	▪ The need for regulatory advancement in storage laws was discussed to ensure fair profit distribution.
Clear information to the population	▪ Some participants mentioned the need to explain very well to people, so as not to generate the feeling of "*nuclear waste".* All information regarding technology, and especially the benefits for the region, must be made expressly clear in order to avoid negative perceptions in this regard.

7.2.3 Short summary of RSC 3

On March 6, 2023, the third RSC was held online and took 1.5 hours. The main objectives of this meeting were to (1) present the importance of trust in CCS projects, (2) assess the level of trust among participants in the context of a hypothetical CCS project, and (3) identify the main actions that could promote trust in the development of CCS technology projects.

Firstly, three concise presentations were given on the objectives of the RSC, updates on the PilotSTRATEGY project in the Ebro basin region of Spain, and the significance of trust in CCS technologies. The final presentation included real case studies demonstrating high and low levels of acceptance within the community, highlighting the crucial role of trust. The social research team applied Covello and Peter's[2] trust determination theory to both the content of the trust presentation and the subsequent activities presented to the participants to encourage discussion on the subject. Following the presentations, participants engaged in an activity using the Mentimeter tool. They were asked to evaluate a **hypothetical scenario** involving the implementation of CCS technology in the region. Participants assigned scores to the level of expected empathy, honesty, transparency, and competence. Finally, participants were asked an open-ended question to reflect on specific actions that the promoter and other stakeholders could take to encourage local confidence in the project.

In this RSC meeting, 17 stakeholders participated (see Table 15). The group welcomed nine new stakeholders, including three from industry, one from research and education, one from support groups, and four influencers. At the end of the session, an evaluation questionnaire was completed voluntarily by 8 stakeholders. Their feedback is shown in Table 18. In addition to the questionnaire results, participants suggested improvements for the RSC sessions, including more frequent updates on project progress and technical information. While one attendee expressed enthusiasm for future involvement, another recommended that case scenarios be presented more broadly to avoid

[2] Covello, V. T., & Peters, R. G. (1996). The determinants of trust and credibility in environmental risk communication: an empirical study. In Scientific uncertainty and its influence on the public communication (pp. 33-63). Dordrecht: Springer Netherlands.

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identifying specific companies “or even to have provided two examples, one from a company located in Aragon and the other from a company located outside”.

Table 18 Assessment of evaluation questions in RSC3 in Spain

Question	I think the workshop discussions have been interesting	The way in which the workshop / committee has been carried out has allowed me to express my opinion	The people who have moderated the workshop / committee have not prompted any specific point of view about CCS technologies
Average score / maximum score	4.25 / 5	5 / 5	4.5 / 5

Overall, the **stakeholders expressed** moderate to high levels of **trust** in the technical competence of the CCS project developer, but were more cautious about the developer's empathy, honesty, and transparency. Participants believed the local population would be even more sceptical, with lower levels of trust across all factors. Key concerns revolved around the siting of the project in an "empty" area rather than near major emission sources, the perceived dominance of oil and gas companies in CCS initiatives, and the need for more detailed technical, economic, and environmental information.

To address these trust-related issues, the stakeholders proposed several **actions for the project developer and other stakeholders to consider**. These included:

- Providing a clear and comprehensive justification for why CCS is the optimal decarbonisation approach for the cement plant, compared to other alternatives
- Transparently communicating the tangible local benefits of the project, such as job creation and revenue generation, using specific data rather than general claims
- Implementing broad-based public information campaigns involving all agencies involved in the project
- Publishing detailed environmental impact assessments and technical information in an accessible format
- Thoroughly explaining all safety measures and monitoring plans related to CO_2 transportation and storage

7.2.4 Short summary of RSC 4

The fourth RSC meeting was held in person on October 3, 2024, in Belchite and lasted 2.5 hours. The objectives of this session were threefold: (1) to reflect on the importance of community compensations within CCS projects; (2) to identify potential needs and compensations for the local community near Lopín; and (3), to discuss the socio-economic impact analysis of the PilotSTRATEGY project.

The session developed according to the following structure. An update on the PilotSTRATEGY project in the Spanish Ebro basin region and the importance of community compensations in CCS projects was presented. Then the project team conducted the following group activity. The first task was for each participant to identify the main needs of the region and write them individually on sticky notes.

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They were also asked to list the community compensations to a possible development of carbon capture and storage. The participants were then divided into three small groups to discuss the needs of the region and the offsets identified by each group. They were then required to locate the offsets according to the five criteria and finally rank the best ones with stickers. Following the group discussion, the project team presented its preliminary results of the socio-economic impacts of the PilotSTRATEGY project. This was followed by a Q&A session with the stakeholders, during which they raised many questions and made a number of final reflections. Upon conclusion of the session, participants proceeded to the arranged visit to the Lopín area, where they had the opportunity to observe the region and provide feedback.

In this RSC meeting, 13 stakeholders participated (see Table 15). The group welcomed four new stakeholders, one from the Directorate General for Climate Change and Environmental Education of the Government of Aragon, a new participant from a company, and a representative of the trade unions. At the conclusion of the session, participants were asked to complete an evaluation questionnaire on a voluntary basis. The feedback of 10 participants is shown in Table 19. In addition, the participants provided constructive feedback alongside questionnaire results, suggesting outreach to the town of Burgos for potential visits or presentations regarding the CIUDEN pilot project. Overall, attendees expressed satisfaction with the meeting's organisation and discussions, highlighting the interesting conclusions and their hoped-for positive impact. Finally, other comments were directed at suggesting information that should be included in future RSCs. It is worth noting the stakeholders' interest in learning about successful cases of CCS technology implementation.

Table 19 Assessment of evaluation questions in RSC4 in Spain

Question	I think the workshop discussions have been interesting	The way in which the workshop / committee has been carried out has allowed me to express my opinion	The people who have moderated the workshop / committee have not prompted any specific point of view about CCS technologies
Average score / maximum score	5 / 5	5 / 5	4 / 5

Based on the **group activity** and as a result of the **discussions** generated in the group, the project team made the following **conclusions**:

- The highest-priority financial measures favoured by the participants included tax benefits and incentives for local entities, while environmental compensation focused on habitat restoration and green space development. In terms of socio-economic development, stakeholders emphasised local employment opportunities, business attraction, and the establishment of a decarbonisation-focused R&D center. Quality of life improvements centered on enhancing health and education services, along with specialized training programs. Infrastructure priorities included transportation network improvements and the development of cultural facilities.
- A communication campaign to the population should be considered as priority in the event of a future implementation of this technology in the region. It is essential to communicate relevant project information in a transparent manner to avoid social fragmentation and encourage support for the technology. This should include information on the potential benefits and risks,

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as well as actual employment figures. It would be beneficial to disseminate information about successful projects in the vicinity (such as CIEDEN in Burgos) or further afield. It would be helpful to understand the impact these have had on local communities and the process of involvement.

7.2.5 Short summary of RSC 5

On April 3, 2025, the fifth RSC meeting was held online. It lasted one hour. The main objectives were to (1) foster a constructive dialogue about their perspectives, expectations, and concerns regarding the PilotSTRATEGY project and (2) to explore the Hontomín CO_2 storage pilot project and identify lessons applicable to the Ebro Basin.

The meeting started with an update on the PilotSTRATEGY project, covering both technical and social aspects. The core of the meeting focused on presenting and discussing lessons from the Hontomín CO_2 Project relevant to the Ebro Basin. A discussion followed. To encourage idea exchange, the workshop organizers posed a question to participants: "After learning about the experimental carbon storage experience in Hontomín, what key lessons do you believe are essential to apply or avoid in our pilot project in the Ebro basin?"

In this meeting, 8 stakeholders participated (see Table 15); no evaluation questionnaire was implemented.

The **discussion** highlighted **several critical factors for the successful implementation of CO_2 storage projects**, emphasising the need for a balanced approach that considers technical, social, and environmental aspects:

- Prioritise community engagement
  - Active participation from local communities is imperative for project success.
  - Fostering a positive reception and a sense of local "ownership" of the project among the population is essential.
- Implement effective communication
  - Clear, accessible, and ongoing communication is vital to prevent conflicts and misunderstandings.
  - Projects must ensure the local population easily understands the objectives, processes, and benefits, instilling confidence that the project is advantageous and not merely imposed.
- Build and maintain trust
  - Establishing trust within the community is fundamental for project acceptance.
  - Transparency, particularly regarding project data and results, is crucial for building and maintaining confidence throughout the project lifecycle.
- Address safety concerns proactively
  - Safety is a primary concern for local communities and must be treated as a top priority.
  - A comprehensive assessment of CO_2 transport methods to the storage site is necessary to identify and minimize potential impacts.

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- Conduct Environmental Impact Assessments
  - All CO_2 storage projects must undergo rigorous environmental impact assessments to identify, mitigate, and manage potential ecological effects.
- Deliver tangible community benefits
  - Projects should actively explore and deliver economic and social benefits for host communities.
  - Incentivising social acceptance can be achieved through additional benefits such as local job creation, infrastructure improvements, or other community-focused programs.
- Acknowledge and navigate technological and perceptual Challenges
  - While CO_2 storage technologies offer significant climate benefits, their implementation involves addressing specific challenges.
  - Openly discuss and clarify the real benefits to local communities, especially addressing concerns when CO_2 might be sourced from non-local companies.

7.2.6 Short summary of RSC 6

The sixth RSC meeting was held face-to-face in at the Directorate-General for Energy and Mines of the Government of Aragon, in Zaragoza. It took place on 29th October 2025 and lasted 2 hours. For this meeting, the research team aimed to co-create a community engagement plan in anticipation of a potential carbon capture and storage (CCS) project in the region. Two specific objectives were set for this meeting: (1) to foster dialogue between stakeholders and the technical team; and (2) to work collaboratively on the development of a community engagement plan focused on the following key aspects: (a) Safety and monitoring, (b) transparency and communication, (c) benefits and compensation (Local Development).

As in previous meetings, an update on the PilotSTRATEGY project in the Spanish Ebro Basin was provided. Before beginning the main activity, a short round of introductions was held. Finally, the activity was explained, and once the World Café exercise concluded, participants were invited to evaluate the session.

9 stakeholders attended the meeting (see Table 15). At the end of the session, participants were invited to voluntarily complete a brief evaluation questionnaire. The quantitative feedback is shown in Table 20. The qualitative feedback from participants indicates a highly positive perception, with respondents praising the excellent organisation, collaborative atmosphere, and the relevance of the project, reflecting strong engagement and overall satisfaction.

Table 20 Assessment of evaluation questions in RSC6 in Spain

Question	I think the workshop discussions have been interesting	The way in which the workshop / committee has been carried out has allowed me to express my opinion	The people who have moderated the workshop / committee have not prompted any specific point of view about CCS technologies

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Average score / maximum score	5 / 5	4.9 / 5	4.8 / 5

Based on this **dialogue between stakeholders and various team members**, the following **conclusions** summarise the key findings from each working group session.

- Safety and monitoring**:** Participants agreed that project safety must be accompanied by clear, accessible, and continuous communication. Transparency of data, direct engagement with citizens, and active participation of local actors were identified as key elements to build trust and legitimacy throughout the process.
- Transparency and communication**:** Effective communication is a fundamental pillar for achieving social acceptance of the project. Timely communication, clarity of messages, and accessibility of information were identified as key elements for building trust, fostering understanding, and preventing potential conflicts.
- Benefits and compensation**:** It was broadly recognized that the benefits of the project must be clearly demonstrated, fairly distributed, and sustainable for local communities. Local hiring, support for social initiatives, and direct economic compensation remain essential to securing community acceptance and long-term integration of the project within the region.

7.2.7 Country-specific reflection and evaluation

The regional team conducting the RSC meetings in Spain had the following reflections on each of the meetings: The first meeting went well and was perceived as a crucial step to involve local actors and hear their diverse opinions on the potential impact of PilotSTRATEGY. Already after this first meeting, stakeholders offered help in organising the next meeting (e.g., by providing locations for the face-to-face meeting). This was perceived as positive feedback regarding their perception of the project and the established relationships.

Regarding the second RSC meeting, the implementing project team mentioned that the meeting was valuable for the project and the face-to-face format facilitated more interactions and more engagement between the project's topic and the attending stakeholders. Thus, stakeholders suggested to have another face-to-face meeting (instead of an online meeting) and one of the mayors attending as a stakeholder offered to host it in their community. Contentwise, although stakeholders identified various risks (e.g., seismicity, leakage, impacts of flora, fauna, people and agriculture) and raised broader social and economic concerns, the meeting was perceived as a successful step forward in the project and the stakeholder engagement.

In the third online RSC meeting, trust was a central theme: By actively addressing this topic, the project team sees potential to foster greater acceptance and support of CCS from the local community and regional key stakeholders. Continuous engagement of the stakeholders in an open and transparent way was perceived as crucial for the long-term viability and success of the CCS initiative.

The reflection for the fourth RSC meeting resembled the third one: Community needs and required forms of compensation were central topics of discussion and could be addressed by an open

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dialogue with key stakeholders. Again, continuity, proactive actions and transparency appear to be central pillars for successful stakeholder engagement.

For the fifth RSC meeting, it has been reflected that not only continuous social engagement but also technical proficiency are key for accepted and successful CCS pilots. In addition, learning from other cases and experiences for future approaches appears relevant. A primary challenge is managing perceptions of safety and simultaneously, building trust among local residents. Therefore, project proposals should clearly demonstrate safety and tangible benefits for both the local population and the environment. To overcome these (potential) barriers, strong relationships with local communities and effective, transparent communications were perceived as central elements, aiming to ensure not only project safety, efficiency and success but also community well-being.

The sixth RSC meeting was perceived as an exceptionally enriching experience, for the project and the stakeholders participating. The interactive task between stakeholders and interdisciplinary members of the project team fostered a reflective dialogue that bridged expert perspectives on technology with the views and concerns of the local community. This exchange of ideas provided valuable insights and laid the foundation for collaborative understanding.

The insights gathered during the RSC meetings highlight the relevance of tangible, equitable, and sustainable benefits for local communities of CCS pilots such as prioritising local employment and training, establishing mechanisms for direct economic compensation, and supporting social, cultural, and environmental initiatives to strengthen community engagement. Equally significant is the role of inclusive dialogues among technical experts, project developers, and a diverse range of stakeholders, building transparency and trust. This also ensures that technological solutions are aligned with societal expectations and regional development priorities.

7.3 France

In France, the pilot study focuses on an onshore site located near Grandpuits-Bailly-Carrois in the Seine and Marne department, roughly 60 km southeast of Paris. This area, part of the Paris Basin, has extensive experience with subsurface applications due to decades of oil and gas activity. The site also includes a significant fertilizer production plant identified as a potential CO_2 source, along with established industrial infrastructure. Additionally, outside the project scope, the commercial operator C-Questra applied in 2024 for an exploration permit (PER). Insights into regional characteristics with regard to public acceptance in this region are provided by Duetschke et al. (2022, 2025).

The French project team, consisting of persons from Symlog and BRGM (with input as needed from IFPEN and Geostock) planned and conducted the four RSC meetings in a manner responsive to local demand. Two of them took place face-to-face in Grandpuits-Bailly-Carrois, i.e. within the project seismic investigation zone. In France, the RSC was called *Reflection Group "Adaptations and Territory"* (GR AT) to underline its research character, and distance any false notion of a decision-making mandate. The total number and distribution of various stakeholder types, along with the gender distribution during the RSC meetings is illustrated in Table 21.

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Table 21 Participants by type of stakeholder (France)

Stakeholder type	RSC I	RSC II	RSC III	RSC IV
Local residents	0	1	4	1
Local elected officials/local authorities	2	3	8	6
Local farmers, landowners	1	3	0	0
Local business associations	2	0	0	0
Local (or central-level) representatives of national environmental NGOs	4	1	4	2
National or decentralized public administration	4	1	0	1
Local industry	4	4	2	1
Scientific and technical organisations	2	2	0	0
Total	**19**	**15**	**18**	**11**
Thereof women	*6*	*2*	*6*	*2*
Thereof men	*13*	*13*	*12*	*9*

7.3.1 Short summary of RSC 1

The first RSC meeting, named "GR AT – Groupe de réflexion Adaptations et Territoire", was held on March 10, 2023, as an online meeting lasting one hour and forty-five minutes. The main targets of the meeting were (1) to present the PilotSTRATEGY project, (2) to initiate discussions about CCS and the project and (3) to identify questions as well as other relevant stakeholder roles and sectors in view of future invitations.

After an introduction round, the PilotSTRATEGY project was presented including an overview of CCS practices in the world. It was explained that the project is currently in the stage of site characterisation, involving preliminary data collection and analysis for a pilot permit application in France. Moreover, future project steps were outlined. Then, stakeholders were split into subgroups for a discussion which was conducted in a brainstorming style and moderated and reported by members of the project team.

During the discussions, stakeholders addressed what they considered to be "central points" of the presentation and project. They also identified questions, as well as the actors to whom these are addressed. These points and questions were explicitly noted for the future RSC meetings. Finally, the

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discussion collected opinions on recruiting other relevant stakeholder roles and sectors for future face-to-face events.

In this RSC, 19 stakeholders from 12 organisations participated (see Table 21): Some are directly related to the territory studied, others are directly concerned with the national CCS file or with industrial environmental compliance monitoring. After the meeting an online evaluation questionnaire was shared with the stakeholders. 13 stakeholders sent replies; four additional evaluations were shared by mail or phone. Overall, the evaluations showed that the opportunity to participate was appreciated. Especially well regarded was the discussion in small groups. Concerning the question "The facilitators did not attempt to advocate a single perspective on CCS issues," 10 out of 13 respondents to the online form (strongly) agreed, while three disagreed (though not "strongly.") Additionally, all but one of the 17 evaluations expressed the willingness to participate in future meetings. As open comments, stakeholders mentioned to receive information about risks and would like to receive feedback from a CCS project already in operation.

As a result of the discussion, the group identified the following **topics**, among others, as **particularly interesting for future development** (a detailed list can be found in the Annex):

- technical, environmental and economic explanation of the CCS option, including consideration of how citizens can be involved in analysing these criteria
- risks and benefits; and feedback from actual experience of CCS.

As for **relevant stakeholder roles and sectors to include in future face-to-face events**, stakeholders highlighted the importance of engaging farmers and their organisations, local citizens, environmental groups, and elected officials. Ensuring motivation and easy access for these guests is crucial. The stakeholders also requested the involvement of national NGOs focused on energy transition. Additionally, inviting CO_2-emitting industries, such as cement manufacturers, and CCS project managers to share their experiences was deemed valuable.

7.3.2 Short summary of RSC 2

On September 26, 2023, the second RSC took place in Grandpuits-Bailly-Carrois, which, is within the project seismic investigation zone and includes the site of LAT-Nitrogen, the industry volunteer for testing geological storage of CO_2. The face-to-face meeting lasted three hours. The main topics of the meeting were (1) how knowledge of the underground is developed by stakeholders and through research and (2) to present and discuss PilotSTRATEGY's safety and risk assessment for the region.

After a round table of introductions, the chronology of a typical pilot site permitting process and the specific chronology of the PilotSTRATEGY project were briefly presented. A presentation on knowledge of the underground followed, with questions expressed and discussed throughout. Manipulation of actual rock samples allowed participants to form a more concrete idea of the permeable and impermeable ground in the zone, and of their potential functionalities in view of creating a safe geological storage facility. Then, the approach on safety and the performance of CO_2 geological storage was presented followed by a discussion of CCS risks and benefits. Due to time constraints, some questions were postponed to future meetings. In addition, follow-up information was provided after the meeting.

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15 stakeholders attended the face-to-face meeting (see Table 21). Thereof 4 persons participated for the first time in an RSC (or in a parallel "open doors" event - see Duetschke et al., 2025). All four local industry participants worked for LAT-Nitrogen. An evaluation questionnaire was sent to the stakeholders one day after the meeting by email. It yielded 12 responses (out of 15).

- Ten persons found the discussion interesting, were able to express themselves, enjoyed participating in this reflection group, and would like to participate in the upcoming meetings. Of the two persons remaining, one chose a neutral midpoint, and another expressed disagreement or strong disagreement.
- Eleven agreed that the facilitators did not seek to promote a unitary view of CCS, whereas one person strongly disagreed.

Participants were asked to rate the element they most appreciated, and those they least appreciated.

- Most appreciated were the presentation-debate concerning knowledge of the underground, and the unstructured exchanges that concluded the day.
- The "ritual of two key words to remember", a quick roundtable at the end of the day, was least appreciated (probably because it was disrupted by the departure of travelers to catch the train).

The evaluation questionnaire also solicited free remarks, including advice on what should be improved, and themes that could be explored in future meetings.

- Negative Feedback: Disappointment over lack of young and non-elected participants[3].
- Requests: More detailed presentation of PilotSTRATEGY chronology (steps, decisions, dates).
- Positive Remarks: Encouragement for the PilotSTRATEGY team to continue stakeholder activities.

The project team received another feedback after the meeting, including sophisticated questions about the chemical aspect of the water/CO_2 mixture. The in-depth scientific and technical reply developed by project members was gratefully received and was circulated in a small NGO network. Overall, stakeholders appreciated high-quality presentations and the serious consideration given to questions. High engagement and interest were seen in the exchanges among stakeholders.

The debate about the **knowledge of the underground** raised several geological and technical questions but also questions regarding the political implications of CO_2 storage, including potential impacts on surrounding populations and the economic benefits of situating storage near CO_2-producing plants.

After the presentation on **safety and risk assessment**, stakeholders highlighted the importance of CCS in maintaining industrial activity and reducing emissions, with government support contingent on integrating CCS into broader decarbonisation strategies. Additionally, elected officials emphasised the need for comparative data on regional CO_2 emissions to facilitate informed decision-making, potentially fostering community acceptance by demonstrating the pollution reduction

[3] The organisers acknowledge that five persons in attendance were of retirement age, although each is still conducting professional activities. On the other hand, the elected sphere did not seem overrepresented, being 3 of 15 participants.

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benefits of the project. Furthermore, the presentation raised questions and comments on the following topics:

CO_2 storage safety: design of wells and their impermeability	▪ How many existing wells are found in the Grandpuits zone at this time? How is their location determined?
The Grandpuits zone as a potential storage site	▪ Would Grandpuits be the site of injection of CO_2 for storage? ▪ Would there be any nuisances, such as tanker traffic transporting CO_2 to be stored from other companies in France?
Risk analysis and prevention	▪ The PilotSTRATEGY risk analysis looks like classical danger analysis used in industry. ▪ Two types of question need to be distinguished: Risks faced during the exploitation period, and the probability of long-term leaks.
Strict European and French regulations	▪ How strict is the regulation? ▪ Is the PilotSTRATEGY study area large enough to obtain valid results?
Questions on risk and nuisances (sample)	▪ What are the dangers of CO_2 gas? Is it flammable? Is it explosive? Is it toxic to breathe? ▪ If there is a leak from the storage facility, is there any danger to the public? If there is a leak or fault, is there a way of plugging it quickly enough?
Regarding climate change and energy transition	▪ The storage solution must not be allowed to exonerate companies from reducing their CO_2 output!
Decision making and responsibility	▪ Who would be the repository operator, and who would manage storage over time? The industry? ▪ How would the authorities be involved?

7.3.3 Short summary of RSC 3

The third RSC was held as a face-to-face meeting in the town hall of Grandpuits-Bailly-Carrois on November 18, 2024, and lasted three hours. The meeting aimed (1) to answer questions identified during last meeting's introductory presentation (including detailed information on existing CCS policy and practice), and (2) to present and discuss the following topics:

- What might a pilot or permanent facility in this area look like? – presentation of WP4 work on optimising pilot options, including photographs from operating sites, followed by detailed discussion.
- What is a "favourable location"? What criteria and priorities should be considered? – presentation of model simulations and "quality mapping" performed by PilotSTRATEGY WP3, followed by open discussion of societal criteria.
- Relations with citizens: What information and support should be provided to citizens over the next 18 months of the PilotSTRATEGY project? – Reminder of selected survey results and open discussion.

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During the RSC, numerous questions were asked. These were answered immediately by the project team or afterwards via email with information material. For instance, elected officials requested information on compensation schemes; although this is not within PilotSTRATEGY's scope, WP4 researched regulation in related fields (oil, mining) and provided a summary of how compensation is typically calculated.

This RSC brought together 18 stakeholders and 7 project members from the French team (see Table 21). Before leaving the meeting, 9 stakeholders took the opportunity to anonymously fill out an evaluation form to share their opinions. The majority found the discussion interesting (2 "absolutely", 5 "yes"). One person found it "moderately" interesting. All said they were able to express themselves during the meeting (4 "absolutely"; 5 "yes"). To the question whether the facilitators refrained from "*promoting a single point of view on issues related to underground CO_2 storage*" the stakeholders generally gave a good rating (4 "absolutely", 1 "yes"), but one person was more reserved ("moderately") and two others did not give a rating. Participants most valued the presentation and discussion on the criteria for a favourable location (five attendees highly appreciating it), while two others mentioned the discussion on what a pilot facility might look like. Stakeholder comments included (1) the request for financial information of interest to communities and (2) emphasis that emissions reduction must take priority over technologies that can support polluting industries. Overall, all stakeholders enjoyed the meeting, with seven expressing a strong desire to engage in the next stage. Issues to address during the next meeting include potential well locations, reported accidents related to CO_2 transport or injection worldwide, and the number of similar sites in France.

Questions from stakeholders **on a pilot or permanent facility in this area** are listed below:

Restoration after a pilot drilling	▪ If a pilot drilling or injection is not followed up, what does "dismantling" mean? What remains on the surface? Is the hole sealed?
Financial aspect - Royalties	▪ In financial terms, what are the benefits of CO_2 storage for the communities concerned? How much rent do people receive for making their land available? What is the profitability and opportunity? ▪ Will the State be able to replicate the model of royalties associated with natural gas storage? ▪ How will this work for the public inter-municipal cooperation establishments (EPCI) concerned? ▪ What contribution should be made to take into account the fact that lorries drive on and wear down roads and bridges? Especially when there are not a large number of jobs created? ▪ If a storage tank is located under one municipality, but the surface installation is in another municipality at the head of an inclined well, are the fees distributed correctly?
Area of technical interest	▪ If there is a project after a test phase, with a concession granted by the State, will it be limited to the 100 square kilometres (10x10 km) specifically studied by PilotSTRATEGY? ▪ What are the local and regional emitters that exist nearby?

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Relationship between the project and the Grandpuits plant	▪ What is the project's stance on LAT Nitrogen's decision to cease CO_2 production? ▪ Wasn't the project designed with this emitter in mind? ▪ Will PilotSTRATEGY have to start its work again elsewhere? ▪ Was the company at all concerned about PilotSTRATEGY?

During the **second discussion**, on the **scientific criteria used to classify an injection wellhead location as "favourable"**, stakeholders identified two types of essential criteria: population (the number of people living in the area who may be affected) and environment (biodiversity and quality of life). They asked the following questions:

Criterion: "distance from existing wells"	▪ To identify a suitable location for a new CO_2 injection well, do you calculate the horizontal distance from existing oil or gas wells measured vertically?
Leak risk analysis	▪ Are you able to carry out leakage studies, estimate the quantity of gas that would escape and the associated pollution? ▪ Do we conduct hazard studies for leaks due to geological faults or well breaches (casing)?
Injection well inclination	▪ Is it possible to construct an injection wellhead within the factory premises, at a distance of 600 metres (linear, above ground) from the targeted underground reservoir?
Hydrological aspect over thousands of years	▪ If water flows through the Dogger aquifer, it will carry CO_2 at a rate ofone metre per year. We are talking about geological timescales here. In terms of space, we can be on a geological scale, and in terms of time, over thousands of years, it will come out.
Transport feasibility	▪ The carbon pipeline may impact residents along its route, particularly given that gas pipelines operate at a pressure of 40 bar and CO_2at 100 bar.

The third, shorter discussion gathered opinions on the information and support needed over the next and final 18 months of the project. In this final open discussion, an elected representative expressed concern over possible commercial motivations behind the application for an exploratory permit, further questioning why the state (rather than enterprises) should compensate local authorities. Local residents emphasised the importance of awareness-raising meetings and called for opportunities to voice their concerns and get clarity before official public consultations might be conducted during the permitting process, noting that licensing documents are often highly technical and difficult to understand.

7.3.4 Short summary of RSC 4

On February 20, 2025, the fourth RSC meeting regarding the French region was held virtually. The main aims of the meeting were (1) to analyse the 2022 public opinion survey and (2) prepare the 2025 edition of the survey.

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11 stakeholders and 7 members of the project team participated in this RSC (see Table 21). Of the 11 stakeholders, 8 filled out an online evaluation. All found the discussion interesting, felt they had expressed themselves, and said they would participate in future PilotSTRATEGY discussions. Free remarks showed that the opportunity to discuss social science data was seen as intriguing and valuable. Another remark, however, highlighted fundamental concerns about whether a CCS facility would fit into the region and the need to clarify uncertainties.

Upstream of the online meeting, participants had received a French-language report of the 2022 survey (see Duetschke et al., 2022). During the meeting, this report of 2022 results was reviewed item by item in light of the interests expressed by stakeholders.

This examination prompted requests to explain and justify the sampling strategy (panel), the quality of the sample (demography, representativeness), and the format of the short report (a narrative presenting majority percentages, leaving the remainder minority values to be calculated by the reader).

During the discussion on the **2025 survey,** stakeholders debated the pertinence of the 2022 questions and suggested to include new ones. They also discussed ways to expand the sample size, with one suggestion being that town halls could publish the survey link.

Subsequent to the meeting, the 2022 report was updated to a technical format, including the full text of each questionnaire item and all % responses. This document was sent to all stakeholders with permission to disseminate it further.

7.3.5 Country-specific reflection and evaluation

Overall, the RSC meetings in the French region were successful and well received by the stakeholders. In the **first meeting**, the stakeholders appreciated being approached as valuable informants for a European project, and the opportunity provided to build and diversify their own networks.

During the **second RSC meeting**, the presentation on the underground was very pedagogical and lively. The PilotSTRATEGY team combined structured transmission of highly technical information, and a constant attention to how people were receiving it, *balancing technical information and stakeholders' views*. Centering on stakeholder reception meant that the facilitator frequently asked what participants thought about each technical presentation, and which questions and remarks they had. This allowed many stakeholders to express themselves and to get clarification without having to interrupt the speakers. This approach led to a very positive atmosphere (initiating some humor indicating that stakeholders felt at ease).

Due to time constraints, the facilitator actively stepped in to streamline the discussion in case of slightly off-topic questions or very lengthy exchanges. Nonetheless, follow-up replies were provided after the meeting taking all stakeholder questions into account. The project team developed a short report (available on the PilotSTRATEGY website) detailing participants' questions and the replies received. A lesson learned was reducing the number of topics for one meeting and providing some elements in written form such as flyers and links for further reading. Of note, the French team organized 3 "Open Doors" meetings in between RSC meetings to address a larger audience and

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provide information revealed by the RSC to be of particular interest and concern (see Duetschke et al., 2025).

Attendance at the **third RSC meeting** reflected growing attention in the community to the CCS topic, following in particular the independent commercial application for an exploratory permit. The project team and the Grandpuits town hall reached out to a larger circle of elected officials to ensure representation of every township potentially affected by new project results. In this way 8 of 18 participants were elected persons. The influx of new participants meant that basic information had to be repeated, and some issues that had been thoroughly discussed at other dates were reopened. Nonetheless, the new attendees came up to speed quickly, and from their position of municipal expertise contributed valuable insights in particular to the discussion of societal criteria for siting a wellhead.

This session however marked a kind of turning point, since it was treated as an “open doors” meeting by some militant individuals (who had previously declined invitations, explicitly rejecting the Chatham House Rule) and now engaged in a monologue of disinformation. In the weeks and months after RSC 3, the regional dynamic changed under the influence of diverse factors. The RSC (and “open doors” meetings) up to this date were experienced as engaging, stakeholder-centred research contexts with a high degree of mutual trust and co-construction. However, disinformation about CCS risks and motivations (which had already existed) was now largely amplified throughout the territory by a small group (and their media contacts). The emergence of a commercial project was felt to muddy the waters, and finally the perspective of municipal elections put local council members into a vulnerable position.

In this context, **the fourth RSC meeting** was held online and centred on tools and concepts to better capture and understand local perceptions. The cooperative, co-constructive atmosphere was intact, but there was a strong demand to ensure that the 2022 survey results were reported in a manner that could be misinterpreted by no one, and to finetune the upcoming 2025 survey such that elected officials felt they could draw vital and reliable information from it. Responding as usual to the action points important to the stakeholders, the project team worked thoroughly to integrate new, requested questions in an updated survey instrument in conformity with the state of the art. In close collaboration with local administrators, a new extended and tiered local sampling pool was determined. A specific link was provided to town halls, allowing local residents to anonymously fill in the second survey. However, external pressures had probably built to the point that officials did not largely disseminate this link; it unfortunately received nearly no responses from the public.

The French team continued to exchange in mutual trust with the elected officials and NGOs who had followed the project developments from the start. However, in order to respect the delicate balance of contextual factors, according to the priorities of stakeholders, the team replaced a 5th RSC meeting by online interviews with the stakeholders in order to reflect together on the 3-year PilotSTRATEGY experience of dialogue and learning across the borders of discipline and roles.

7.4 Greece

In Northern Greece, the selected region is Mesohellenic Basin (MHB) situated in Western Macedonia and encompassing the industrial areas of Kozani and Ptolemaida. This region is characterized by low

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population density and offers storage resources from the Mesohellenic Trough. Deeper insights into regional characteristics with regard to public acceptance are provided in Duetschke et al. (2022, 2025).

The Greek project team consisted of people from CERTH who planned and conducted the two RSC meetings, which are shortly described in the following subchapters. Table 22 displays the total number and distribution of various stakeholder types across RSC meetings, including the gender distribution.

Table 22 Participants by type of stakeholder (Greece)

Stakeholder type	RSC I	RSC II
Research and education	3	8
Industry	1	3
Politics and policies	4	4
Support organisations	8	7
Local media	0	2
General Public	2	2
Tourism	1	0
Total	**19**	**26**
Thereof women	*5*	*11*
Thereof men	*14*	*15*

7.4.1 Short summary of RSC 1

The first RSC meeting in Greece took place in person on September 25, 2023, at C.E.R.T.H./C.P.E.R.I.'s premises in Ptolemaida. It lasted two hours and 15 minutes. The key themes of the session were the results of the project surveys on social acceptance of CCS and the discussion of these results.

Following a short introduction round and welcome (including a written greeting from a Greek Parliament member), CCS technologies, the project and the geological storage potentials in Western Macedonia were presented and discussed. Subsequently the survey results (see Duetschke et al., 2022) were showcased. The workshop concluded with a detailed, in-depth discussion of the survey results among the stakeholders. Participants freely stated their views on CCS and whether they believe it is a realistic choice in the area. Stakeholders participated actively: They were eager to discuss the survey results and CCS, asked many questions and initiated discussions. Following the meeting, attendees stayed at CERTH premises, divided into groups, and discussed CCS technologies,

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probable future stages in the research method, and strategies to promote them to the general public.

The workshop was attended by 19 stakeholders of 8 organisations from regional research, business and policy (see Table 22). Three stakeholders had attended an RSC meeting of the previous EU project StrategyCCUS. In addition, nine project team members of CERTH organised and participated in the meeting. At the end of the meeting, an evaluation questionnaire was shared with the stakeholders, 9 answers were recorded. Several comments were left in the questionnaire: Apart from positive feedback, participants requested more information on CCS projects in other countries. They noted that CCS could help reduce CO_2 emissions from thermal power plants, while questioning the feasibility of achieving ongoing CO_2 reductions through renewable technologies.

Table 23 Evaluation results from RSC1 in Greece

Question	Results
1. I found the discussion during the workshop interesting.	78% very interesting; 22% quite interesting
2. The way the workshop was conducted allowed me to express my opinion.	100%
3. I believe that the workshop organizers (CERTH) did not promote a particular view on CCUS issues.	56% felt no concise view was promoted; 22% felt it was promoted to some extent; 11% (one answer) stated it was promoted to a significant extent.
4. Are you interested in participating in a future workshop?	67% highly interested
5. Overall, how much did you enjoy this workshop?	67% highly enjoyable; 33% interesting

Stakeholders asked the following **questions during the discussions**:

- Are you sure that CCS technologies will help the local community? Have you done any kind of cost-benefit analysis?
- What will be the measurable impact? On health, on employment, on the environment?
- Are you sure that the area's geology is suitable for CCS technologies? Have there been any field measurements or studies to prove that the geology of the area is suitable for carbon dioxide storage?
- What are the plans for the Western Macedonia area if these geology basins exist?
- Can we have access to the telephone survey questions?
- What is the legal framework regarding CCS technologies in Greece?

The **discussions revealed the following results**. Most stakeholders found CCS, primarily, a solution for rapidly decarbonising Western Macedonia while keeping existing power plants operating during a smooth transition. In addition, some expressed concerns regarding the potential of carbon storage

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in Pentalofos and Eptachori. Specifically, they were worried about the existence of such underground geological formations, proposing extensive research in these areas or possible other storage sites, like in the Ionian Sea or Prinos basin, an oil field near Thassos Island. Furthermore, the matter of social acceptance arose and all of them agreed that the local citizens of the area, close to the storage sites, should be approached with caution and should be well informed regarding CCS technologies, while receiving some benefits and motivation from the Greek Government. Moreover, stakeholders suggested the Greek government's construction of a legal and legislative framework for CCS and highlighted the need to evaluate Greece as a prospective storage location.

7.4.2 Short summary of RSC 2

On November 20, 2025, the second RSC in Greece was held at C.E.R.T.H./C.P.E.R.I.'s premises in Ptolemaida in a hybrid format and lasted about three hours. The key themes of the session were (1) the project results on CCS in Western Macedonia, (2) social acceptance, (3) risks and a general discussion.

The workshop started with presentations on (a) the PilotSTRATEGY project and CCS technologies in Greece, the projects results on (b) geological approach and field research and (c) seismic data processing in the Mesohellenic Trough. Then, other European-funded projects were presented (CEEGS – Novel CO_2-based Electrothermal Energy and Geological Storage system" and POMHAZ – Post-Mining Multi-Hazards evaluation for land-planning). Stakeholders took the opportunity to ask many questions. Afterwards a concluding discussion on CCS in Greece followed.

26 stakeholders from the area's scientific, professional, and political sectors (see Table 22) and 10 project members attended the RSC meeting. At the end of the workshop, participants were asked to complete an evaluation questionnaire. 14 stakeholders provided feedback. The results were the following (scale 1-5, totally disagree - totally agree):

Table 24 Evaluation results from RSC2 in Greece

Question	Results
1. I found the discussion during the workshop interesting.	79% very interesting; 21% interesting.
2. The way the workshop was conducted allowed me to express my opinion.	79% totally agreed; 14% agreed; 7% neither agreed nor disagreed.
3. I believe that the workshop organizers (CERTH/CPERI) did not promote a particular view on CCUS issues.	64% totally agreed; 14% agreed; 14% neither agreed nor disagreed; 7% felt a view was promoted.
4. Are you interested in participating in the final event of the PilotSTRATEGY project?	79% highly interested; 14% interested; 7% neither interested nor not interested.
5. Overall, how much did you enjoy this workshop?	71% very enjoyable; 29% enjoyable.

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Regarding the presentations, a range of questions emerged from the participants, specifically on the following topics:

Technical Feasibility & Site Characterisation

- Geological Suitability: Clarification on how surface observations correlate to deep storage conditions
- Seismic Risk: Inquiry about potential for CCS operations to induce "substantial seismicity,"
- Data & Infrastructure: Questions about the source of seismic data and past exploration findings

Safety, Environment & Public Perception

- Leakage & Water Contamination: Concerns on safety of drinking water aquifers and CO_2 migration prevention
- Capture By-Products: Questions on the management of other captured gases (SOx, NOx)
- Public Trust: Scepticism regarding CCS as a genuine climate solution or a "license" for fossil fuel companies to continue operating. The need for absolute transparency and independent oversight in permitting was emphasised.

Regulatory & Economic Viability

- Permitting Challenges: Questions on difficulties in CCS permits across European countries.
- Integration with Renewables: Question on frequent legal pairing of CCS with geothermal energy
- Project Economics & Scale: Discussion on reduced CCS costs and implications for energy strategies

Local Application & Strategic Vision

- Utilising Existing Assets: Debate on CCS development for Greece's former lignite plants
- Regional Hub Potential: Exploration of Greece as a CO_2 storage hub for the Balkans or Eastern Mediterranean
- Practical Methodology: Requests for access to the risk assessment framework and the GIS-based decision support tool online

Infrastructure & Logistics

- CO_2 Transport: Questions about transport methods (pipelines vs. ships) and local traffic impacts

The concluding **discussion** expanded **on local concerns in Western Macedonia**, focusing on the potential application of CCS for the region's legacy power plants, such as the CCS-ready Ptolemaida 5 unit, and debated the economic and environmental rationale for potentially reviving lignite operations with carbon capture. The dialogue also touched upon Greece's potential role as a regional CO_2 storage hub for neighbouring countries, citing international examples like Iceland.

7.4.3 Country-specific reflection and evaluation

Both RSC meetings were perceived as highly effective in achieving the core objectives, disseminating CCS research and fostering critical, multi-stakeholder discussions. The presentations provided

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stakeholders with a solid knowledge base, facilitating to move the discussion from theory to practice. Technical team members were perceived as essential to answer the technical questions in depth, leading to informed discussions with and among stakeholders.

In the context of northern Greece and the Region of Western Macedonia, the discussions held during the RSC meetings were indicative of the strong influence of the lignite legacy of the region and the ongoing just transition on stakeholder perceptions of CCS. Geological suitability, induced seismicity, groundwater protection, and regulatory clarity were among the major concerns consistently raised, suggesting that technical credibility and institutional trust are key factors for social acceptance. An advancing maturity of stakeholder engagement and a progression of discussions are reflected between the two RSC meetings. In particular, it was documented that scientific evidence, transparent governance, and tangible local benefits favour a shift from general scepticism towards a more conditional acceptance.

For the project team, the RSC meetings presented important milestones since they provided valuable feedback from the stakeholders. Stakeholders were actively engaged in the RSC meetings and discussed the complex interplay of **science, regulation, economics, and social license**. This was indicated by the progress of the discussion moving from technical details to broader strategic and ethical considerations. Thus, the stakeholders noticed the multifaceted challenges of implementing CCS projects. Consequently, it was perceived that a continuous dialogue and further stakeholder mapping are essential elements for stakeholder engagement.

7.5 Poland

The Upper Silesia region in Southern Poland, known for its industrial centres like Katowice, Rybnik, and Bedzin, is Poland's most industrialized area. The pilot-scale CO_2 injection site is positioned north of this industrial zone, which includes a high concentration of potential emitters such as cement factories, steel mills, waste incinerators, and combined heat and power (CHP) units (see Ron et al., 2025). Duetschke et al. (2022, 2025) provided deeper insights into regional characteristics with regard to public acceptance in this region.

Drawing on the regional characteristics, the Polish project team from GIG-PIB organized and facilitated two RSC meetings, which are briefly outlined in the following subsections. Table 25 presents the total number and distribution of different stakeholder types, as well as the gender distribution observed during the RSC meetings.

Table 25 Participants by type of stakeholder (Poland)

Stakeholder type	RSC I	RSC II
Industry	2	2
Public administration	1	1
Local authorities	1	0
Policy makers	1	0

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Civil society organisations	1	0
Scientific community	1	1
Total	**7**	**4**
Thereof women	3	2
Thereof men	4	2

7.5.1 Short summary of RSC 1

The first RSC workshop was held face-to-face at the GIG-PIB headquarters in Katowice on October 5, 2023. It was planned for three hours. The main objectives of the meeting were (1) to update the stakeholders on the project and (2) on the survey results; the workshop was entitled "development of CCS technology in the region – transformation paths and strategies".

Following a short round of introductions, updates on the PilotSTRATEGY project and results of the survey on social acceptance in the region (see Duetschke et al., 2022) were presented. Subsequently, the survey results were discussed, and questions were directly answered by the project team. Two presentations (a) on determining the CO_2 storage potential in the region and (b) the current legal status of CC(U)S in Poland followed, providing insights into current changes in legislation. Stakeholders were highly interested in the latter. After a short break, the stakeholders were randomly divided into two groups for a discussion in an interactive workshop session. The main focus of the discussion was the issue of the common goal 'Planning of a potential CCS pilot in Upper Silesia', specifically, (a) pilot vs. commercial installations, (b) what are the key steps and (c) resources required to achieve the goal and (d) when will it be achieved. After brainstorming on a whiteboard, each group selected a representative to present the most important conclusions on the board. Afterwards, the workshop moderator closed the meeting with a short summary (take-home messages).

The meeting was attended by seven stakeholders (including four for the first time) plus six people from the project team (see Table 25). An evaluation questionnaire was shared with the stakeholders at the end of the meeting. All seven stakeholders completed the evaluation questionnaire. The qualitative feedback is shown in Table 26. Overall, the workshop was perceived as very positive. The only participant who did not express interest in attending the next workshop rated their experience as medium (=3). Open comments provided positive feedback. One stakeholder suggested expanding the discussions to cover other elements of the CCUS chain beyond CO_2 storage.

Table 26 Evaluation results from RSC1 in Poland.

Question	Results (Average score / maximum score)
1. I found the discussion during the workshop interesting.	4.4 / 5

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Question	Results (Average score / maximum score)
2. The way the workshop was conducted allowed me to express my opinion.	5 / 5
3. I believe that the workshop organizers did not promote a particular view on CCUS issues.	4.4 / 5
4. Are you interested in participating in the next workshop?	4.1 / 5 (6 out of 7 participants are interested)
5. Overall, how much did you enjoy the workshops?	4.6 / 5 (ratings from 3 to 5)

During the discussion **on the survey results**, participants raised the following questions and concerns:

- Did the surveyed people have previously been provided with information about CC(U)S?
- Why is there so much support for CCS technology in Poland (58%), if a large percentage of people (46%) have not encountered this issue before? Doubts arose whether people would respond equally enthusiastically to CCS technology if its implementation in the immediate vicinity became a fact. Then social protests were expected.
- By conducting an online survey, it addresses only a specific group of people with a higher social status who have access to a computer and the Internet.
- Why is there greater opposition in other countries to storing CO_2 offshore than onshore? These results are different from those reported by, for example, Eurobarometer.

After the presentation on **planning the CCS pilot in Poland,** stakeholders were interested in whether the areas in Podkarpacie with inexhaustible hydrocarbon deposits (Kraków-Niepołomice region) were considered in the project. There was also the proposal to minimize potential social conflicts, e.g. by building a CCS installation next to an existing refinery, avoiding CO_2 transport and related costs (compression, tanks, etc.).

After **presenting the current legal status of CC(U)S in Poland,** one of the stakeholders confirmed that the ministry is considering the possibility of storing CO_2 onshore, but it is still in work in progress. Introducing changes will probably take longer than expected due to the current electoral calendar in Poland and the results of the parliamentary elections on October 15, 2023.

The **results of the interactive workshop format** presented by representatives of each workshop group were very similar. Under current legislation, the requirements for both, pilot and commercial installations, were perceived as similar, differing mainly in project scale and financing mechanisms. The following topics were discussed for a CCS pilot in Poland.

- Security of the CCS process
  - Geophysical examinations of existing wells and monitoring the landfill area
  - Model injection capacity in terms of storage capacity and test overburden tightness

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- Consider establishing a pilot installation at a large site for scalability

- Economic aspects
  - CO_2 sources, transport costs
  - Monitoring after completion of the CO_2 storage process - at whose expense? Co-financing? The division of profits from the constructed CCS installation should take into account the income for municipalities and local communities, as is the case with waste storage.
- Social aspects
  - Need for social campaigns & benefits - building awareness of residents and decision-makers. Incentive (economic), job creation, safe location
  - Engage local authorities and technical professionals throughout the project
- Legal and administrative issues
  - Obtain necessary consents and permits
  - The need for a special act (lack of regulated transport issues)

Stakeholders emphasised the urgency of initiating most activities, particularly those related to legislation and public awareness (but also geological modelling, community engagement, risk identification, and infrastructure preparation). The installation design may then follow. The expected timeline by the stakeholders varied from 5 to 50 years for full implementation and monitoring.

Take-home messages of RSC 1 in Poland:

- It is necessary to conduct a large-scale social campaign aimed at providing residents with reliable information about CCS. The information should be specific and provided by reliable people who enjoy social trust and, due to their competences, may constitute an authority for people. At the moment, there are no authorities on which public trust in CCS can be built.
- Stakeholders suggested another detailed survey of the habitants after selecting specific locations of CO_2 storage.
- Regulation of legal issues and involvement of national and local authorities in the development of CCS are central for success.
- Finding a source of financing planning and creation of a pilot appears difficult, in the case of an industrial installation, it will probably be easier to find investors.
- Stakeholders suggested a systemic approach including competent people at every stage of the progress, starting from legislators through professional employees responsible for the technical side (geologists, designers, etc.).

7.5.2 Short summary of RSC 2

The second RSC meeting took place on January 14, 2026, in Katowice, Poland, at the headquarters of GIG-PIB. The meeting was conducted in a face-to-face format and focused on the potential deployment of CCS technology in Poland, with particular attention to regulatory, economic, geological, and social aspects.

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Following an introduction round, an update on the Pilot STRATEGY project was presented. Three thematic presentations were then delivered, addressing:

- the local potential for CO_2 storage in Poland,
- economic aspects of CCS implementation, and
- the current legal and regulatory framework for CC(U)S in Poland.

All presentations prompted active discussion and exchange of views among stakeholders. After a short break, the meeting continued with an interactive workshop session focused on discussion and a preliminary joint risk analysis related to CCS in Poland. The Slido.com platform was used to facilitate real-time interaction and anonymous input from all Stakeholders. Specifically, the following three questions were asked:

1. How would you rate your knowledge of CCS?
2. What emotions do you associate most with CCS?
3. Which safety issue is most important to you in the context of a CCS pilot project in Poland?

Despite repeated follow-up via e-mail and telephone only four external stakeholders (three participating for the first time) and six representatives of the GIG-PIB project team attended the meeting (see Table 25). After the meeting, all 4 stakeholders filled in an evaluation questionnaire (see Table 27), providing uniformly positive feedback. Stakeholders highlighted the strategic significance of CCS for Poland's industrial sector but expressed disappointment over the lack of attendance from representatives of potential CCS sites and key policy decision-makers, indicating a potential gap in stakeholder engagement.

Table 27 Evaluation results from RSC2 in Poland

Question	Results (Average score / maximum score)
1. I found the discussion during the workshop interesting.	5 / 5
2. The way the workshop was conducted allowed me to express my opinion.	5 / 5
3. I believe that the workshop organizers did not promote a particular view on CCUS issues.	4.5 / 5
5. Overall, how much did you enjoy the workshops?	5 / 5

Key discussion points of the different debates are noted below:

- Stakeholders raised concerns about the methodology of **social acceptance surveys for CCS** (Duetschke et al., 2025), such as small sample sizes and limited reproducibility across countries like France. Recent survey results may indicate a decline in public support for CCS, potentially driven by the influence of populist and far-right narratives that often criticize climate policies and decarbonisation technologies. This trend may contribute to increased skepticism and

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reduced trust in CCS, affecting the stability and comparability of social acceptance survey outcomes.

- Stakeholders highlighted that Poland currently has one of the most restrictive **regulatory environments for CCS development**, with even pilot projects facing significant compliance challenges due to extensive environmental and energy legislation.
- The debate on **economic and technical considerations** emphasised that the economic viability of CCS investments, whether pilot or commercial, largely relies on sustained high EU ETS CO_2 prices: incentives are crucial for competitive deployment.
- Stakeholders also underscored the importance of comprehensive geological characterisation and site-specific risk assessments before implementation, acknowledging that each potential storage site has distinct technical and environmental conditions.

Results on the workshop session

Despite their professional involvement in CCS, stakeholders reported varying levels of self-assessed knowledge: 38% rated their knowledge as very high, 25% as high, and 38% as moderate. Emotions related to CCS were mixed; positive feelings included interest in future deployment and trust in scientific expertise, while negative sentiments involved uncertainty, scepticism, and perceptions of greenwashing. Safety concerns were also divided, with the primary worry being the risk of CO_2 migration (33%), followed by insufficient geological characterisation and unclear responsibility (22% each). Individual participants also pointed to risks related to rock-brine-CO_2 interactions and to social factors, the latter were considered potentially underestimated. Stakeholders agreed that a dedicated risk assessment is required for each potential CO_2 storage location.

Take-home messages of RSC2 in Poland:

1. Economic viability of CCS investments (both pilot and commercial scale) is feasible only under conditions of sustained high EU ETS CO_2 prices.
2. A site-specific risk assessment is required for every potential CO_2 storage location.
3. CCS is not a “media-friendly” technology and lacks clear, immediate arguments that could easily foster positive public perception and local acceptance.
4. Delays in updating national regulations continue to hinder both scientific research and commercial assessment of potential CO_2 storage sites.

7.5.3 Country-specific reflection and evaluation

In both RSC meetings in the Polish region, despite resending invitations, only about half of the contacted stakeholders (50% response rate) were interested in participating in the RSC in Poland. Despite repeated e-mail and telephone invitations, none of the representatives of local authorities (potentially affected by future CO_2 sequestration in Poland) decided to take part in the event. A reason for the restricted interest and involvement raises concerns regarding the general perception of CCS in Poland and suggests that the technology is not yet widely regarded as a realistic or imminent option for implementation. While stakeholder engagement and discussion were of high

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quality, the low attendance highlights a persistent challenge for CCS development: limited institutional ownership and weak societal anchoring of the technology.

8. Conclusions on Stakeholder Engagement

The following section will provide overall reflections and conclusions on the conducted RSC meetings as well as recommendations regarding stakeholder engagement for a successful implementation in a team of social scientists and technical partners.

8.1 Overall reflections

Across RSC meetings, we noticed the following aspects:

- In almost each meeting, critical voices regarding CCS were raised and concerns were discussed. The interdisciplinary project teams conducting the RSC meetings were often confronted with questions about safety and risks. This highlights the relevance of high-quality information, technical expertise to answer the questions, trust in the key communicators in the region (potentially influencing the trust in the technology), and the relevance of social science methods to ensure transparency and honest consideration of the concerns, questions and thoughts to ensure that stakeholders feel heard and seen. From the early stage of project development, the relevance of communication strategies and a good planning to handle questions is central; even for stakeholders who are – to some extent – familiar and involved in CCS topics (compared to the general public).
- More importantly, different stakeholder types asked different questions. These questions mainly mirrored the stakeholder's interest and foci (e.g., questions regarding financial feasibility and economic aspects from businesses vs. the effect on the environment or the role of CCS regarding climate change mitigation from ENGOs). Consequently, it appears crucial (i) to bring together different stakeholders, (ii) to ensure serious consideration of the diverse range of aspects and (iii) to ensure all stakeholders feel heard to create trust and a sustainable relationship (see also above).
- In general, stakeholders were engaged, participated actively and appreciated the opportunity to come together with other relevant stakeholders for CCS topics. This is indicated by the high number of questions asked during (and after) the RSC meetings. This also demonstrates the need for reliable information and indicates some potential level of insecurity regarding the technology – even among CCS stakeholders. In line with this was the request in several regions for feedback on operating CCS cases and stakeholders' high interest in these other running CCS cases.
- The successful implementation of stakeholder engagement activities was facilitated by the combination of technical information, demonstrations and models as well as good communication strategies. Hence, the interdisciplinary character of the teams working together in each region was not only appreciated by the stakeholders but was also of high importance to provide successful workshops. The interaction with and between stakeholders and with the socio-technical team allowed to establish a dialogue as a tool for engagement, going beyond one-way communication. Transdisciplinary knowledge is built up, providing information to the

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stakeholders and communities while also enriching the project with regional perceptions and specific information.

- Although we aimed for an equal distribution of genders, most stakeholders attending the meetings were men (across regions). Only in two RSC meetings in Spain were more women than men engaged in the RSC meetings.
- Inviting national stakeholders and authorities to the RSC meetings appear valuable and corresponded to requests from both local and centralised actors; however, it also had its challenges. While they could provide additional inputs on subjects of concern to local actors (e.g., on legal aspects), national stakeholders were often harder to engage (e.g., more scheduling constraints, inconvenience of travel to the region required for face-to-face meetings). In some contexts, for future research, it could be envisioned to separate the different levels of stakeholders (e.g., only local vs. only national) to address convenience but also to ensure everyone feels secure to raise their voice.
- Although not all stakeholders relevant for CCS in the region were attending the RSC meetings (reasons unknown/potentially diverse), the project team remained open for their participation and reinvited them to always "keep the door open."

8.2 Recommendations for stakeholder engagement

Based on the results outlined above and our experiences within the PilotSTRATEGY stakeholder engagement across the five regions, we derived the following seven recommendations.

Do it! And do it early on!

We experienced stakeholder engagement to be very valuable and received corresponding feedback from participants. Involving the stakeholders early on in the process indicates respect for their role, keeps them informed, and can foster continuous exchange to establish sustainable relationships (also among stakeholders).

It is a two-way street

If you engage with the relevant stakeholders for CCS in the region, it is not only you providing information. The stakeholders will share valuable information for the further progress: For instance, about the conditions under which a CCS facility could become part of the region and provide guidance on options and aspects that can be adjusted within technical limits. Considering and knowing the local context very well is key for a successful stakeholder selection and engagement. In planning agendas, asking stakeholders for topics and relevant questions has proven to be appreciated, and must lead to team commitment to follow up if not in subsequent meetings, then by other means (e.g., written information).

Stay flexible for local dynamics

The local context and its specific features should be mirrored in the implementation of the stakeholder engagement. Moreover, it is crucial to adjust the planning to local dynamics and changes that (may) occur as the project unfolds. Hence, grounded knowledge of the region, a good connection to the local context (through informed key persons with whom a respectful relationship

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is established), open internal communication, and flexibility are important qualities for the team implementing stakeholder engagement.

Choose your words wisely

Not only for stakeholder engagement reflected and transparent communication is essential (e.g., science-based research project, choosing a name for the meetings, trying to avoid the promotion of a one-sided view); stakeholders also highlighted that the communication for the general public needs to be adjusted to the respective concerns, knowledge and other local specificities.

Interdisciplinary team working hand in hand

Combining social science and humanities on the one hand and technical expertise on the other hand was perceived as valuable for the success of the workshops. It ensures that technical questions from the stakeholders can be answered appropriately while simultaneously fostering productive, mutually satisfactory implementation of the workshop and active engagement supported by participatory methods.

Key agents to build lasting relationships and trust

For a successful stakeholder engagement, it is central to have one to three key agents who function as the primary contact person for the stakeholders in the region. They should have a good social understanding of the situation and be present in the meetings to answer questions with transparency and honesty (without promoting a one-sided view). This does not only lead to lasting relationships but also builds trust within the respective team.

Empowered intermediaries for the general public

A successful stakeholder engagement has further impact: The stakeholders themselves feel empowered and serve as CCS informants, according to their respective interests, in the region. They can explain the steps along the way if approached by the general public. Moreover, they form a basic grasp of both technical issues and local priorities that will serve in municipal debates or in formal state consultations. However, it must be acknowledged that until a CCS project reaches a stage of concrete local planning, CCS is a small part of stakeholders' lives. This means that constancy, responsibility, accountability and transparency from the researchers take on even higher value in the perspective of a sustainable relationship.

On a more general note, the following two means could be implemented for stakeholder and public engagement:

- Creating public forums or regional mechanisms through which citizens, NGOs and other stakeholders can engage with a CCS project across its lifetime (and beyond), for instance, on safety questions or social implications.
- Developing a long-term vision for stakeholder and public engagement integrated into national climate strategies, beyond individual projects.

To summarise, it is important that stakeholder engagement is not perceived as convincing stakeholders on (certain options of) CCS. Instead, stakeholder engagement should aim to provide a platform for exchange on scientific evaluations, ensuring transparency and building trust. This is an

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important basis for taking socially accepted decisions on local and regional pathways for decarbonisation - including CCS or not.

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10. Annex

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D6.4: Stakeholder engagement

Regional Committees

- Annex -

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Table of Contents

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

A. Annex

A.1. Regional Stakeholder Committees (RSC)

A.1.1. Portugal

A.1.1.1. Report of RSC 1

A.1.1.1.1. Introduction

On the 7th of February 2023, between 10 and 12am, the first Regional Stakeholder Committee (RSC) meeting was held in Portugal (online) as part of the PilotSTRATEGY project. The purpose of the RSC is to bring together various actors, including representatives from industry, local, regional and national public administration, business associations, environmental NGOs and civil society to explore the different points of view, the expectations and concerns regarding a CCS pilot offshore, near the coastal city of Figueira da Foz. The goal was also to develop a network of stakeholders that can extend beyond this project and work together to build a realistic proposal for a Carbon Capture and Storage (CCS) project in the region while reporting on the achievements of the PilotSTRATEGY project and final results.

17 stakeholder representatives from 14 organisations participated in the first meeting of the committee (Table 1). The group of participants was fairly diverse, including stakeholders at the national (10) and local (7) level, from the public (5), the private (6) and the third (6) sectors. Due to the chosen location for the pilot, we had a high number of representatives from organisations connected to maritime activities. 5 participants were women, 12 were men.

Table 1 Participants by types of stakeholders

Stakeholder Type	Organisations	Participants
National/regional government agencies	3	3
Local authorities	2	2
Companies	3	5
Business associations	3	3
ENGO	2	2
Other CSO (fishermen associations)	1	2
Total	14	17

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Several objectives were proposed for the session, including introducing and presenting committee members, presenting the PilotSTRATEGY project and the studies underpinning the choice of the location for the CCS pilot, discussing first impressions and doubts about the project, and exploring the perceived initial benefits and costs of the project. Since almost all participants were interviewed before the meeting (Task 6.2) and received both a leaflet about the project[1] and a summary of the results of the first stage of the project[2], they were already fairly familiar with the project. Although a representative from GALP attended the meeting, he had little intervention in the presentations and discussion.

The meeting followed a structure closely derived from the Spanish 1st RSC meeting. It started with a welcome and introduction to the Regional Committee and the objectives of the meeting by ICS. Afterwards, all participants introduced themselves and the organisation they were representing, as well as what motivated them to participate in the RSC.

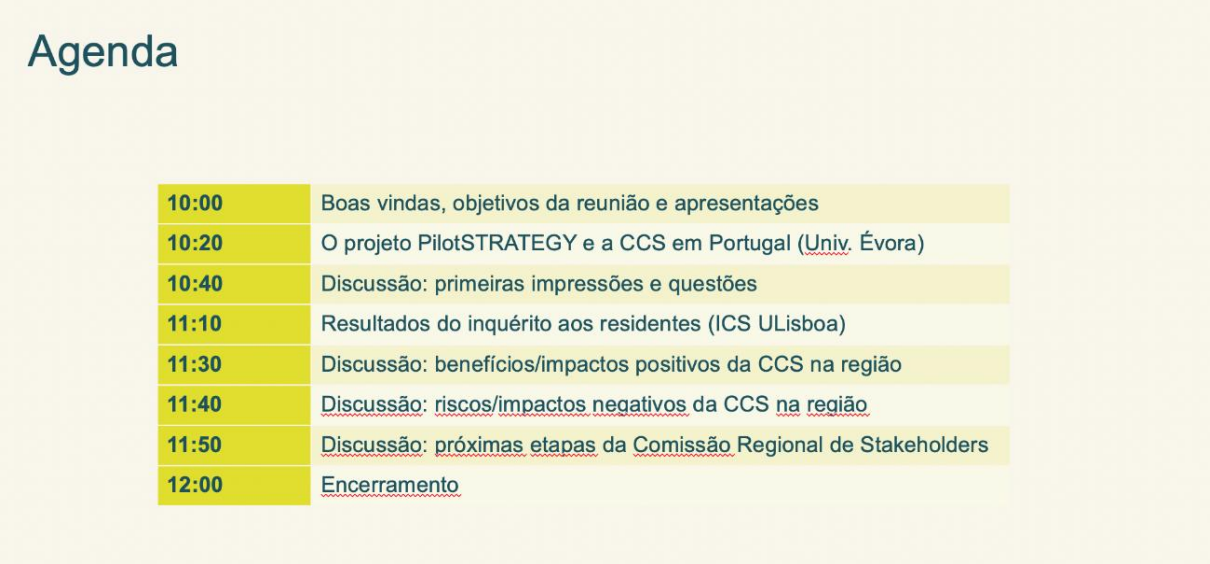

Figure 1 RSC Meeting Agenda

Next, Júlio Carneiro (U. Évora), as coordinator of the Portuguese teams on PilotSTRATEGY project, presented the PilotSTRATEGY project and CCS technology, including why, where, and how the project is being developed in Portugal. Discussions were held to gather first impressions, mostly in the form of questions from participants. A planned presentation of the results of the community survey was skipped as a result of insufficient time, due to the high volume of questions and the length of the discussion. Participants were then asked to share opinions on the benefits and risks of CCS for the region (through Menti polls) and finally to make suggestions for topics to be addressed in

[1] The Leaflet included information on the aims of the project, CCS technology and the areas under study in Portugal. This leaflet was sent to all the stakeholders before the interview.
[2] The summary of the results was a document consisting of three pages. It provided information about the reasons behind the selection of the offshore location for the pilot site, as well as the findings derived from interviews and survey. This summary was distributed to all the participants prior to the RSC.

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the next meeting. The meeting was held online, through the Zoom platform, and recorded, after obtaining consent from participants[3].

Overall, the first RSC in Portugal was a crucial step in the PilotSTRATEGY project's progress, facilitating the involvement of local actors and gathering diverse perspectives on the project's potential impact.

A.1.1.1.2. PilotSTRATEGY project presentation

The Coordinator of Lusitania Basin work presented the general purpose and scope of the PilotSTRATEGY project, the relevance of carbon capture and storage (CCS) within the mix of technologies to mitigate climate change, and some examples of successful implementation of CCS in the world. He then underlined the relevance of CCS in the national context (based on STRATEGY CCUS results), before proceeding to explain the selection of the offshore area in Figueira da Foz as the most suitable location for a pilot. He then detailed the next steps in the PilotSTRATEGY project.

Figure 2 First slide of the presentation in the RSC meeting

After the presentation, RSC members were invited to ask questions or make comments. Most opted for asking detailed questions which were replied to by members of the U. Évora team. Table 2 summarises the questions asked by participants in the meeting, by type of stakeholder. Business representatives were more concerned with technical issues and the participation or benefits for the private sector. ENGOs asked questions about climate change mitigation and risks. And the fishermen association was particularly worried with the impacts on fishing activities.

[3] Registration to the RSC was made through a Microsoft Office form which included information regarding participation, video recording, and data protection. All participants who registered confirmed being informed and gave permission for the video recording. Four participants did not complete the registration form and instead received the meeting link from their colleagues. Nevertheless, the information regarding video recording and confidentiality was verbally reiterated at the beginning of the meeting for all participants.

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Table 2 Participants' questions by types of stakeholders

Business representatives	How is CO_2 captured in the factories? What role/contribution could my organisation have in this project? Will there be a roadshow to present the project or technology to companies? Can a start-up company emerge from this project? How does CCUS technology compare to nature-based solutions for capturing CO_2? What will the pressure at the storage site be? Will the process for CO_2 transportation and injection need compression? With what kind of equipment? Will the transportation of CO_2 be carbon free? Part of the captured CO_2 is expected to be used: in what way? In what state will the CO_2 be and how will it expand from liquid to gas? Why hasn't the ceramics sector been considered for carbon capture?
ENGO	How much CO_2 is expected to be stored in Portugal? What will the price by CO_2 tonne? How will the monitoring of the storage will be done? How is it being done in active CCS sites? Has there been any problem with seismic risk? Has there been any leaks in existing storages? If CO_2 will be transported by pipeline, is the location of the corridor already defined and takes into account territorial planning and other projects for the region (e.g. solar farms)?
CSO (fishermen associations)	How frequent will be the seismic monitoring? What restrictions will a CCS well inflict on fishing activities? How large will the restricted area be?

Some participants also made comments that are particularly useful for the next stages of the project. One of the government agency representatives raised doubts that offshore CCS would be in line with current policies of preserving the sea (not using it to store pollutants) and reducing carbon emissions of maritime activities. He underlined the fact that CCS is not foreseen in the current maritime spatial plan and in the national strategy for the blue economy. This project would have to demonstrate that private use supersedes common use, which is necessary for the use of maritime space and to establish that this is a public interest project.

The other government agency representative called attention to the fact that the study area covers two regions, under different administrative bodies, that should also be involved. He also pointed out that the term "environmental impact study" has a particular legal definition and that the project should not use it in order not to generate confusion and raise expectations.

One of the business representatives drew attention to the absence of the Environmental Agency from the RSC and the need for involving this crucial actor in the debate.

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The CSO representative expressed his belief that the sea at Figueira da Foz would be too rough for implementing this technology (as well as wind farms, which are currently planned also for the area). In his opinion (due to his familiarity with North Sea oil platforms), underwater pipelines may be feasible, but a platform would have to be very large to withstand the waves. He then recommended that the pipeline should be close to the cables that will connect the future wind farm to the shore, to limit restriction areas. Additionally, he raised concerns about the seismic tests, since the ecosystem in the area has not yet recovered from the seismic tests performed a few years ago for oil and gas prospecting, which had a severe impact on fishing activities.

A.1.1.1.3. Benefits and risks

The following are the main ideas derived from the Mentimeter exercise (Figure 3) regarding the potential benefits of a carbon storage for the region:

- Job creation
- Economic development
- New industries
- Uses of the sea (in line with the national strategy)
- Sustainability, environmental image of the region; community engagement with environmental issues, regional role in climate change mitigation
- International visibility of the region
- Scientific knowledge, technological development

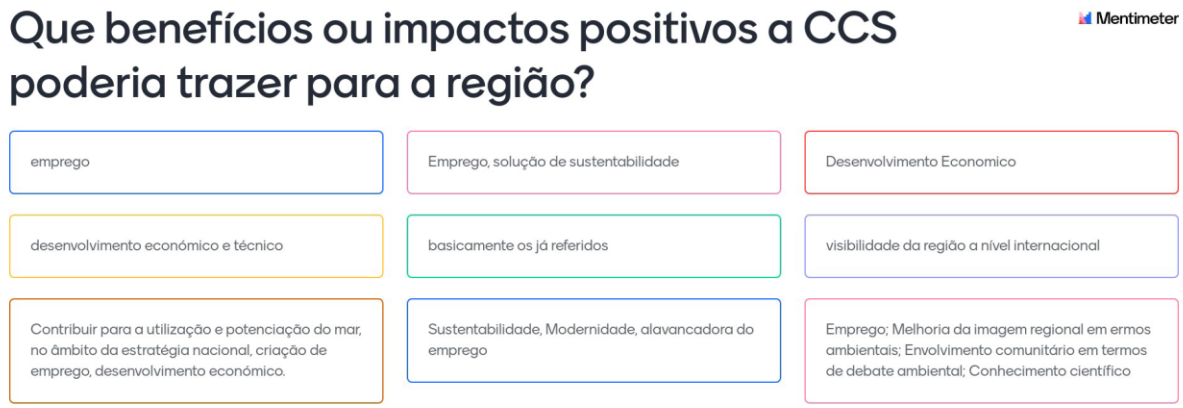

Figure 3 Main perceived benefits of carbon storage in the region. Mentimeter results

Regarding the potential risks of a CO_2 storage site for the community, participants mentioned the following:

- Conflicts between uses and activities in the sea
- Mistrusts and negative reactions from the population, NIMBY, accidents that can cause "antibodies" in a population that already feels punished by the sea
- Failure of the solution
- Environmental impacts, impacts over biodiversity, impacts in Natura 2000 sites
- Lack of knowledge
- Not involving the community
- Decrease in tourism activity

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- Impacts in the construction stage (pipelines), expropriations

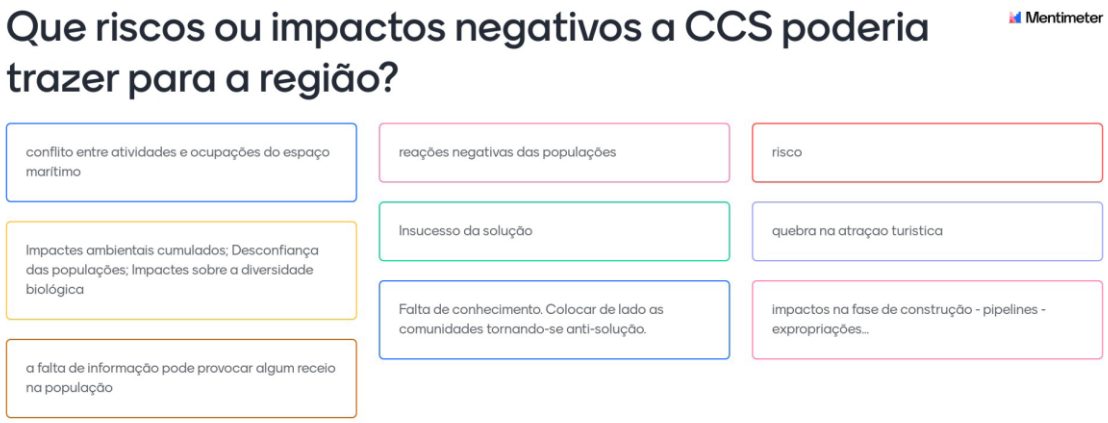

Figure 4 *Main risks or perceived impacts of carbon storage in the region.*

A.1.1.1.4. Second RSC meeting

In the final part of the event, participants were shown a tentative schedule of the RSC meetings throughout the project and were asked to use Menti again to suggest topics to be addressed in the next meeting. These were as follows:

- Public participation, non-technical communication, public presentation of the project
- Contribution to the blue economy
- Evolution of long-term CO_2 storage
- Examples of successful cases of carbon storage and transportation.

A.1.1.1.5. Workshop evaluation results

Participants were asked to fill in an evaluation questionnaire at the end of the meeting and on the following day, by email (together with a pdf file of the presentation by Júlio Carneiro). Only 7 of the 17 participants answered the questionnaire and the results were as follows:

- 2 respondents agreed and 5 fully agreed with the statement “The presentations at the meeting were informative and allowed me to learn more about the technology and the project“;
- 1 respondent agreed and 6 fully agreed with the statement “The way the meeting was conducted allowed me to freely express my opinion”;
- All respondents fully agreed with the statement “The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage”

A.1.1.1.6. Conclusion

The first Regional Stakeholder Committee meeting of the PilotSTRATEGY project was held in month 22 of the project, bringing together national and local actors to explore expectations and concerns regarding a potential CCS project in the region. The meeting involved representatives from various industries, public administrations, business associations, ENGO and civil society. Just like what had happened during the interviews stage, the stakeholders had a lot of questions that needed to be

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answered in order to develop an informed opinion about CCS technology and its implementation in the region. But they also had relevant information to share with the team members and already a perception of multiple risks and benefits.

Overall, the RSC meeting was a significant step in the PilotSTRATEGY project's progress and provided valuable insights for the project team. The next meeting will take place face-to-face in Figueira da Foz, in October 2023.

A.1.1.2. Report of RSC 2

A.1.1.2.1. Introduction

On the 17th of October 2023, between 2.30 and 5.00 pm, the second Regional Stakeholder Committee (RSC) meeting was held in Portugal in Figueira da Foz as part of the PilotSTRATEGY project. The purpose of the RSC is to bring together various actors, including representatives from industry, local, regional and national public administration, business associations, environmental Non-Governmental Organisations (NGOs) and civil society to explore the different points of view, the expectations and concerns regarding a Carbon Capture and Storage (CCS) offshore pilot, near the coastal city of Figueira da Foz. The goal was also to develop a network of stakeholders that can extend beyond this project and work together to build a realistic proposal for a CCS project in the region while reporting on the achievements of the PilotSTRATEGY project and final results.

19 stakeholder representatives from 12 organisations participated in the second meeting of the committee (Table 3). The group of participants was fairly diverse, including stakeholders at the national (8) and local (11) level, from the public (8), the private (10) and the third (4) sectors. 9 participants were women, 10 were men.

With regard to the first meeting, 5 participants attended both meetings, 9 participants from the first meeting were unable to attend the second and we had 14 new participants in the second meeting. However, in terms of organisations, 7 attended both meetings (in two cases with different representatives), 7 only the first and 5 only the second.

Table 3 Participants by types of stakeholders

Stakeholder type	Organisations	Participants
National/regional government agencies	2	2
Local authorities	2	4
Companies	2	4
Business associations	2	2
ENGO	2	3
Other CSO (fishermen associations)	1	1

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Stakeholder type	Organisations	Participants
Academia	1	3
Total	12	19

This session had two main objectives: to provide stakeholders with updates about the project and to discuss options for citizen engagement. Although a representative from GALP attended the meeting (online), he had little intervention in the presentations and discussion.

The meeting started with a welcome and brief introduction to the objectives of the meeting by ICS. Afterwards, all participants introduced themselves and the organisation they were representing (since there were a few new members since the last meeting).

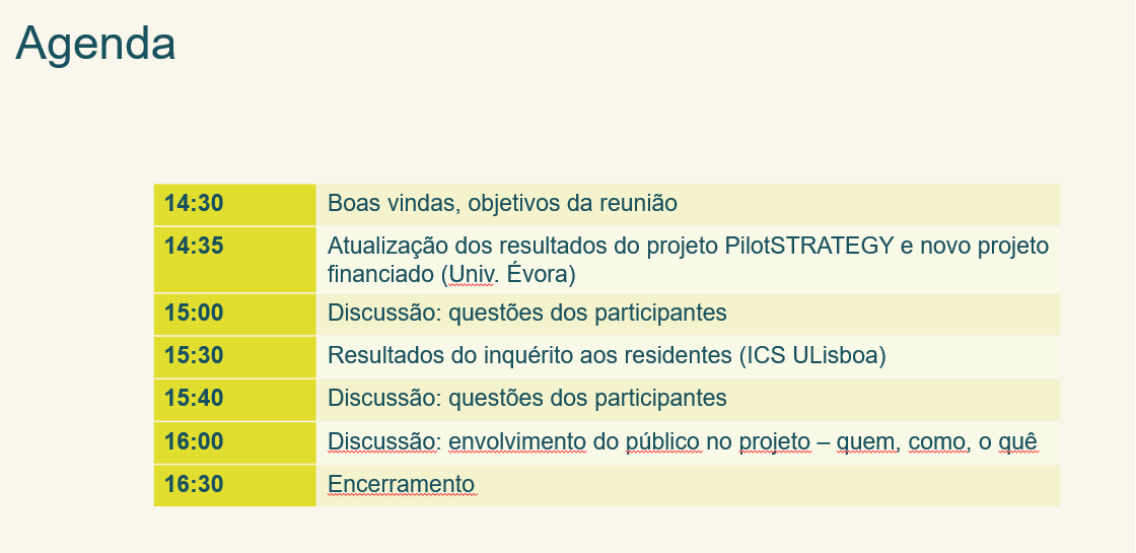

Figure 5 *RSC meeting agenda*

Next, Júlio Carneiro (U. Évora), as coordinator of the Portuguese teams on PilotSTRATEGY project, presented an update of the technical work developed for the project. This motivated a large number of questions from the participants, which required extensive replies. The section of the meeting devoted to discussing public engagement had to be quite shortened.

The meeting was held in a hybrid format, face-to-face at Quartel da Imagem (a municipal building at Figueira da Foz) and online (5 participants) through the Zoom platform, and recorded, after obtaining consent from participants[4]. The organisation of the meeting relied on the support of the local municipality, which provided the meeting space and internet connection. Some refreshments were made available to participants at the end of the meeting.

[4] Registration to the RSC was made through a Microsoft Office form which included information regarding participation, video recording, and data protection. All participants who registered confirmed being informed and gave permission for the video recording. Four participants did not complete the registration form and instead received the meeting link from their colleagues. Nevertheless, the information regarding video recording and confidentiality was verbally reiterated at the beginning of the meeting for all participants.

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Overall, the second RSC meeting in Portugal was an important step in the PilotSTRATEGY project's progress. Gathering face-to-face strengthened the connection with local actors, facilitating their involvement and collecting information on the needs and concerns of stakeholders.

Figure 6 Quartel da Imagem, Figueira da Foz

Figure 7 RSC meeting at Quartel da Imagem, Figueira da Foz

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Figure 8 RSC meeting at Quartel da Imagem, Figueira da Foz

A.1.1.2.2. PilotSTRATEGY project updates

Julio Carneiro started by remaining participants of the objectives and tasks of the PilotSTRATEGY project. He then revisited the scenarios for CCS implementation in Portugal (StrategyCCUS) and the criteria for selecting the offshore storage area at Figueira da Foz. He provided more information on the geological suitability of the geological storage formations to safely store the CO_2 and presented an animation of the preliminary model of the CO_2 plume dispersion over time, for both pilot and commercial scales (Figure 9). He explained the particular challenges posed by offshore storage and how some will be addressed in a forthcoming research project. He finalised his presentation by presenting the strategies for the development of the pilot and the tasks that will be carried out until the next RSC meeting.

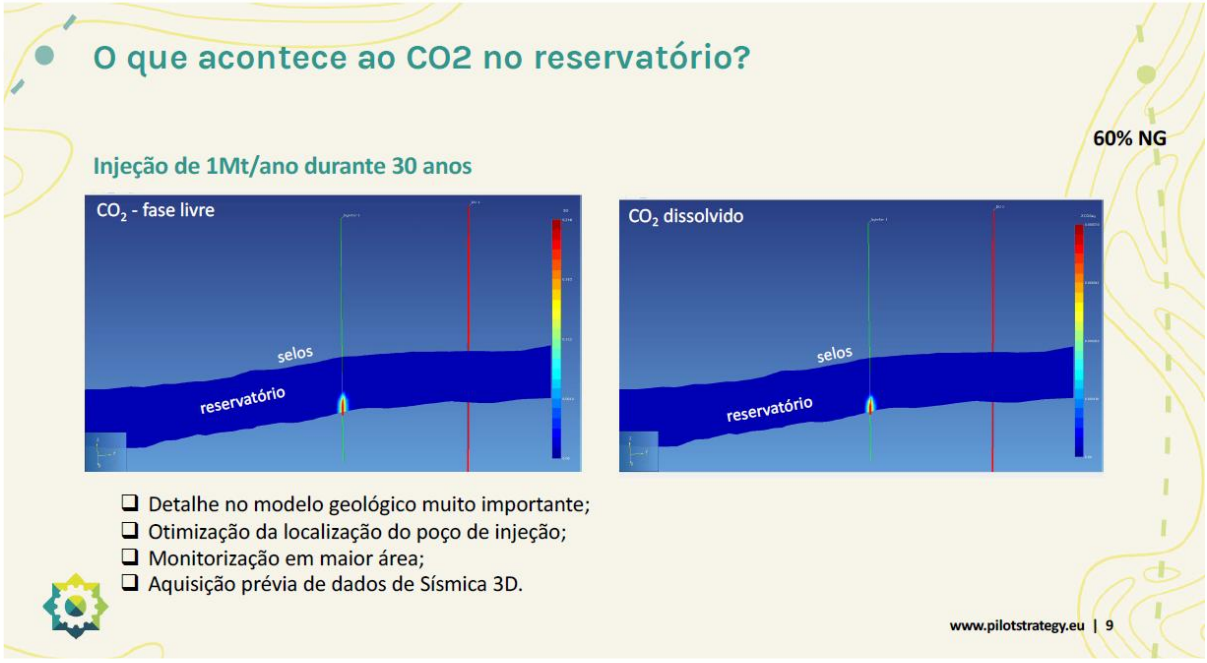

Figure 9 Slide of the presentation in the RSC meeting

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In addition to the presentations, some more information about the PilotSTRATEGY project and other CCS projects conducted in Portugal was presented in the format of posters (Figure 10) and a roll-up that participants could browse before and after the meeting.

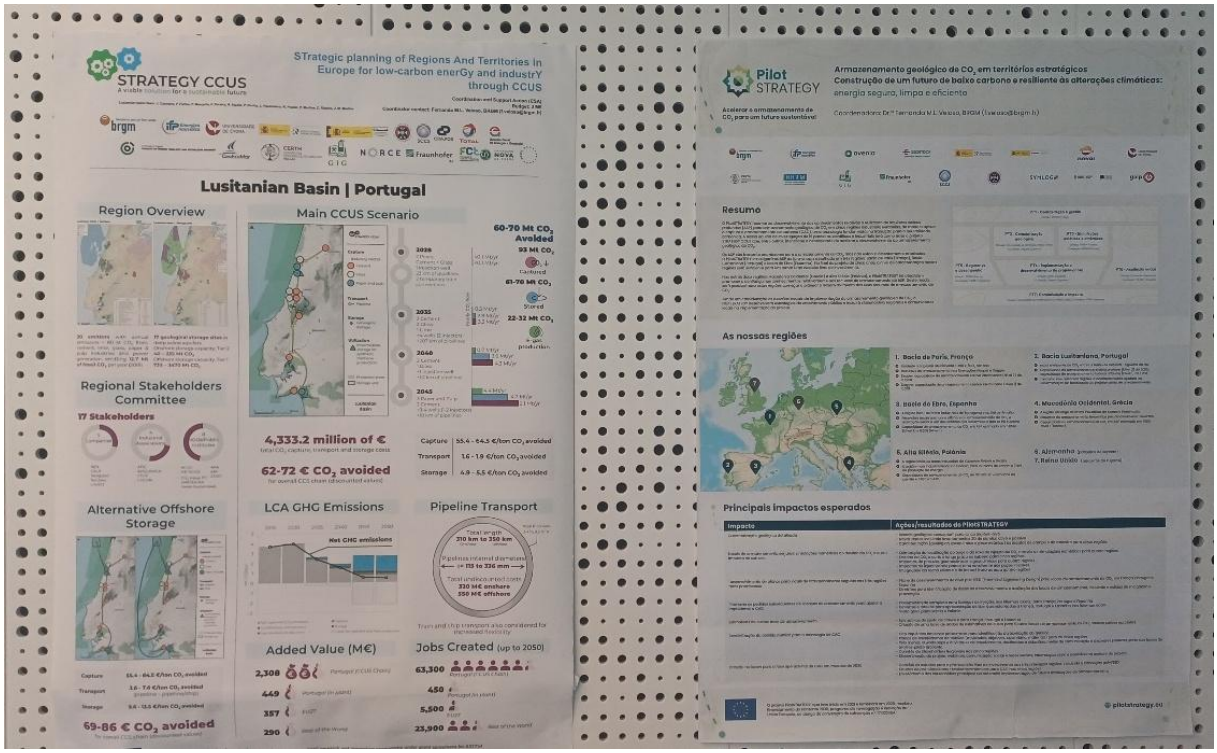

Figure 10 Strategy CCUS project poster (left) and PilotSTRATEGY project poster (right)

After the presentation, RSC members were invited to ask questions or make comments. Most opted for asking detailed questions which were replied to by members of the U. Évora team. Table 4 summarises the questions asked by participants in the meeting, by type of stakeholder. Public actors, ENGOs and the fishermen association expressed concerns in particular with leakage risks and monitoring procedures. Business representatives asked questions especially about government support to CCS and licensing but also had doubts about the conditions for using the Figueira da Foz port. The academics present raised attention to the particular conditions of the sea off Figueira da Foz, far rougher in autumn and winter than other locations where offshore CCS is carried out.

Table 4 Participants' questions by types of stakeholders

Government agencies/authorities	Durability of the injection infrastructure, maintenance needs Risks of leakage either with a platform or by ship Mitigation measures for a potential leak during injection Risks of leakage in the temporary storage site in the port of Figueira da Foz Technologies for mineralisation of CO_2 Monitoring of CO_2 leaks necessary for quantifying emissions (CCS Directive regulations about monitoring during injection and throughout the storage period)
Business representatives	Constraints placed by the conditions of the port for CO_2 transport by ship: size of ships, lack of space inland for a support area

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	Government support for CCS, funding Who has ownership over the offshore space Other industrial solutions for carbon emissions at a shorter term
ENGO/CSO	Monitoring procedures to assess changes in sea water acidity and impacts over marine biodiversity Which area will be studied for its geological suitability Scale of other CCS projects Compatibility with offshore wind development Evaluation of cumulative impacts of CCS and offshore wind Use of CO_2 for synthetic fuels rather than storage Comparison with radioactive leakage in salt mines and with oil leaks in offshore platforms Risks of CO_2 leaks Seismic risks
Academics	Access to the storage site throughout the year (weather and sea conditions) Licensing of offshore CCS and the need to obtain a private land use title

A.1.1.2.3. Citizen engagement

Since there was little time left for this section of the meeting, the ICS team just did a brief presentation of the survey results regarding public opinion on CCS in the region and then asked participants to fill in in coloured post-its their recommendations for citizen engagement (online participants were asked to write in the chat box): which members of the community should be invited to discuss the project, what topics should be discussed and how should the discussion take place.

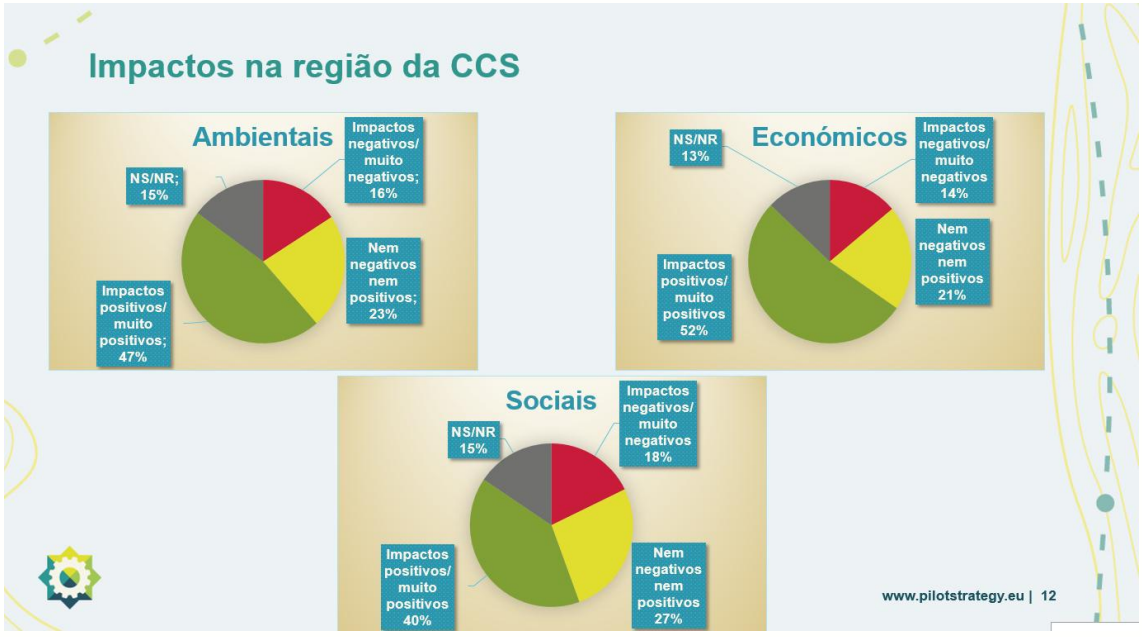

Figure 11 Slide from the presentation of survey results

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Table 5 summarises the results of the stakeholders' suggestions. They emphasised the need to reach citizens through intermediate structures of the community (authorities, associations, business, schools, journalists) rather than inviting random residents. They stressed that the topics should include both technical information about CCS but also an assessment of benefits and risks and impacts. They recommended face-to-face meetings but relying on support materials: videos, leaflets, models, demonstrations.

Table 5 *Stakeholders suggestions for citizen engagement*

Who should be involved?	▪ Local authorities, mayor, parish presidents ▪ Police ▪ Civil protection ▪ Law makers ▪ Local associations ▪ NGOs ▪ Clubs ▪ Shop owners ▪ Businesses ▪ Energy industry ▪ Transport industry ▪ Business associations ▪ Industrial associations ▪ Beach and nautical tourism ▪ Fishermen ▪ Scientists ▪ Schools, vocational training schools ▪ Teachers ▪ Public health professionals ▪ Journalists
What should be discussed?	▪ Definitions of storage ▪ Explanation of the technology ▪ Technical and safety aspects ▪ The investment needed ▪ Benefits of the technology ▪ The urgency of the solution ▪ CO_2 emissions ▪ Drawbacks of the technology ▪ Risks ▪ Environmental impacts ▪ Social impacts, how the population can be affected ▪ Impacts on fishing
How should the discussion be organised?	▪ Meeting in an auditorium ▪ Using a video to explain the technology ▪ Showing a scale-model ▪ Experimental activities ▪ Distributing leaflets without too much technical information ▪ Showing impact scenarios ▪ Allowing participants to share their visions and concerns ▪ Giving examples of CCS already existing

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	▪ A suitable framing of the project ▪ Several public presentations ▪ Invite people in charge of the gas storage in Carriço

Figure 12 Post-its with suggestions for citizen engagement

A.1.1.2.4. Workshop evaluation results

Participants were asked to fill in an evaluation questionnaire on the following day, by email (together with a pdf file of the presentation by Júlio Carneiro). Only 6 of the 19 participants answered the questionnaire and all of them had been present at the place of the meeting. The results were as follows:

- 4 respondents agreed and 2 fully agreed with the statement “The presentations at the meeting were informative and allowed me to learn more about the technology and the project “;
- 1 respondent agreed and 5 fully agreed with the statement “The way the meeting was conducted allowed me to freely express my opinion”;
- 1 respondent agreed and 5 fully agreed with the statement “The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage”

A.1.1.2.5. Conclusion

The second Regional Stakeholder Committee meeting of the PilotSTRATEGY project was held in month 30 of the project, bringing together national and local actors to explore expectations and concerns regarding a potential CCS project in the region. The meeting involved representatives from various industries, public administrations, business associations, ENGO and civil society. Just like what had happened during the first meeting, the stakeholders had a lot of questions that needed to be answered in order to develop an informed opinion about CCS technology and its implementation

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in the region. But they also had relevant information to share with the team members regarding citizen engagement.

After the meeting, all participants, plus the ones from the first meeting, received a summary of the results of the meeting.

Overall, the RSC meeting was a significant step in the PilotSTRATEGY project's progress and provided valuable insights for the project team. The next meeting will take place online, in the first trimester of 2024.

A.1.1.3. Report of RSC 3

A.1.1.3.1. Introduction

On the 20th of March 2024, between 2.30 and 4.30 p.m., we conducted online the third Regional Stakeholder Committee (RSC) meeting of the PilotSTRATEGY project in Portugal. The purpose of this RSC meeting was to update the various stakeholders, including representatives from industry, local, regional and national public administration, business associations, environmental Non-Governmental Organisations (NGOs) and civil society on the ongoing project, collecting their points of view, expectations and concerns related to a CO_2 Storage pilot, about 20 km offshore from the coastal city of Figueira da Foz.

Sixteen stakeholder representatives from fourteen organisations participated in the third meeting of the committee (Table 6). The group was fairly diverse, including stakeholders at the national (9) and local (7) level, from the public (9), the private (6) and the third (1) sectors. Seven participants were women and nine were men. One company and one ENGO participated for the first time, while the rest were representing organisations that had participated in previous meetings.

Table 6 Participants by types of stakeholders

Stakeholder type	Organisations	Participants
National/regional government agencies	4	4
Local authorities	2	4
Companies	6	6
ENGO	1	1
Academia	1	1
Total	14	16

The primary objectives of this session were to present and discuss the latest findings and advancements related to the projects, particularly, the results from the citizen engagement event in Figueira da Foz, shedding light on stakeholders' perspectives and gathering feedback. Additionally,

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the session covered updates on WP3, focusing on the geological model and optimising the location for the injection borehole, as well as the progress and strategic plans outlined in WP4, which include the development of the pilot and its implementation strategies.

The meeting started with a welcome and brief introduction to the objectives of the meeting by ICS. Afterwards, all participants introduced themselves and the organisation they were representing (since there were a few new members).

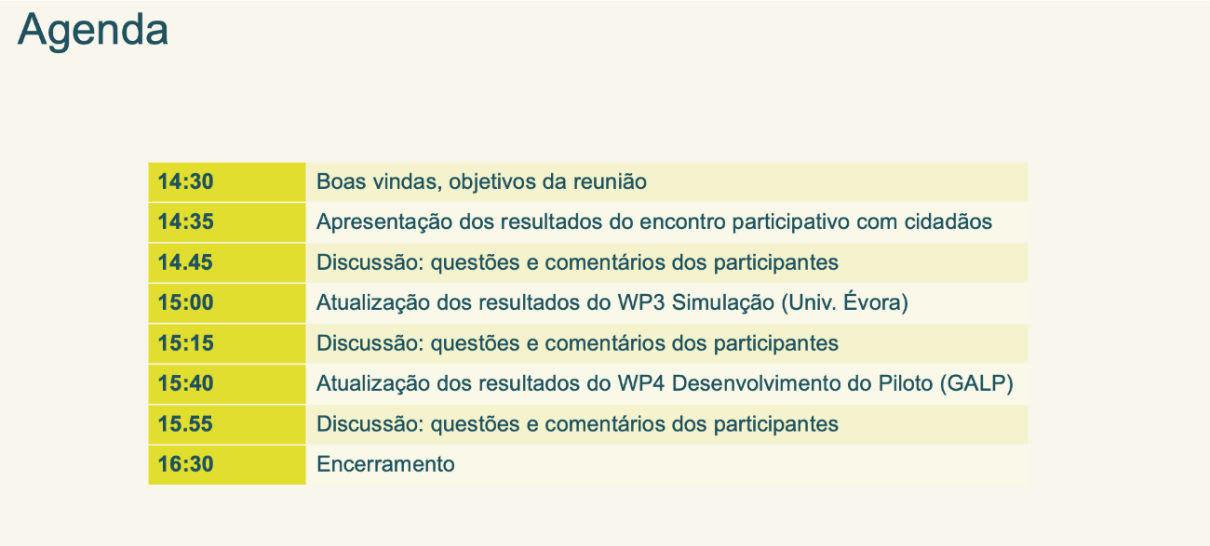

Figure 13 RSC meeting agenda

Next, Ana Delicado (ICS-ULisboa) provided a concise overview of the results obtained from the citizen engagement event held in Figueira da Foz the previous month. She outlined the views of the nine individuals who participated, focusing on their apprehensions about the proposed technology and its implementation in Figueira da Foz. She highlighted the importance of these insights for understanding the specific concerns and objections related to the proposed pilot project in the area but also emphasised that the opinions of this small group should not necessarily be considered indicative of the sentiment of the wider community, as they may represent a vocal minority.

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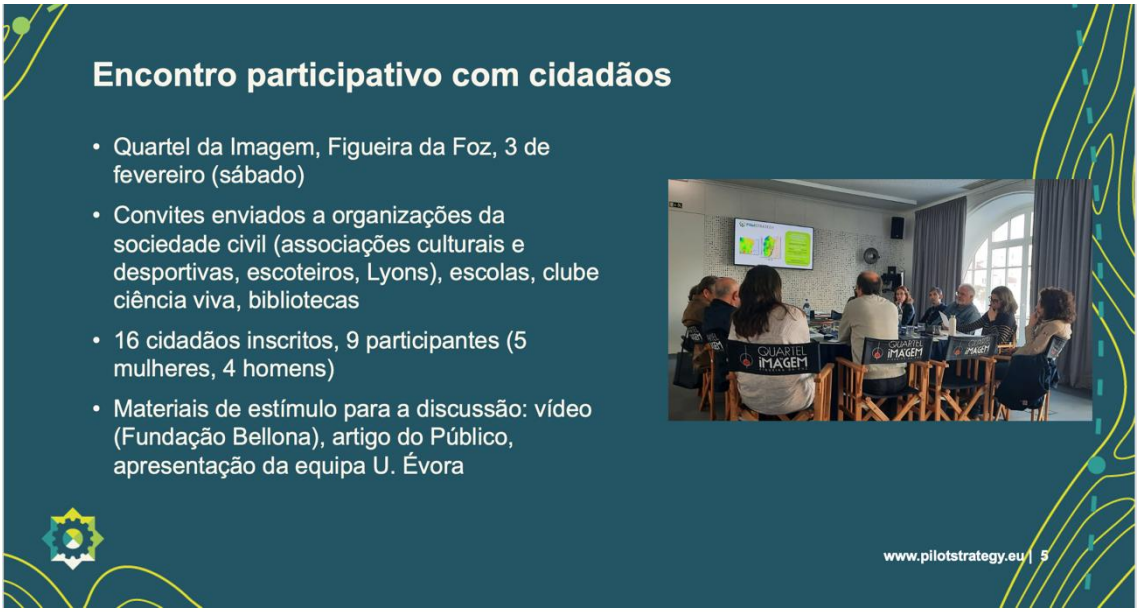

Figure 14 Slide of the presentation on citizen engagement

Following this presentation, participants were asked if they had questions. One participant expressed little surprise at the local resistance, noting a common 'Not in My Backyard' attitude towards climate-related projects. He suggested that the project team should consider ongoing mobilisation agendas for decarbonisation, citing examples from the ceramic and glass sectors, which may provide useful insights.

Another participant highlighted the significant knowledge gap among local populations regarding the technical aspects of carbon capture, which could contribute to a disconnection from the issue and hinder their participation in climate change solutions.

An ENGO representative countered these positions by highlighting that citizens' perspectives should not be disregarded and emphasising the importance of broader ecological approaches to climate change, and stressing natural processes like ecosystem restoration, versus solely focusing on technological solutions.

The conversation then touched on the urgent need to explore a range of methods for carbon capture due to the critical nature of the climate situation and the importance of using various approaches in tandem, rather than relying solely on a single method. The challenge of engaging stakeholders was also highlighted, as exemplified by a project involving the CCDR Center and the OECD, which saw limited political participation from municipalities despite the urgency of the subject matter.

Júlio Carneiro (Univ. Évora) then presented an update of the technical work developed for WP3. He started to explain that the decision to work in the Figueira da Foz area emerged from a previous project called Strategy CCUS, which involved several organisations, including Cimpor, the Directorate-General for Energy and Geology, Universidade Nova, and others. This earlier project aimed to assess the viability of CO_2 capture and storage (CCS) technology in the Portuguese industrial and energy context.

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Julio highlighted that the previous project identified the need for pilot study locations for both CO_2 injection and geological storage, as well as CO_2 capture. Various capture technologies exist, but not all are at the same level of development or applicable across all industrial sectors. The scenarios developed suggested that, by 2028, it would be feasible to have two pilot projects in Portugal, focusing on CO_2 capture in the cement, lime, and glass sectors, and an injection well, which they opted to locate in the offshore Torres Vedras Group formation offshore.

They proposed transporting CO_2 by train from the capture sites to the port of Figueira da Foz and then by ship to the offshore storage location. The estimated costs for this entire chain—capture, transport, and storage—ranged from €69 to €86 per tonne of CO_2 avoided, for a commercial scale full-chain network running up to 2050 and encompassing capture facilities in the cement, glass and pulp & paper sectors extending from Setúbal to Souselas. These costs are becoming competitive in the context of the European CO_2 market, making the scenarios developed for PilotSTRATEGY realistic.

Júlio Carneiro explained that extensive geological studies were conducted, covering the offshore area from Alcobaça to the Nazaré region. They utilised all available geological data in Portugal, and then focused on the Torres Vedras Group near Figueira da Foz, chosen for its high-quality reservoir characteristics, low seismicity hazard, and proximity to necessary infrastructure. The location offers good reservoir properties, secure geological conditions for storage, and preliminary estimates indicating a storage capacity of around 30 million tons of CO_2. The area also allows for efficient linkage to the port of Figueira da Foz, facilitating CO_2 transport from various emission points to the offshore storage site.

Júlio Carneiro noted that since the last Regional Stakeholder Committee meeting in October, they have been working on risk analysis, which is a lengthy and detailed process. This analysis is crucial for WP3, which involves simulating CO_2 injection and long-term behavior in the reservoir. The results will inform the design and optimisation of the injection well and help quantify the risks associated with the project.

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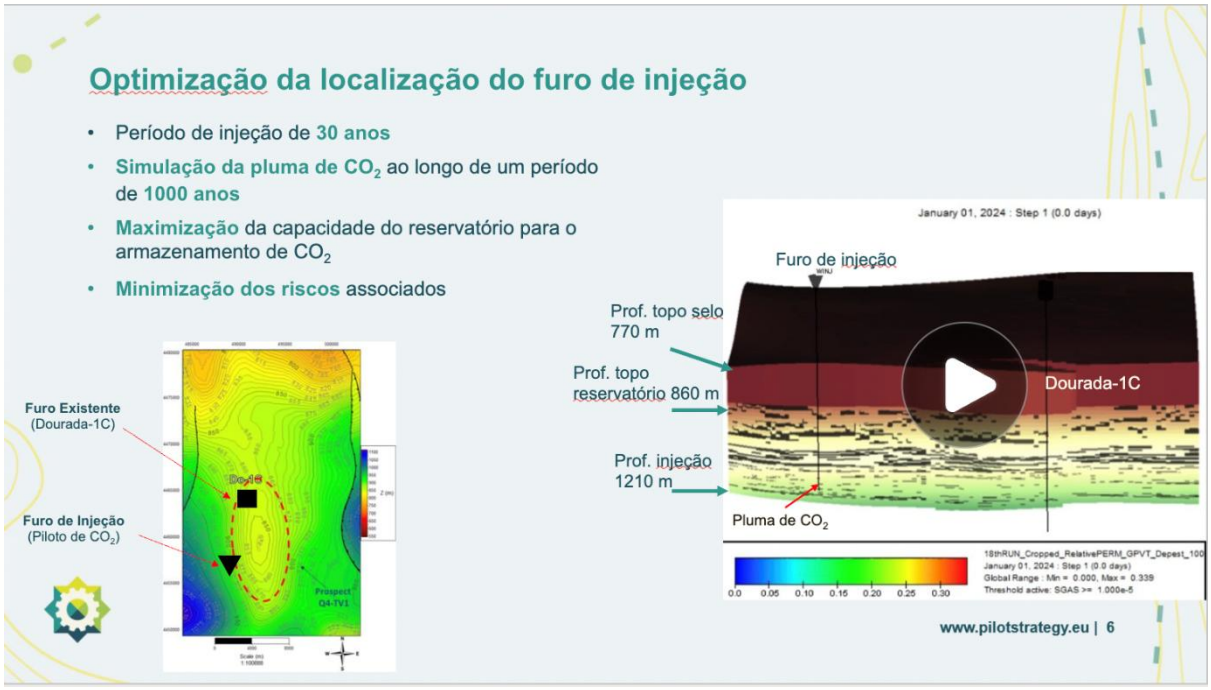

Figure 15 Slide of the presentation in the RSC meeting

João Casacão (GALP) started his presentation by reminding participants of the objectives and tasks of the PilotSTRATEGY project, focusing specifically on WP4, which is centred on the development and implementation of a pilot project for CO_2 storage. He explained that this WP relies heavily on the modelling results provided by the Évora team, particularly regarding the reservoir model.

João Casacão highlighted the importance of consolidating a storage site, an effort that the team has been working on for approximately a year. The goal is to move from a regional scale to a more operational and realistic application, while minimising technical uncertainties whenever possible. By the end of the project, it will be essential to evaluate the options for CO_2 sourcing and transportation and to develop business and economic models for the project.

A key point of the presentation was the injection strategy for CO_2, which includes determining the type of fluid, volumes, injection rate, and duration. The team must ensure that the reservoir does not experience overpressure, avoiding induced fractures. This involves ensuring that the injected fluid does not cause a pressure increase that could compromise the reservoir's integrity, which is a confined saline aquifer.

João Casacão also discussed the necessary infrastructures for the project, such as the design of the wells and the installations for CO_2 injection. He emphasised the need to follow the oil & gas industry's best practices to ensure the project's safety and efficiency. Additionally, the business model, including carbon credits, was deemed essential for the long-term commercial viability of the project.

The location of the injection well is still under technical discussion, but it is becoming increasingly defined. João presented a preliminary schematic of the injector well, detailing the water column and well design, which will be adjusted as needed to ensure the safety and efficiency of CO_2 storage. João finished his presentation by offering to answer any technical questions from the audience.

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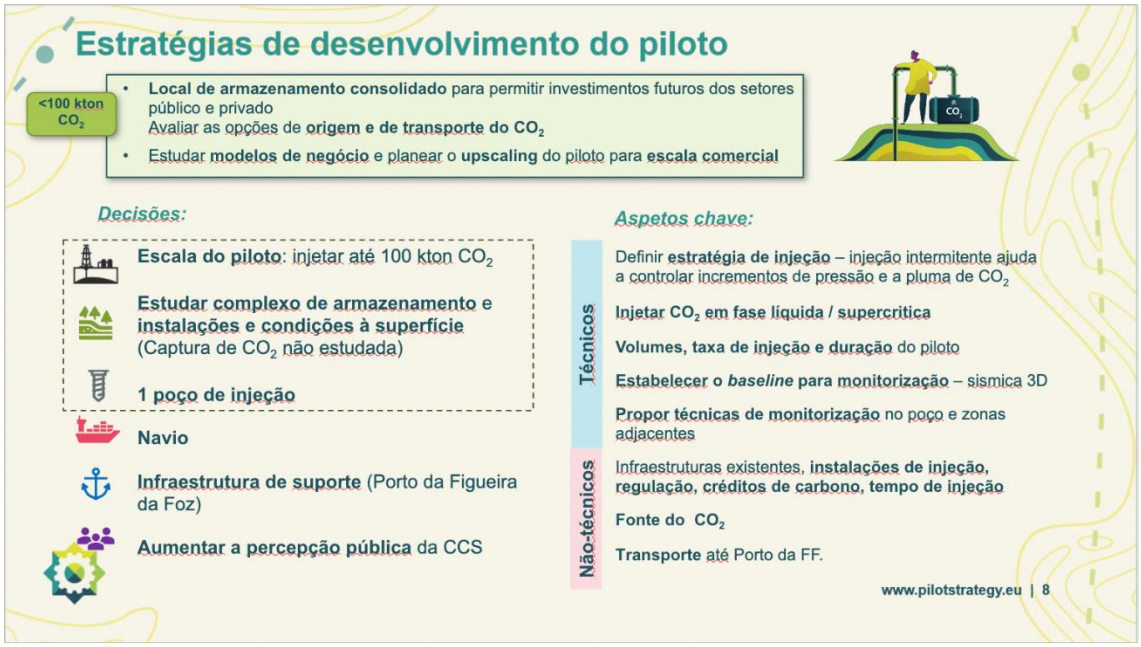

Figure 16 Slide of the presentation in the RSC meeting

After the presentation, the stakeholders asked several questions. One stakeholder from the industry raised an issue regarding the consideration of cost estimates for charges levied by reservoir holders. The PilotSTRATEGY team clarified that for the economic model, the cost of capturing emissions is not being considered; it is more focused on transportation and long-term storage costs. They also noted that the business model for the storage location is still undefined and therefore, such fees will not be included. They emphasised that each company and industry have different capture strategies making the process complex and ambiguous. It was agreed that taking these values as national in the economic model is currently the best approach.

The same industry stakeholder also asked for information about other reservoirs and projects. It was highlighted that the North Sea, specifically Norway, is preparing to start analogous projects.

There was also a question related to what the Technology Readiness Levels (TRLs) are expected to be achieved with the project. Júlio Carneiro explained that the project aims to reach TRL 9. There are about 40-41 similar projects worldwide. The goal is to characterize and scale the storage site using established technologies, not to develop new ones. Unlike many projects in the United States that use CO_2 for hydrocarbon production, this project focuses on climate change mitigation. Therefore, it targets TRL 9, demonstrating technology in a commercial environment.

One stakeholder from the public sector asked if, in terms of licensing, the regulation of the technological free zone could be relevant. She explained that a technological free zone in Viana do Castelo allows initial tests without strict regulations. These zones, also known as regulatory sandboxes, enable testing of new technologies not yet covered by current regulations.

Another stakeholder from a national agency elaborated that technological free zones, managed by ANI under the National Digital Action Plan, provide spaces for testing new technologies not yet covered by current regulations. There are currently two approved zones, in Viana do Castelo and Marinha, with more in the pipeline. These zones, which can be physical or virtual, enable the testing of innovative technologies.

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A stakeholder from a governmental agency clarified that a technological free zone, like the ones in Viana do Castelo and Marinha, does not exempt the issuance of a private use title for the national maritime space. The regulations are public and clearly state the need for this title. Additionally, according to the Council of Ministers' resolution, the only mechanism for the project would be through an allocation plan. This does not guarantee execution or support; it depends on future developments. These points are important for the project's considerations, especially regarding the public maritime domain, which does not exempt technological free zones from requiring permissions.

The discussion then shifted to the responsibilities and risks associated with CO_2 storage. It was mentioned that the current Portuguese legislation does not fully clarify the business model or the responsibilities in case of CO_2 leakage. However, examples from other European countries indicate that such risks are often managed through insurance and governmental support.

Júlio Carneiro explained the importance of monitoring and verification (MMV) as required by both national and European legislation. This will involve seismic monitoring and analysis of environmental impact, particularly around the injection sites. The University of Évora and Galp will lead these efforts, ensuring comprehensive monitoring to mitigate risks and comply with regulatory standards.

Finally, Júlio Carneiro outlined the key objectives for the next phase of the project. These include clarifying the regulatory requirements for CO_2 storage in the maritime space, determining the source of the CO_2 for the pilot, clarifying space availability and constraints at the Figueira da Foz port, and understanding the government's stance on CCS technology. These steps are crucial for progressing the project and ensuring that all regulatory and technical requirements are met.

Table 7 Participants' questions by types of stakeholders

Government agencies/authorities	▪ What Technology Readiness Levels (TRLs) are expected to be achieved with this project? ▪ Could the regulation of the technological free zone be relevant in terms of licensing?
Business representatives	▪ Will storage cost estimates include charges from the reservoir holders? ▪ Is there any information available from reservoirs that is further along in this process? ▪ How is the ownership of stored CO_2 managed? Does the CO_2 supplier rent storage space or trade the CO_2? ▪ In the event of a CO_2 leak, how are financial responsibilities handled? Is there a loss of carbon credits, and are there insurances available for this? ▪ Is seismic monitoring planned for the project?
ENGO/CSO	▪ Is biological, environmental, and ecological monitoring planned? ▪ Will the University of Évora lead this monitoring? ▪ What are the plans for the environmental impact assessment of the project? Who is designated to conduct this assessment? ▪ In terms of licensing, will the project follow the normal procedures for a project of this kind?

After this discussion, RSC members were invited to use a Menti board (Figure 17) to suggest topics for future meetings. Suggested topics included environmental risks and impacts of CCS (Carbon Capture and Storage), alternatives to CCS and their economic viability, and integration into the

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regional economic and social context. They also requested more information on other case studies and experiences from other countries, especially real projects from northern Europe focusing on their environmental and legal aspects and involvement of the local population. Participants also suggested debating a life cycle analysis of the CCS process, comparing existing alternative solutions in Portugal, understanding emissions associated with CO_2 capture, transport, and storage, and clarifying the importance of CCS in long-term carbon cycles and its role in CO_2 removal.

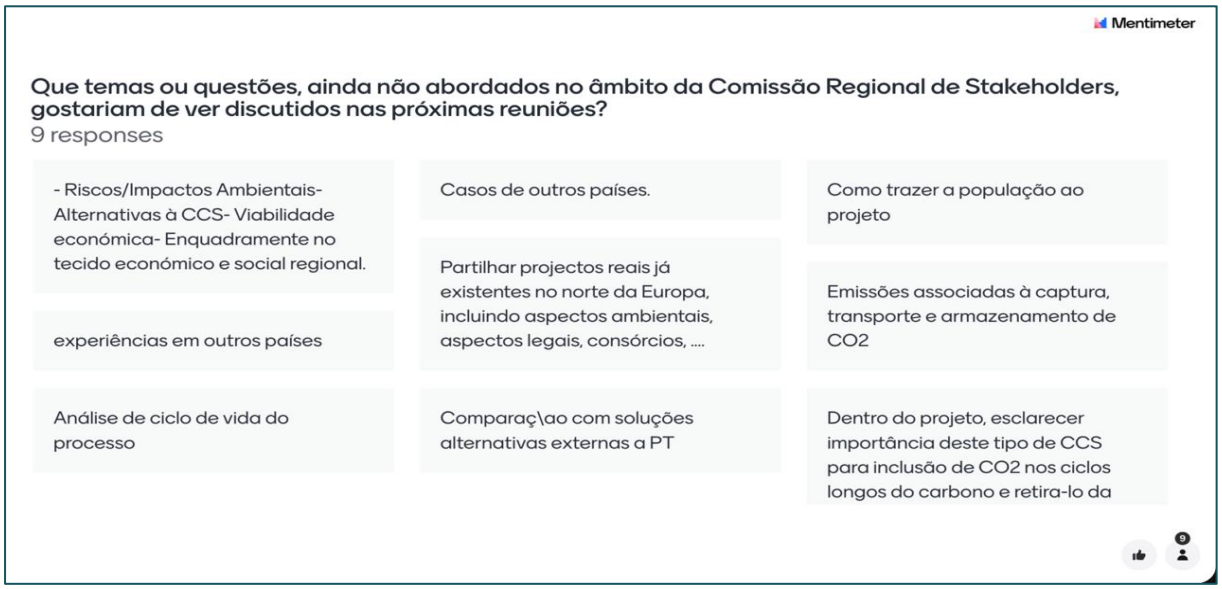

Figure 17 Menti results regarding topics to discuss in the next RSC meeting

A.1.1.3.2. Workshop evaluation results

Participants were asked to fill in an evaluation questionnaire at the end of the meeting, and we received answers from 11 of the 16 participants. The results were as follows:

- 6 respondents agreed and 5 fully agreed with the statement "The presentations at the meeting were informative and allowed me to learn more about the technology and the project";
- 4 respondents agreed and 7 fully agreed with the statement "The way the meeting was conducted allowed me to freely express my opinion";
- 5 respondents agreed and 6 fully agreed with the statement "The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage"

Two respondents left additional comments in the form. The first one remarked that the presentation was excellent and the clarification timely. The second respondent expressed concerns about the project's objectives and the potential acceptance of CCS:

> *«It was not clear to me whether the project aims to raise awareness of the general population and stakeholders in particular towards CCS. From what I understand, the goal is only 'an evaluation of factors that affect CCS acceptance'. I trust in the leadership and professionalism of ICS and UNL in this dimension, but I was concerned that project participants may not be at all open to the possibility that the general public and stakeholders in particular may not accept the activity, and*

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more generally, that the viability of CCS may not exist in the near future. In other words, a pilot project does not necessarily imply the validation of an activity and the feasibility of new projects and the activity itself. It aims precisely to see if this validation and feasibility exist. Thank you for your availability and your work."

A.1.1.3.3. Conclusion

The third Regional Stakeholder Committee meeting of the PilotSTRATEGY project was held in month 35 of the project, bringing together national and local actors to discuss the project development and stakeholders' perspectives. The meeting involved representatives from various industries, public administrations, business associations, ENGOs and civil society, with some participants joining for the first. The project team presented the results of the citizen engagement and advancements in WP3 and WP4. Stakeholders had several questions about the development of the project and the next steps. They also provided the team with valuable insights regarding their concerns and expectations, particularly about monitoring and licensing.

Overall, the RSC meeting was another significant step in the PilotSTRATEGY project's progress. The next meeting will take place online in the third trimester of 2024.

A.1.1.4. Report of RSC 4

A.1.1.4.1. Objectives

Aim

This RSC meeting aimed to update national and local stakeholders on the latest developments in the project, particularly the technical tasks of WP3 and the work conducted under WP4 on Pilot Development and Implementation Plans.

A key focus of the meeting was to discuss with stakeholders the content of a second survey to be conducted in 2025. This survey will be targeted at the coastal municipalities neighboring Figueira da Foz to assess public acceptance of Carbon Capture and Storage (CCS). Stakeholders were invited to provide additional questions and content for inclusion in the survey.

In response to feedback from previous RSC meetings, where stakeholders expressed interest in learning about existing CCS projects, the meeting also included presentations by two international specialists on offshore CCS projects currently operating in Norway and Italy.

Main Objectives

- Update national and local stakeholders on the latest project developments, including a discussion of a survey to be applied to the local population to gather feedback on its content.
- Present two offshore CO_2 storage projects by international experts: Philip Ringrose (Norway) and Roberto Ferrario (Italy).
- Answer questions and discuss aspects of the project's development.

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A.1.1.4.2. Methodology

Date: 3rd December 2024, 2:00–4:00 PM. Online

Programme

1st part:

- Update on WP3. Júlio Carneiro (Univ. Évora)
- Questions and Answers
- WP4 – Pilot Development and Implementation Plans. João Casacão (GALP)
  Questions and Answers
- Discussion with the stakeholders on the Content of the 2nd Survey to the Population on the Social Acceptance of CCS (Led by Ana Delicado)

2nd part:

- Presentation: "CO_2 Storage Experience from Norway". Phil Ringrose, Professor of Energy Transition Geoscience, NTNU, Norway
- Presentation: "Ravenna CCS". Roberto Ferrario (ENI)
- Final Considerations

Participants:

Fourteen stakeholder representatives from ten organisations participated in the third meeting of the committee (Table 8). The group included stakeholders at the national (7) and local (3) level, from the public (3), the private (6) and the third (2) sectors. Four participants were women and ten were men. All the participants were representing organisations that had participated in previous meetings.

Table 8 Participants by type of stakeholders

Stakeholder type	Organisations	Participants
National/regional government agencies	1	2
Local authorities	1	2
Companies/Business associations	5	7
ENGO	2	2
Academia	1	1
Total	10	14

The second part of the meeting was also attended by several PilotSTRATEGY team members and colleagues interested in the two international presentations.

A.1.1.4.3. Results

The meeting started with a welcome and brief introduction to the objectives of the meeting by ICS.

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Next, Julio Carneiro presented an update on the progress of technical tasks of WP3, outlining key activities such as risk analysis, dynamic and static simulations, pilot design, environmental impact assessment, and seismicity monitoring. He identified the optimal location for the offshore injection well, situated 20 km off the coast of Figueira da Foz, with an estimated injection capacity of 600,000 tons of CO_2 per year. Regarding CO_2 transportation, he explained that rail was being considered for the pilot phase due to its flexibility and cost-effectiveness, with a transition to pipelines planned for the commercial phase. He also shared insights into seismic activity monitoring in the study area, confirming low seismicity levels, and elaborated on the chemical interactions between CO_2, the reservoir, and the sealing rocks.

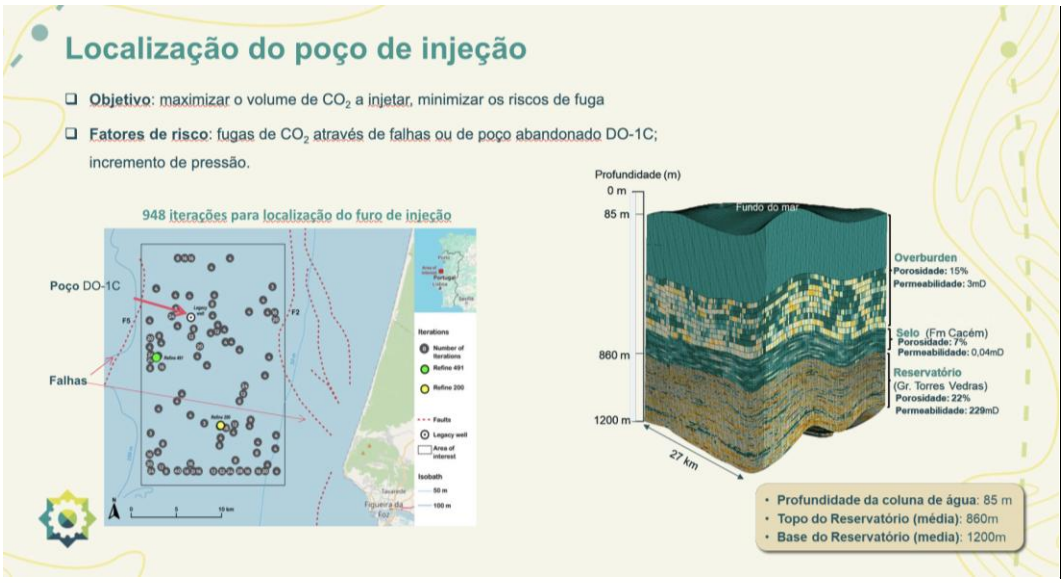

Figure 18 Slide of the presentation in the location of the injection well

Following the presentation, a question-and-answer session took place. A representative of an ENGO, who had not been present at the previous meeting, took the opportunity to clarify some doubts regarding the technology. In particular, she asked whether the studies conducted on the reactivity of CO_2 with the surrounding rock assumed that the CO_2 was already dissolved in water and in contact with the porous rock. She also inquired if CO_2 was injected into rock saturated with saline water and whether the laboratory studies focused on specific reactions, such as CO_2 with the rock, with the water, or with both. Additionally, she questioned whether there was a risk of CO_2 migrating to the surface due to chemical reactions or other causes.

Júlio provided comprehensive responses to these questions, addressing the doubts raised.

Next, João Casacão presented an update on WP4, focusing on Pilot Development and Implementation Plans. He outlined the design of two project phases: the pilot phase (3–5 years) and the commercial phase (scaling up with a pipeline). He also presented comparative tables analyzing the costs and feasibility of various transportation methods, including train, ship, and pipeline. Additionally, he identified potential locations for temporary terminals at the Port of Figueira da Foz and emphasised the importance of monitoring to evaluate the CO_2 plume and ensure operational safety and efficiency.

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Figure 19 Slide of the presentation on transport methods and location for temporary terminals

Following his presentation, a representative from the Port of Figueira da Foz commented on the ships mentioned in the update. She addressed potential misunderstandings regarding navigation and port infrastructure, explaining that after the completion of upcoming works, the port would have depths of 8 meters and a maximum draft of 7.5 meters up to the bridge, with drafts of 6.5 meters beyond it. She questioned the suitability of some of the proposed locations for transferring CO_2 into the ships, noting that some were in areas with insufficient depth.

She highlighted the distinction between a ship's draft and the actual depth, stressing the risk of grounding. She suggested adjusting the ship size in the plan and reconsidering the location of the proposed installation, indicating that it would be more suitable for a liquid bulk terminal. Additionally, she recommended scheduling a dedicated meeting with specialised port technicians to address these concerns in detail.

Building on this consideration, a representative of an ENGO sought clarification regarding logistics. Specifically, she asked whether the short-term plan involves using ships for CO_2 transportation, with a frequency of one to two times per month depending on the CO_2 volume, before transitioning to pipelines in the long term. She questioned the practicality of accommodating these ships in the Port of Figueira da Foz, including whether they would need to remain docked while CO_2 is accumulated and inquired whether the port, given its current traffic, offshore wind activities, and other operations, would be capable of handling this additional demand.

She also asked about the storage of CO_2 to be injected, seeking clarification on whether it would first be stored on land before being transferred to either the pipeline or the ship.

The representative of the Port of Figueira da Foz clarified that ships are docked at the quay only while they are being loaded. She explained that, although some cargo operations take longer than others, it is not feasible for a ship to remain docked waiting for cargo to arrive.

Following this presentation, Ana Delicado gave a brief overview of the planning for the implementation of a new survey of CCS acceptance targeting the population of coastal municipalities

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neighboring Figueira da Foz in 2025. She explained that the first survey, conducted in 2022, addressed topics such as knowledge about CCS, perceptions of its impact, trust in the stakeholders involved, and compensatory measures. She then invited stakeholders to share any additional questions or suggestions for the new survey.

A stakeholder from a local authority suggested including a question about alternatives they consider safer, more feasible, or economically viable that the population might propose for the CCS project, should they not consider it ideal. Additionally, an ENGO representative suggested adding an open-ended question to address specific community concerns, such as potential impacts on the landscape, fishing, and other coastal activities. They noted that this approach could be beneficial for the project's development, as unjustified concerns might be easily debunked if they are based on myths.

Another ENGO representative endorsed these suggestions, expressing confidence in the PilotSTRATEGY team's ability to conduct the survey impartially. They also suggested it would be valuable to focus on more targeted groups in the future, such as those involved in fishing or other related activities.

Table 9 Participants' suggestions for the survey

Stakeholder type	Suggestion
Local authority	Include a question asking about alternative solutions the population considers safer, more feasible, or economically viable, should they oppose the CCS project.
ENGO	Add an open-ended question about specific community concerns, such as impacts on the landscape, fishing, and other coastal activities.

The second part of the meeting was devoted to the presentation of two international projects presentations by two international specialists on offshore CCS projects currently operating in Norway and Italy.

Phil Ringrose presented on CO_2 Storage: The Norwegian Experience, highlighting Norway's extensive expertise in CCS projects. He discussed pioneering initiatives such as Sleipner, which began operations in 1996, and subsequent projects that have served as valuable learning platforms. Ringrose emphasised the importance of flexibility in projects to address unexpected technical challenges, such as adjustments to injection points. He also underlined the role of advanced monitoring technologies in ensuring the safety and efficiency of carbon storage, the need for long-term strategic planning, and the significance of scalable strategies for industrial deployment.

During the Q&A session, a representative from an ENGO asked:

"You mentioned that most of the companies participating in these projects—such as cement and fertilizer companies—are not from the oil and gas sector. Do you know why this is the case?"

Phil Ringrose explained that this stems from a decision by the Norwegian government to prioritize industrial carbon capture over oil and gas sector initiatives. Since these projects are heavily subsidised by the Norwegian state, the government aimed to promote industrial capture to avoid associations with the fossil fuel industry and to stimulate growth in CCS for industrial emissions. The ENGO representative followed up, asking whether this approach included incentives for industry

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participation. Ringrose confirmed that incentives were indeed part of the strategy to encourage industrial adoption of CCS.

Roberto Ferrario introduced the CCS Project in Ravenna, Italy, one of the country's first initiatives of geological carbon storage in the Adriatic Sea. He outlined the phased planning approach, which begins with capturing CO_2 from local industrial sources and transporting it for offshore storage. Ferrario addressed the challenge of overcoming initial regulatory barriers for CCS implementation in Italy and explained how existing infrastructure, such as offshore platforms, is being leveraged to reduce costs. He emphasised the use of a robust monitoring system to ensure safety and effectiveness, the scalability of the project to accommodate larger CO_2 volumes, and the development of an integrated infrastructure to capture and store emissions from various industries in the region.

A.1.1.4.4. Workshop evaluation

Participants were asked to fill in an evaluation questionnaire at the end of the meeting, and we received responses from 12 out of the 14 participants. The results were as follows:

- 4 respondents agreed and 8 fully agreed with the statement "The presentations at the meeting were informative and allowed me to learn more about the technology and the project ";
- 1 respondent neither agreed nor disagreed, 4 respondents agreed and 7 fully agreed with the statement "The way the meeting was conducted allowed me to freely express my opinion";
- 4 respondents agreed and 8 fully agreed with the statement "The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage"

Three respondents provided additional comments in the form. One remarked that the presentations were excellent, and another encouraged the team to "keep up the good work." One respondent posed a specific question about whether the anticipated rise in sea levels would have a direct impact on the study.

A.1.1.4.5. Final Reflections

The fourth Regional Stakeholder Committee meeting of the PilotSTRATEGY project was held in month 44 of the project, bringing together national and local actors to discuss the project development and stakeholders' perspectives. The meeting involved representatives from various industries, public administrations, business associations, ENGOs and civil society. The project team presented the results and advancements in WP3 and WP4. Stakeholders posed several questions about the technology and project progress, while also providing valuable insights regarding port capacity and and providing suggestions for the survey.

The meeting also served as an opportunity to showcase examples of ongoing European offshore CCS projects, as requested by stakeholders in previous sessions. These examples provided context and practical references for stakeholders, fostering deeper understanding of the technology and its development.

Overall, the RSC meeting was another significant step in the PilotSTRATEGY project's progress. The next meeting will take place online in the second trimester of 2025.

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A.1.1.5. Report of RSC 5

A.1.1.5.1. Objectives

Aim

This RSC meeting aimed to bring together local and national stakeholders to share recent project developments and reinforce their involvement. The session focused on three main areas:

1. presenting the final concept for the pilot,
2. the techno-economic assessment of the surface facilities, and
3. the preliminary analysis of storage risks.

Another objective was to gather feedback and input from participants to inform the next phase of citizen engagement in Figueira da Foz. This will help ensure that future activities reflect local perspectives and are aligned with community concerns.

A.1.1.5.2. Methodology

Date: 29th May 2025, 2:30–4:30 PM. Online

Programme

- 14:30 - Welcome and meeting objectives
- 14:35 - Preliminary analysis of storage risks (Júlio Carneiro, University of Évora)
- 14:50 - Discussion: questions and comments from participants
- 15:20 - Presentation of the final pilot concept (João Casacão, GALP)
- 15:30 - Discussion of the techno-economic considerations of surface facilities (João Casacão, GALP)
- 16:00 - Discussion: questions and comments from participants
- 16:20 - Gathering input on upcoming citizen engagement activities in Figueira da Foz (Ana Delicado, ICS)
- 16:30 - Closing remarks

Participants

Fifteen stakeholder representatives from eleven organisations participated in the committee's fifth meeting (Table 10). The group included stakeholders operating at the national (7) and local (3) levels, and represented the public (5), private (4), and third (2) sectors. Only two participants were women; the remaining thirteen were men. All participants represented organisations that had taken part in previous meetings.

Table 10 Participants by type of stakeholder

Stakeholder type	Organisations	Participants
National/regional government agencies	3	5

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Stakeholder type	Organisations	Participants
Local authorities	1	1
Companies/Business associations	4	6
ENGO	2	2
Academia	1	1
Total	**12**	**15**

Represented national government agencies included the Directorate-General for Energy and Geology (DGEG), the Directorate-General for Natural Resources, Safety and Maritime Services (DGRM) and the Commission for Coordination and Regional Development of the Centre (CCDRC).

A.1.1.5.3. Results

The meeting began with a welcome and brief introduction to the objectives by ICS.

João Casacão (GALP) presented the preliminary implementation plan for the CCS pilot project, focusing on two main areas: the identification of emission sources and the techno-economic assessment of surface facilities.

He started to present the preliminary implementation plan for the CCS project, focusing initially on the identification of potential CO_2 sources for the pilot phase. He explained that while BEG/Lusogás was initially considered, current plans prioritize emissions from Cimpor (Souzelas) and Navigator, due to their higher emission volumes and significant fossil CO_2 content. The CCS project is designed in two phases - pilot and commercial - with the first aimed at validating the geological and technical feasibility of injection. The storage site under consideration lies offshore Figueira da Foz, where the harbour's role as a potential CO_2 unloading hub is critical.

Stakeholders' questions/ comments

- The representative of Figueira da Foz Harbour noted that the areas being considered for CO_2 offloading are currently unavailable, due to existing commitments or lack of verified suitability. She stressed the need to formalize site viability studies and specify operational requirements (e.g., ship type, storage area).
- The DGEG representative raised a regulatory issue: the proposed 180,000 tonnes of CO_2 for the pilot phase exceeds the 100,000 tonnes limit defined in Decree-Law 60/2012 for pilot storage. João Casacão and Júlio Carneiro clarified that the volume was for planning purposes only, with licensing being accounted for in the project timeline.
- The DGRM representative reiterated that no commitments can be made at this stage and formal processes are needed. They expressed openness to dialogue once technical details are clearer.

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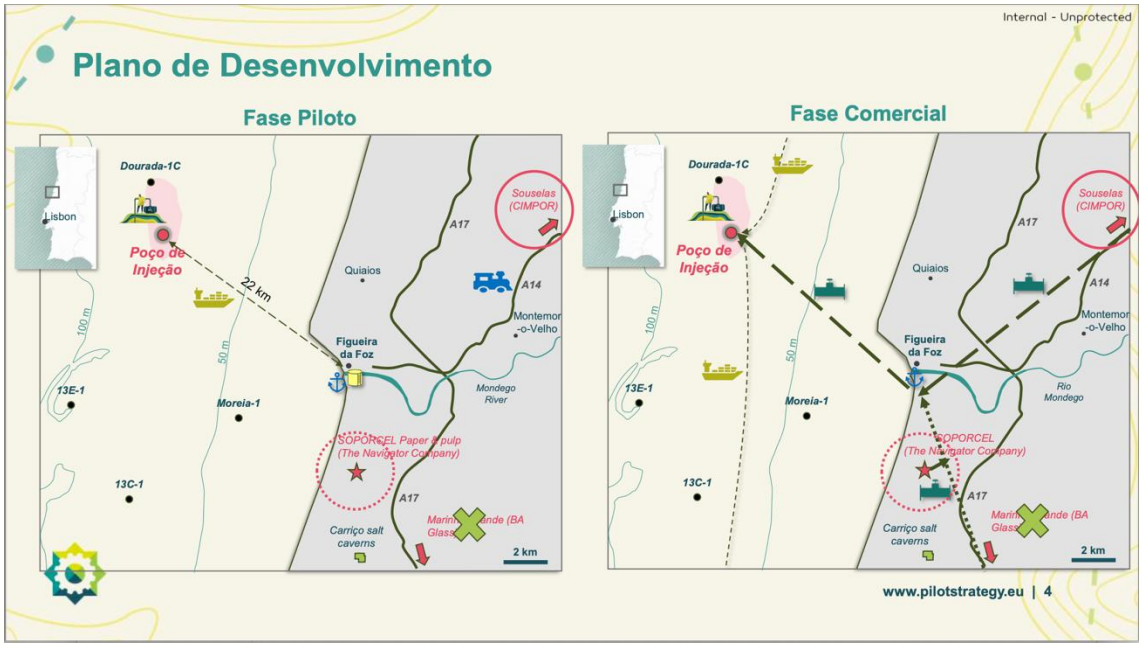

Figure 20 Development plan with the identification of potential CO_2 sources for the pilot and commercial phases

In the second part of his presentation, João Casacão focused on the techno-economic assessment, presenting indicative CAPEX and OPEX figures for both pilot and commercial phases. He stressed that shipping presents the highest costs in the pilot, while the offshore pipeline dominates commercial costs. A proposed timeline from 2027 to 2036 was shown, outlining licensing, drilling, injection, and monitoring stages, including 3D and 4D seismic surveys.

Stakeholders' questions/ comments

- A new representative from an ENGO that had participated in previous meetings expressed concern about long-term risks, referencing Norwegian NGO partners who question the guarantees of geological CO_2 retention. He asked whether mineral carbonation (e.g., CarbFix) had been considered as a safer alternative. Júlio Carneiro (Univ. Évora) responded by emphasising the maturity of sedimentary geological storage and the European legal requirement to model long-term containment over 1,000 years. He noted that CarbFix has injected only ~80,000 tonnes since 2012, whereas CCS projects in Norway (e.g., Northern Lights) aim for millions of tonnes annually.
- Another ENGO representative asked for clarity on the boundary between the research project and future commercial phases. Júlio emphasised that PilotSTRATEGY is a research project with no permitting authority, and its main deliverable is a detailed technical dossier.
- The CCDRC representative reinforced that the current project's goal is purely scientific and preparatory, with any future implementation depending on external promoters and a full environmental impact assessment process.

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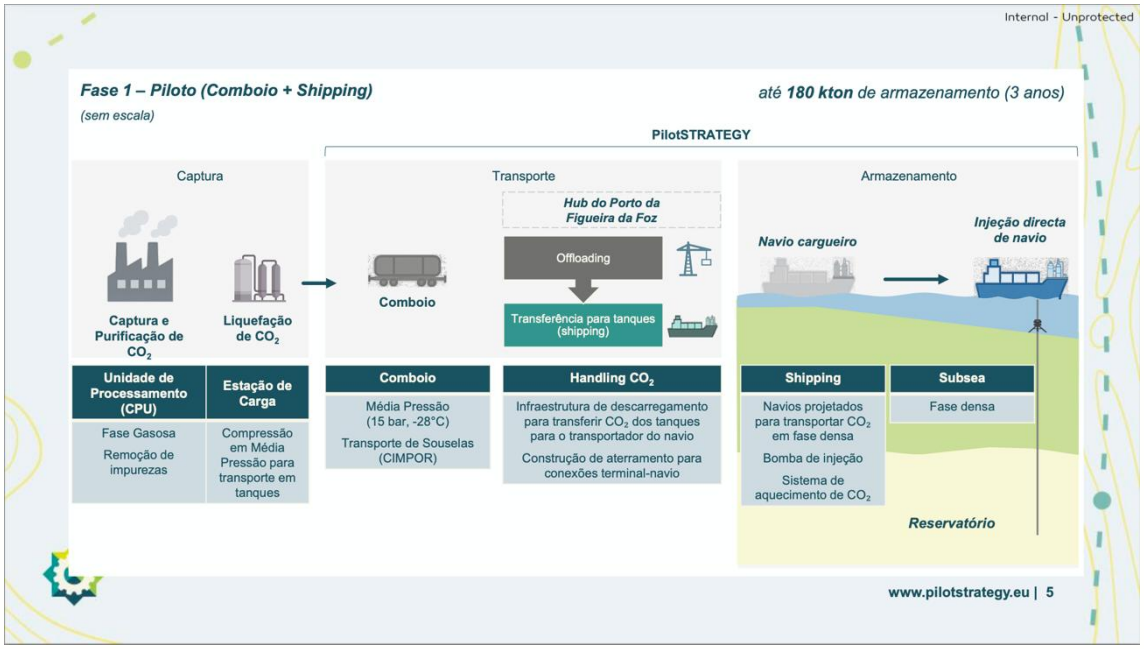

Figure 21 Slide with the development plan for the pilot phase (train + shipping)

Júlio Carneiro then presented the preliminary risk assessment for the offshore CO_2 storage site near Figueira da Foz. He began by outlining the energy and emissions trade-offs of CO_2 compression and transport, noting that liquefaction is particularly energy-intensive and that emissions from these processes must be factored into net climate benefit calculations. While such data were not fully presented, he indicated that relevant figures are available in deliverables from other related projects.

The main focus of the presentation was the structured risk assessment methodology aligned with EU Directive 2009/31/EC and its Portuguese transposition (Decree-Law 60/2012). A total of 44 potential risk events were screened, with 15 scenarios analysed in greater detail. These included leakage through faults, abandoned or injection wells, seal failure due to geochemical interaction, and induced seismicity. Socio-economic risks such as potential interference with fisheries and tourism were also included.

Júlio reported that 500 long-term simulations over a 1,000-year horizon showed no CO_2 reaching sensitive areas under baseline conditions, although more extreme cases are still under review. He explained that most risks are highest during the injection phase due to elevated subsurface pressures. For this reason, the team decided not to use dedicated monitoring wells, which have been shown in other projects to introduce their own leakage risks. Monitoring will instead rely on indirect methods such as 3D/4D seismic and fibre optic sensing. Full quantification and final monitoring plans are expected by November 2025.

Stakeholder questions/comments

- The national ENGO representative welcomed the thorough technical approach but emphasised the critical role of active pressure management during injection. He noted that while the geological seal is not inherently a weakness, it must be treated as a top priority to ensure system integrity. He raised concerns about undetected faults, pointing out that international experience

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has shown these to be among the most difficult risks to anticipate and control. He advocated for conservative injection rates and questioned the robustness of post-closure monitoring frameworks, given the long geological timescales involved and potential institutional discontinuity.

- Another ENGO representative asked whether the project also considered risks associated with transport and Harbour infrastructure. Júlio clarified that the current risk assessment is limited to the storage site, as mandated by the European Commission.
- The DGEG representative mentioned that the European Union is preparing a directly applicable regulation on the transport of CO_2, which will facilitate the licensing process and require all Member States to implement it immediately.
- The DGRM representative raised concerns about the legal and institutional framework for long-term liability after site closure. Júlio responded that current legislation mandates monitoring for 20–30 years post-injection, after which liability transfers to the State (DGEG), backed by financial guarantees from the operator.
- The DGEG representative confirmed that this process is outlined in Decree-Law 60/2012.

Figure 22 Slide *referring to the risk analysis framework*

Ana Delicado from ICS-ULisboa closed the meeting by summarising the next steps for public engagement, noting that a broader outreach event is being planned for residents of Figueira da Foz during the summer. She noted that the session had run out of time to explore these issues in greater depth and asked participants to share their ideas with the team by email if needed. She confirmed that a summary of the session, along with links to relevant materials, will be shared with all participants and members of the stakeholder group.

A.1.1.5.4. Workshop evaluation

Participants were asked to fill in an evaluation questionnaire at the end of the meeting, and we received responses from 8 out of the 15 participants. The results were as follows:

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- 3 respondents agreed and 5 fully agreed with the statement “The presentations at the meeting were informative and allowed me to learn more about the technology and the project“;
- 5 respondents agreed and 3 fully agreed with the statement “The way the meeting was conducted allowed me to freely express my opinion”;
- 4 respondents agreed and 4 fully agreed with the statement “The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage”

No additional comments were left on the form.

A.1.1.5.5. Final Reflections

The fifth Regional Stakeholder Committee meeting of the PilotSTRATEGY project took place in project month 49, bringing together national and local actors to discuss ongoing developments and gather stakeholder perspectives. As in previous meetings, the event brought together representatives from various sectors, including industry, public administration, business associations, environmental NGOs, and civil society.

During the meeting, the project team presented key results and updates, including the development of the final concept for the pilot, the techno-economic assessment of the surface facilities, and the preliminary analysis of storage risks. Stakeholders engaged actively, raising questions about the technology and overall project progress. They also offered valuable input on topics such as harbour capacity and current and future regulatory frameworks relevant to the technology.

Overall, the RSC meeting marked another important milestone in the PilotSTRATEGY project. Notably, there was increased in engagement from environmental NGOs and national agencies. The next RSC meeting is scheduled to take place in the fourth quarter of 2025, in hybrid mode (face to face with local stakeholders, online with national stakeholders), in Figueira da Foz.

A.1.1.6. Report of RSC 6

A.1.1.6.1. Objectives

Aim

This RSC meeting aimed to bring together local and national stakeholders to share recent project developments and reinforce their involvement. The session focused on three main topics:

1. Results of the citizen engagement event and of the second survey;
2. Detailed plan for CO_2 transport solution during the pilot phase;
3. Monitoring, measurement and Verification (MMV) plan.

A.1.1.6.2. Methodology

Date:18th November 2025, 2:30–4:30 PM. Face to face (Quartel da Imagem, Figueira da Foz) and online

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Programme

14:30 p.m. Welcome, meeting objectives

14:35 p.m. Presentation of the results of the event with citizens and the second population survey, Ana Delicado (ICS)

14:45 p.m. Detailed CO_2 transport solution during the pilot phase, Paulo Mesquita (U. Évora)

15:05 p.m. Discussion

15:20 p.m. Monitoring , measurement and Verification (MMV) plan, João Casacão (GALP)

15:40 p.m. Discussion

15:55 p.m. Cost analysis, João Casacão (GALP)

16:15 p.m. Discussion

16:30 p.m. Closing

Participants

27 stakeholder representatives from 18 organisations participated in the committee's sixth meeting (Table 11). 14 were in the room at Figueira da Foz and 13 were online. The group included stakeholders operating at the national (14) and local (13) levels, and represented the public (9), private (13), third (3) sectors and universities (2). Eight participants were women; the remaining 19 were men. Most participants represented organisations that had taken part in previous meetings but there were also representatives from three new companies with whom the team from the University of Évora had been having discussions recently.

Table 11 Participants by type of stakeholder

Stakeholder type	Organisations	Participants
National/regional government agencies	5	6
Local authorities	1	3
Companies/Business associations	9	13
ENGO	2	3
Academia	1	2
Total	**18**	**27**

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Represented national government agencies included the Directorate-General for Energy and Geology (DGEG), the Directorate-General for Natural Resources, Safety and Maritime Services (DGRM), the Agency for Climate (ApC), the Innovation agency (ANI) and the Commission for Coordination and Regional Development of the Centre (CCDRC). The business companies present were emitters (cement, paper, lime and waste sectors) and transporters (port authority, train transportation, energy).

Figure 23 RSC meeting at Figueira da Foz

A.1.1.6.3. Results

The meeting began with a welcome and brief introduction to the objectives by ICS.

Event with citizens and the second population survey

Ana Delicado (ICS) then presented the results of the event with stakeholders (participatory exhibition) that took place at Figueira da Foz in September, and the preliminary results of the second public opinion survey carried out in the summer (just for the sample of residents at Figueira da Foz).

Figure 24 Slides from the presentation on the citizen event and survey

Stakeholders' questions/ comments

Business stakeholders were mildly surprised with the results, in view of the high levels of acceptance of CCS and attributed that to the lack of conflicting economic interests. They also noted that the one third of indecisive respondents might become opponents once the project progresses. In response, Júlio Carneiro (U. Évora) explained that some opposition comes from people who believe that there should be other solutions to climate change, namely a transformation of the economic system, whereas the sessions in schools show that young people are more in favour of technological solutions that in fact mimic the natural process through which oil and gas are formed underground. Júlio described the sessions at schools and the materials that were designed for them.

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Another stakeholder asked about the negative reactions to the project that were found in social media when the citizen engagement session was advertised. Ana Delicado clarified that it was once again due to the rejection of technosolutionism that was mentioned before and explained that the criticism was still online and offered to send the report of the event where it was mentioned.

A team member from U. Évora asked whether it was possible to understand the reasons for acceptance/rejection from the survey and Ana Delicado explained that there were a few open questions that needed to be analysed. Since stakeholders also showed an interest in more detailed results, she committed to send a summary of results to the RSC members.

Detailed CO_2 transport solution during the pilot phase

Paulo Mesquita (U. Évora) presented the transportation options for the pilot phase. In the pilot phase, trains and boats will be used to transport CO_2 from a cement factory to the injection site. The team has made calculations regarding the capacity and number of containers needed, the time necessary for filling in the containers, transporting them to the port, loading them into the ship, transporting them to the site and inject the CO_2, estimating cycles of 24 hours. The pilot stage would need 152 cycles, that would last 15 months. Sea conditions will have a strong bearing on this duration, since the injection stage may face constrains with waves over 2m, which represent, on average, 40% of days at Figueira da Foz. At the end of the presentation, an estimation of costs was shown, totalling €25 million for the transport component during the pilot Phase, of which the larger part will be spent in renting the ship.

Figure 25 Slides from the presentation on transportation and CO_2 injection

Stakeholders' questions/comments

Stakeholders first asked about the restrictions to direct injection from caused by wave height, then about the amount of CO_2 to be inject and the impact it would have on emissions, considering that transportation also emits CO_2. Another stakeholder, connected to the train sector, clarified that most trains operating in Portugal and all in Spain are electric, so emissions are reduced. Their company estimates all emissions by client, so those values will be known and certified. The stakeholder then asked if trains would be necessary on the commercial phase or if all CO_2 will be transported via pipelines. Another business stakeholder pointed out that the estimation of costs does not take in consideration the revenues that could exist from certified storage of CO_2 in a future market which could compensate the costs with ship rental.

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A representative from the NGO asked about the estimation of emissions caused throughout the process of capture, pressurisation, transport and injection. Team members clarified that the purpose of the pilot stage was to assess the geological conditions for CCS, not to have a direct impact on climate mitigation nor be carbon-neutral and mentioned another University of Évora research project (CTS) in which those components are being considered.

Another business stakeholder asked about capture and injection costs, but Paulo explained that injection costs would be presented afterwards and Júlio Carneiro that CO_2 for the pilot, as a last resort if the capture pilot is not operating in time, might even be bought, not captured from any factory. One other asked about the capacity of the reservoir to receive CO_2 and what the monitoring process would be like to ensure CO_2 remains in the reservoir.

Finally, a government agency stakeholder asked about the possibility to leave the ship on the site of the injection and use another ship to transport the CO_2 containers from the port to the injection site. The team replied that that has not been considered feasible do to the costs involved in renting two ships.

Monitoring plan

João Casacão (GALP) presented the Measurement, Monitoring and Verification plan for the pilot phase. He listed the technologies that are planned to monitor the water column, seabed, subsurface and the injection well. He also presented the well design and lithostratigraphic prognosis and the programme for data acquisition, showed the model of plume dispersion evolution after 3 years of injection and explained the 3D seismic acquisition and baseline acquisition using low-impact methods. He also talked about the monitoring of the environmental impact for detecting underwater leaks and showed the timeline for the monitoring actions.

Figure 26 Slides from the presentation on monitoring

Stakeholders' questions/comments

A business stakeholder started by asking whether the monitoring procedures were different from those used in oil extraction wells and João Casacão replied that many of the techniques used in the wells are common to those wells, but monitoring of the plume resorts to different technologies. A geologist from the municipal authority questioned the use of denominations of the geological formations that were not quite accurate. Team members replied that that was a practical decision made to simplify the deliverable reports.

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Another business representative asked whether the pilot stage was mean to start in 2030, with a first injection of CO_2. The team explained that 2031 was more likely and that in 2030 only water would be injected as to test reservoir permeability. The meeting participant then asked about the commercial phase, when would it start and with how much CO_2 would be stored. Júlio Carneiro explained that in a commercial phase other wells would be included and several other emitting industries would participate, in a scaling up process. A business stakeholder then asked about when would a second well be drilled and Júlio explained that is being designed in the CTS project. The discussion then moved to biogenic carbon and carbon from fossil fuels. Another stakeholder asked about the mineralisation of CO_2 and João Casacão explained that it would be difficult to quantify and the 3D seismic would just allow seeing the dispersion of the carbon in the reservoir.

An NGO representative asked whether the need for synthetic fuels was taken into account in the calculations of CO_2 to be stored. Júlio clarified that for the pilot stage that was not considered, but for the commercial phase carbon reuse would be.

A business representative made a question about the costs of different uses of carbon would make it more or less appealing to industries, depending on regulation. Another stakeholder intervened to explain that synthetic fuels need electricity, and not all biogenic CO_2 can be used to produce fuels, since it would require huge amounts of renewable energy, so some need for sequestration will remain.

After being probed by Júlio to step in the discussion, a representative from a government agency talked about negative emissions and how they came to realise that CCS was essential to achieve carbon neutrality and European targets. That marks a change from the previous roadmap that did not consider CCS and it is based on studies that are currently being made. Natural carbon sinks are not sufficient for reaching neutrality in 2045, so studies such as PilotStrategy are necessary to implement climate policies. About the economic side, she declined to speak since it falls on industries to evaluate what best serves their interests. An NGO representative then questioned the intervention of the government agency representative, pointing out that that CCS is a policy option, not an inevitability, and that there are other actions that can be done to promote decarbonisation.

Cost analysis

João Casacão (GALP) made a short presentation about the costs of drilling the injection well and seismic monitoring, explaining that some costs would be abated in the commercial phase. Júlio Carneiro pointed out that these are provisional estimations, that should be still be confirmed and adjusted, and underlined that some costs would be abated in the commercial stage (the well and the baseline 3D seismics).

Stakeholders' questions/ comments

One stakeholder asked whether the costs presented were at current prices. Another asked about the costs of following wells. A municipal authority representative asked about the cost per ton of CO_2. Júlio Carneiro explained that they are trying to estimate the costs by CO_2 emissions avoided, but that

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would only make sense on the commercial phase, since the purpose of the pilot is not to achieve economic viability.

Another business stakeholder asked for confirmation that the overall cost of sequestering 100,000 tons of CO_2 would then be €97 million and Júlio clarified that this is the cost of the pilot stage, not the cost of storing this amount of carbon, so the costs would go down once the injection is in operation. Even the amount of carbon stored in the pilot stage is uncertain, since it is far more than what is needed to test the reservoir. He then explained that financing the pilot would require industry co-funding and there were regulatory issues still to be solved.

Ana Delicado from ICS-ULisboa closed the meeting by summarising the next steps for the RSC, a final online meeting in March that might possibly be changed into a face-to-face event in Lisbon, with a wider audience. She noted that participants should share their ideas with the team by email if needed. She confirmed that a summary of the session, along with links to relevant materials, will be shared with all participants and members of the stakeholder group.

A.1.1.6.4. Workshop evaluation

Participants were asked to fill in an evaluation questionnaire by email on the following day of the meeting. We received responses from 12 out of the 27 participants. The results were as follows:

- 6 respondents agreed and 6 fully agreed with the statement "The presentations at the meeting were informative and allowed me to learn more about the technology and the project ";
- 3 respondents agreed and 9 fully agreed with the statement "The way the meeting was conducted allowed me to freely express my opinion";
- 4 respondents agreed and 8 fully agreed with the statement "The moderators of the meeting ensured the inclusion of different points of view and created space for the exchange of different opinions towards carbon capture and storage"

An additional comment was left on the form, suggesting that more technical sessions should be carried out, in view of the importance of the project. Another comment commended the presentations as "excellent".

A.1.1.6.5. Final Reflections

The sixth Regional Stakeholder Committee meeting of the PilotSTRATEGY project took place in project month 54, bringing together national and local actors to discuss ongoing developments and gather stakeholder perspectives. As in previous meetings, the event brought together representatives from various sectors, including industry, public administration, business associations, environmental NGOs, and civil society. It was the meeting with the highest number of participants, both in terms of individuals and organisations.

During the meeting, the project team presented key results and updates, including the transportation costs and timeline and the monitoring of injection. Stakeholders engaged actively, raising highly technical questions. They also offered valuable insights on topics such as transport emissions and

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current and future regulatory frameworks relevant to the technology, in what seems to signal a change in policy regarding CCS.

Overall, the RSC meeting marked another important milestone in the PilotSTRATEGY project. The next and last RSC meeting is scheduled to take place in the first trimester of 2026, in online mode, although it might be replaced by a face-to-face meeting in Lisbon.

A.1.2. Spain

A.1.2.1. Report of RSC 1

A.1.2.1.1. Introduction

On the 24th of January 2023, the first Regional Stakeholder Committee (RSC) was held in Spain as part of the PilotSTRATEGY project. The purpose of this committee is to bring together various local actors, including representatives from industry, universities, research centres, public administrations, business associations, and civil society to explore the different points of view, the expectations and concerns within the community regarding the project. The goal was also to develop a network of stakeholders that can extend beyond this project and work together to build a realistic proposal for a Carbon Capture and Storage (CCS) project in the region while reporting on the achievements of the PilotSTRATEGY project and final results.

Table 12 Agenda of the first Regional Stakeholder Committee (RSC)

10:00 Welcome (Fernanda de Mesquita, Coordinator of the PilotSTRATEGY project)
10:10 Regional Committee and objectives of the meeting (Christian Oltra, CIEMAT)
10:15 PilotSTRATEGY project: what, where and how (Paula Canteli, IGME)
10:30 Discussion: first impressions (moderated by Christian Oltra, CIEMAT-CISOT)
10:50 Local community view on geological storage of CO_2 (Christian Oltra)
11:00 Questions
11:10 Discussion: map of benefits and risks (moderated by Christian Oltra, CIEMAT)
11:30 Farewell and thanks (Christian Oltra, CIEMAT-CISOT)

During this first meeting, 14 stakeholder representatives (8 women and 6 men) participated in the committee. Several objectives were proposed for the session, including introducing and presenting committee members, presenting the PilotSTRATEGY project and the study in the Ebro Basin, discussing first impressions and doubts about the project, and exploring the perceived initial benefits and costs of the project. A consent form, approved by the Ebro Basin team, was sent by e-mail to all stakeholders, together with an invitation to attend the meeting of the Regional Stakeholder Committee and some project information flyers. Participants returned the signed consent forms also by email. Two information flyers were sent as PDF documents attached to the email: one related to the PilotSTRATEGY project and the other specific regarding the onshore region of the Ebro Basin in Spain.

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Table 13 Types of stakeholder representatives

Stakeholder type	Participants
Industry	4
Research and education	1
Public Administrations	4
Support organisations	4
Influencers	1
Total	14

The meeting followed a specific structure, starting with a welcome by Fernanda de Mesquita (BRGM), Coordinator of the PilotSTRATEGY project and an introduction to the Regional Committee and objectives of the meeting by CIEMAT-CISOT. The meeting lasted 90 minutes. Paula Canteli (IGME-CSIC), as coordinator of the Ebro Basin region on PilotSTRATEGY project, presented the PilotSTRATEGY project and its application in Ebro Basin area, including why, where and how the project is being developed in this area. Discussions were held to gather first impressions and the local community's vision on the geological storage of CO_2, followed by a map of benefits and risks.

Overall, the first RSC in Spain was a crucial step in the PilotSTRATEGY project's progress, facilitating the involvement of local actors and gathering diverse perspectives on the project's potential impact.

A.1.2.1.2. PilotSTRATEGY project presentation

After welcoming all workshop participants, the local Spanish team briefly introduced the PilotSTRATEGY project. The Coordinator of Ebro Basin work presented the general purpose and scope of the project, as well as a brief description of the selected region (Lopín) and the reasons why it was selected. It was also explained the relevance of carbon capture and storage (CCS) within the mix of technologies to deal with the impact of climate change. Finally, CCS technologies and some examples of successful implementation in the world were briefly exposed.

Participants commented on the following topics:

- What are the chances of Lopin being selected as a storage site? The representative from the regional authority, as well as other participants, asked about the actual possibilities of selecting the region for a future commercial storage site.
- Role of private companies. Participants asked about the interest of the private companies in capturing and storing CO_2 in the study area.
- Potential economic compensations for the local municipalities. One participant, representative of the Association for Comprehensive Rural Development of the Campo de Belchite Region (Adecobel), asked about the potential economic compensation for the affected municipalities derived from the project. A representative from the Government of Aragon emphasised the

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need for the potential storage site to provide benefits to the surrounding territory, indicating that such benefits may not occur naturally.

- Potential interest in CCS technologies in the local industry. A representative from the local industry said they are exploring ways to reduce carbon emissions using multiple technologies, including carbon sequestration for remaining emissions. It is still in the early stages, and they need to confirm the viability of the project before forming an opinion. Another participant from the same organisation echoed the sentiment and expressed caution about public acceptance.
- Landscape and visual impact. The SEO BirdLife representative asked about the infrastructure requirements and surface area during the construction and injection phases. During the discussion, a representative of the project team shared an image of the CO_2 pilot storage in Hontomin, Burgos, Spain (Figure 27). This pilot is currently the only onshore injection site Spain. It is managed by Fundación Ciudad de la Energía (CIUDEN) and it was recognised by the European Parliament as a key test facility.
- Environmental impacts. Two local representatives expressed concerns about the potential impacts of CO_2 storage on underground aquifers, local land, agriculture, and animal life. A representative of a local agricultural cooperative shared his thoughts on the possible effects on the local agriculture: "We are the region with the largest number of hectares in Aragon. An ecological agriculture area. We should analyse this with more meetings and think things through. Seismic issues come to my mind. I see the project as very interesting, but I have my doubts. At the level of agriculture, it is a bit scary to put things under it, it does not mean that I am against it, but that I have many doubts."
- Need for information and engagement. Overall, participants in the session were quite receptive and expressed satisfaction with the opportunity to voice their concerns about the project.

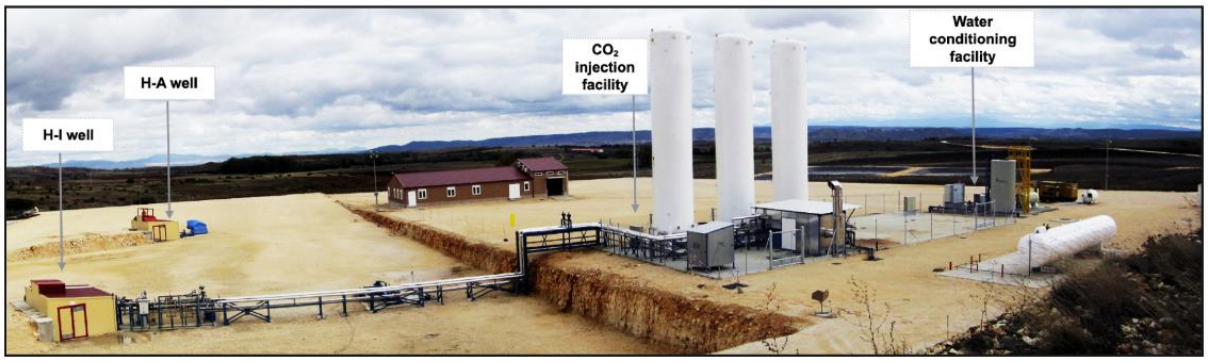

Figure 27 The Hontomin Technology Development Plant (TDP) for CO_2 geological storage, located close to the city of Burgos (Spain)

Vision of the local community on the geological storage of CO_2

CISOT-CIEMAT presented the local community's perspective on the geological storage of CO_2. The results of a secondary analysis of the community, a survey of local residents, and interviews with representatives of key actors were briefly outlined. Following this presentation, an online interactive session using Mentimeter was conducted to explore the potential benefits and costs of a carbon storage project in the region, as perceived by the participants.

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Map of benefits and risks

The following are the main ideas derived from the Mentimeter exercise (Figure 2) regarding the potential benefits of a carbon storage for the region:

- Helping to reduce CO_2 emissions from activities with dispersed emissions, such as transportation, economic activities, or domestic use. Some specify the specific benefit of local industrial decarbonisation.
- The possibility of generating economic and social benefits to encourage population settlement in rural areas. This could include generating new infrastructures and diversifying the rural economic model. It is also suggested that creating employment opportunities in rural areas could help combat depopulation, as long as traditional agricultural and livestock economies are protected. Compensation with a positive socioeconomic impact is often mentioned as a primary benefit.
- Other possible benefits associated with technological development include public-private partnerships, such as the establishment of companies or economic benefits for municipalities that, in turn, benefit residents. Additionally, the ability for companies in Aragon to access storage is highlighted as an important factor.

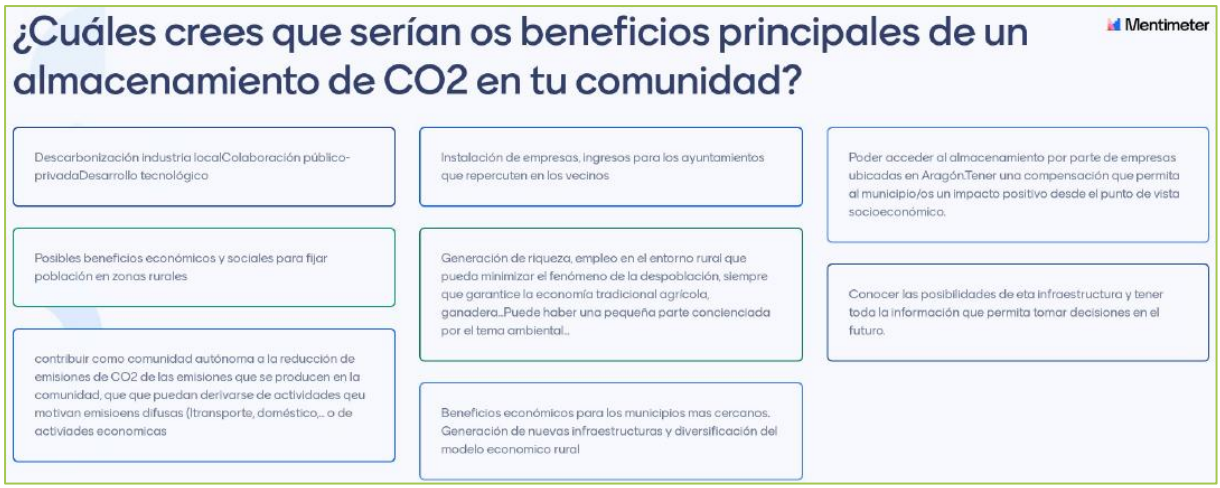

Figure 28 Main perceived benefits of carbon storage in the region. Mentimeter results

Regarding the potential risks of a CO_2 storage site for the community, participants mentioned the following:

- The fear that too many storage projects will be implemented in the region due to its favourable geological characteristics without any benefit for the community.
- There is also concern that a significant amount of money will be invested, but it may ultimately not be useful or result in any community benefits.
- Direct or indirect environmental and socioeconomic effects on the region, including interference with existing forms of life, risks to economic activity, seismic and environmental risks, potential leaks, risks to leisure activities, tourism and agriculture, and other unidentified risks.
- In terms of environmental risks, stakeholders are concerned that this technology could negatively affect endangered species of flora and fauna in the Ebro Basin. However, they are confident that the PilotSTRATEGY project's environmental study will consider these aspects and determine its feasibility without harming the region's flora and fauna.

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- Stakeholders also refer to possible risks related to perception and social acceptance. For example, they mention the vision of being perceived as a "simple CO_2 dump," the perception that it only benefits large corporations and not communities, fear of living near a CO_2 deposit, conflicts between detractors and defenders, and harm social relations within the community.
- Finally, perceived risks associated with the technology include a lack of infrastructure for CO_2 transport, long and complex authorisation processes, a lack of capture technologies, high costs, and the possible installation of polluting companies in the surrounding area.

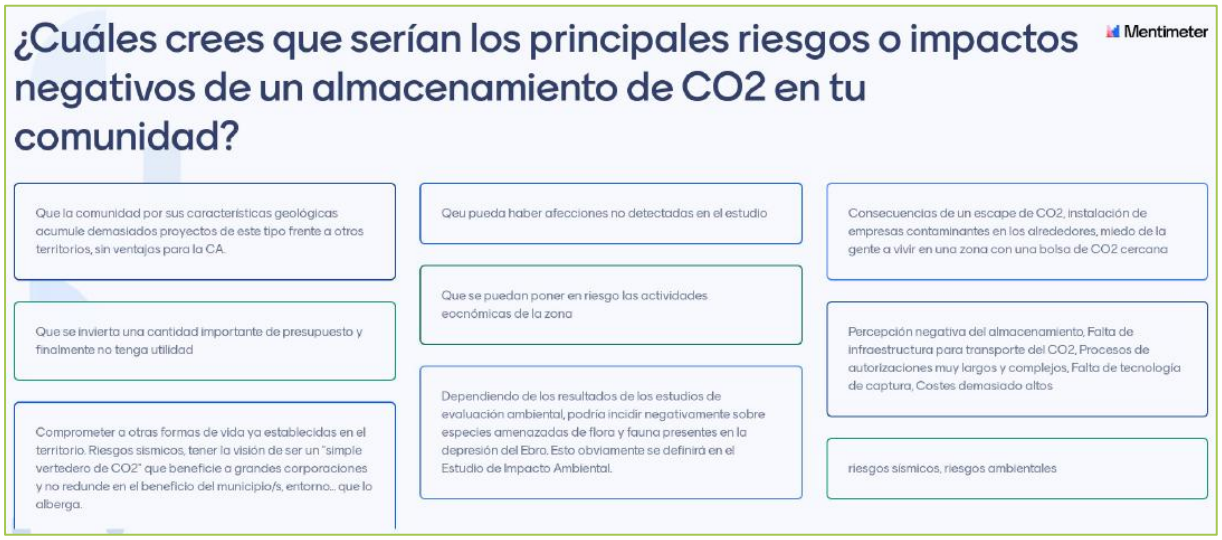

Figure 29 Main risks or perceived impacts of carbon storage in the region.

A.1.2.1.3. Workshop evaluation results

An evaluation questionnaire was completed by participants (n= 6) after the first session. The results of the questionnaire were as follows:

- The participants gave an average score of 4.83 out of 5 in response to the question "The workshop discussions have been interesting". All participants either agreed or strongly agreed with this statement.
- The participants gave an average score of 4.83 out of 5 in response to the question about the freedom to express their opinions during the workshop.
- When asked about the neutrality of the RSC moderators, the participants gave an average score of 4.67 out of 5.
- In the open comment section, one participant expressed interest in visiting the potential area of the facility in the future. Another participant commented that he would like to know if the technical results of the project support the initial expectations about the structure. He also stated that it is necessary to carry out an information campaign with the public in the selected area to address any doubts about the technology.

A.1.2.1.4. Conclusion

In conclusion, the first Regional Stakeholder Committee (RSC) of the PilotSTRATEGY project was held in Spain, bringing together local actors to explore expectations and concerns regarding a potential CCS project in the region. The meeting involved representatives from various industries, research centres, public administrations, business associations, and civil society. The stakeholders discussed

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various topics, including the potential for Lopín to be selected as a storage site, the role of private companies, potential economic compensations, potential interest in CCS technologies in the local industry, landscape, visual and environmental impacts, and the need for information and engagement. Overall, the RSC was a significant step in the PilotSTRATEGY project's progress and provided valuable insights for the project team. Some participants offered their willingness to help on the organisation of the next RSC, that will take place next September, in face-to-face modality, in the municipality of Quinto.

A.1.2.2. Report of RSC 2

A.1.2.2.1. Introduction

On the 19th of September 2023, the second Regional Stakeholder Committee (RSC) was held in Spain as part of the PilotSTRATEGY project. The objective of this committee was planned in response to WP5 Task 5.5 (Stakeholder Dialogue) with the specific aim of understanding how stakeholders view the risks associated to carbon capture and storage technologies (CCS). According to the project planning, this task would benefit from the Regional Stakeholder Committees of WP6 where these discussions on risk perception could take place in the framework of these committee meetings (Milestones M5.4 and M5.7).

From WP6, we considered that the perceived risks towards carbon capture and storage technologies by stakeholders also represent a very relevant dimension within the model of public perception and social acceptance of this technology. Furthermore, the face-to-face design of the activity facilitated an enriching debate with interesting outcomes for both work packages of the project. The aim was also to develop a network of stakeholders that can extend beyond this project and work together to build a realistic CCS project proposal in the region, while reporting on the achievements of the PilotSTRATEGY project.

The specific objectives proposed for the session were the presentation of the PilotSTRATEGY project and the update on the work conducted regarding the Ebro Basin, and the discussion on the perceived risks associated with the geological storage of CO_2. The organising team sent an invitation to attend the Regional Stakeholder Committee meeting and some information leaflets on the PilotSTRATEGY project and on the onshore Ebro Basin region in Spain. The participants returned the signed consent forms also by e-mail. Table 14 shows the structure followed in the meeting.

Table 14 Agenda of the second RSC meeting

10:00	Welcome and presentation of the participants.
10:10	Regional Committee and objectives of the meeting
10:20	PilotSTRATEGY Project Update
10:35	Questions
10:40	Activity
11:45	Pause
12:00	Risks and mitigation actions

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12:15	Debate
12:45	Farewell and thanks
13:00	Networking (Eat & Meet)

According to the proposed agenda, the second stakeholders' meeting lasted 3 hours and took place at the Mayor's Office of Quinto (Zaragoza) in Spain. Eleven stakeholders participated in the committee (4 women and 7 men). Six of the attendees also participated in the first committee and some of them invited to new participants. Thus, on this occasion there were five new stakeholders (2 from industry and 3 from public administrations). Table 15 shows the participants in the second regional stakeholder committee.

Table 15 Types of stakeholder representatives

Stakeholder type	Participants
Industry	4
Research and education	1
Public Administrations	5
Support organisations	1
Influencers	0
Total	**11**

After the presentation on the PilotSTRATEGY project updates in the Ebro basin region in Spain by Paula Canteli, the CIEMAT-CISOT team carried out the following group activity. First, each participant had to identify different risks in relation to a possible carbon store in the region. Then, participants were grouped into three small groups to discuss the risks perceived by each of them. Subsequently, they had to rank the identified risks in a matrix considering two criteria: the importance and the controllability of the risk, as shown in Figure 30.

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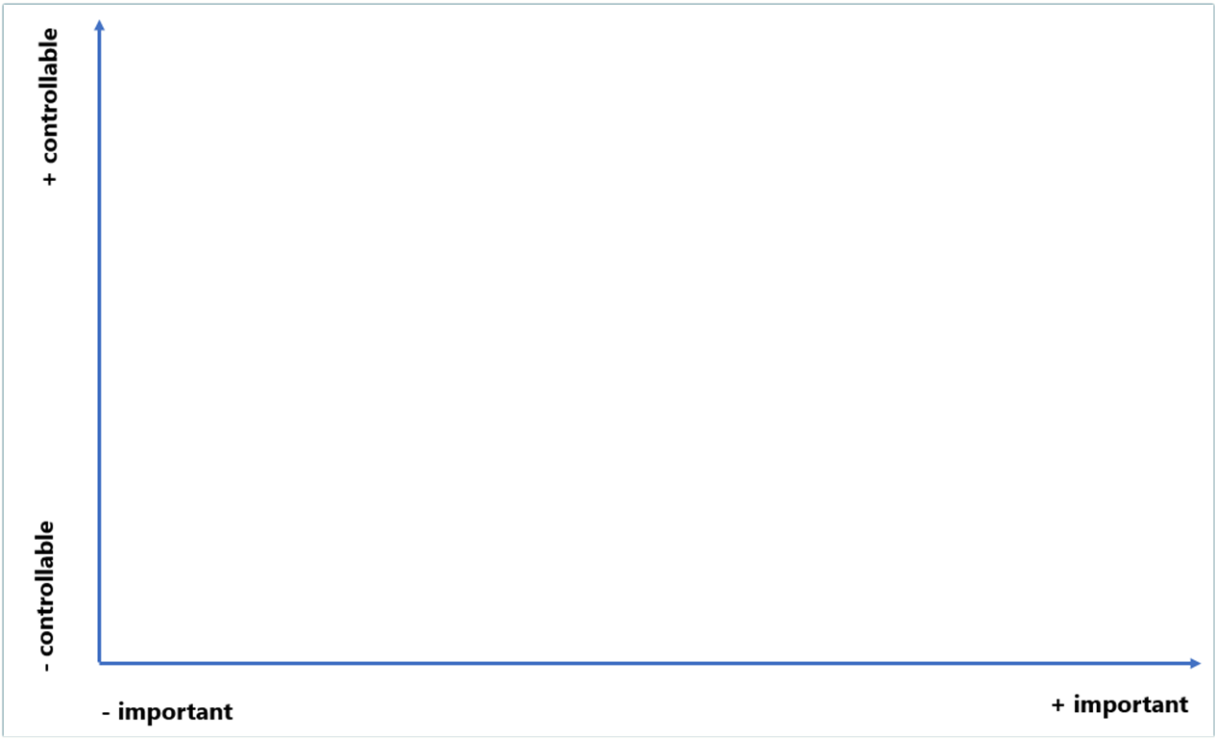

Figure 30 Ranking of perceived risks

To conclude the activity, a representative from each group had to present their results to all participants and place their risks in a joint matrix, which included the analysis of the risks from a global view including all three groups. Therefore, it was possible to obtain both a specific analysis per group and the general analysis of the whole commission in relation to the perceived risks.

After the group discussion, the Ebro Basin team presented the possible risks associated with carbon storage, an overview of the preliminary risk assessment in the region and possible control and mitigation actions. Finally, an interesting debate on the topic arose and lines of discussion for subsequent committee meetings. The session culminated with the respective thanks, the evaluation questionnaire and the global planning of the next RSC.

The following section presents the results obtained, both the analysis carried out by each group and an integrated view of all the participants.

A.1.2.2.2. Perceived risks of carbon storage

Group 1

The first risk that all the members of the group thought of refers to "*earth tremors*" that could affect the structures above, buildings, etc. They thought it was very important because an event of this type could be serious and does not seem controllable. They emphasise that it is the first thing that everyone in the region is going to think: "*you are here drilling holes in the earth and what is going to happen here*."

Another risk to health and the environment that also seemed important but a little more controllable, refers to emissions into the atmosphere. Rather than CO_2, they thought about emissions of other types of pollutants such as emissions of suspended particles or other types that

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were also pollutants and could be produced at the time of injection. They considered it more controllable, in the sense that the air quality in the area can be measured and there can be some control.

A risk that was perceived to be important, but to a lesser extent, is the contamination of other aquifers or the risk to the hydrological cycles of the area, the course of groundwater, leaks of saline water, etc. They did not consider it as important as the previous risks because if it is produced at such depths, it would still not affect human consumption. It was ranked as a little less important and with little controllability. At this same level, the following risks were also mentioned: CO_2 leaks, effects on flora, fauna and people. In the middle of both criteria, as moderately important and controllable, they mentioned the impossibility of monitoring in the event that CO_2 was transferred to other underground spaces or how that monitoring would be done

Finally, the region could be identified as a '*contaminated area*', which could influence the population not wanting to live in that area. This risk was considered less important and moderately controllable. Although they do not consider it so important in the sense that it will not affect, in principle, people's health, the environment and safety, but it is a risk that they have associated, for example, with the storage of radioactive waste that has generated a lot of controversy and opposition in neighbouring towns.

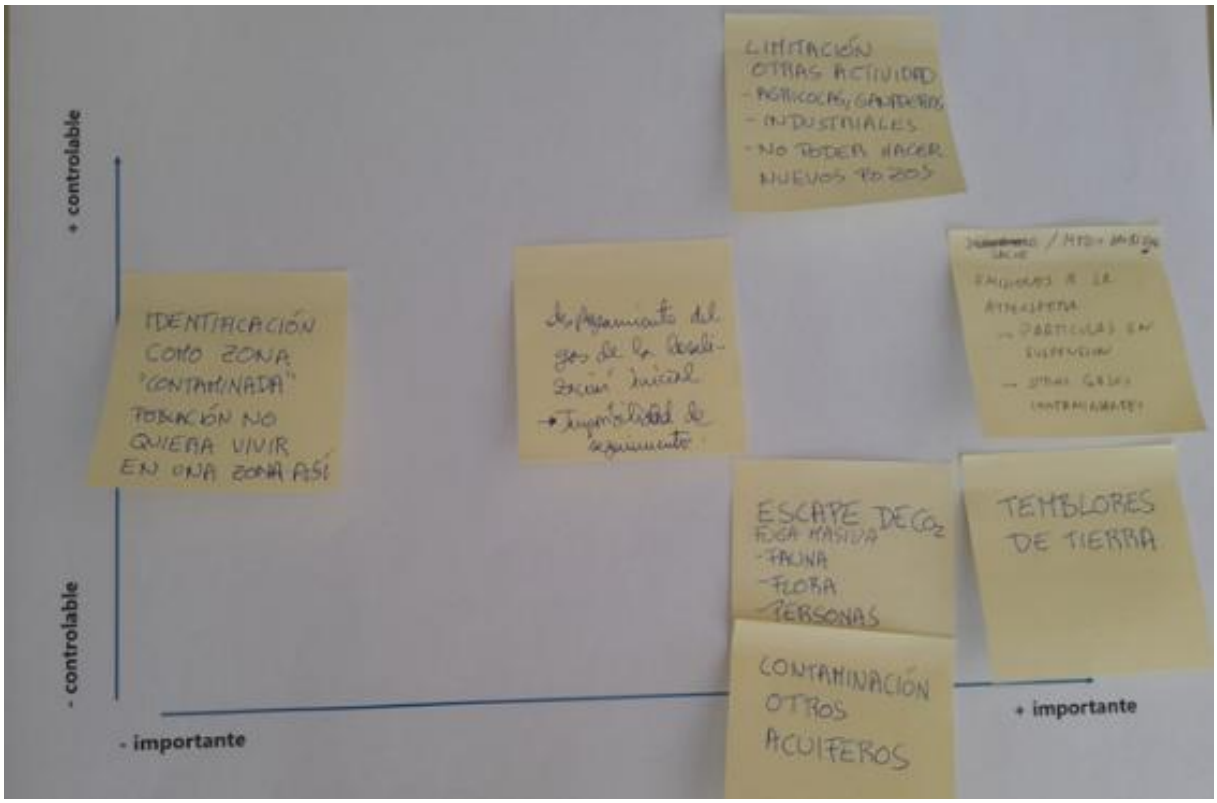

Figure 31 Ranking of risks perceived by group 1

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Group 2

Like the previous group, the first risk perceived by the group 2 (as more important and less controllable) are "*subsurface seismic movements, such as what occurred at Castor*"[5]. They point out that everyone is very aware of what happened in Castor and it is quite important. All the members of the group also agreed to mention CO_2 leaks. They have put it in the middle (moderately important and controllable) because of all the implications it could have (short, medium and long-term leaks).

They also highlighted the risk of contamination of aquifers, groundwater, and soil, which they considered important and perhaps more controllable. Some of them may even be related to the execution of the well when injecting.

Other risks that they considered very interesting to analyse, also important and more or less controllable, is the massive transport of waste. They mention the uncertainty of not knowing how the CO_2 is going to be transported. *"If it's going to be done with gas pipelines, or through a lot of trucks and this could have repercussions in the area."* Another risk similar to the previous one is the perception that it can encourage the use of fossil fuels, at a time when we are heading towards the decarbonisation of the economy. *"Well, if in the end what interests me is to continue emitting and injecting it... It's very interesting for us to know."*

Finally, the participants in this group also mentioned another aspect that they found worrisome and that they rated as less important and more controllable. They refer to the uncertainty of what types of industries this project will be able to bring, because in the end, it turns out that industries that are related to CO_2 emissions may come to the area. It was highlighted that the latter risks could be interesting from a global point of view of the economic impact that this project may have.

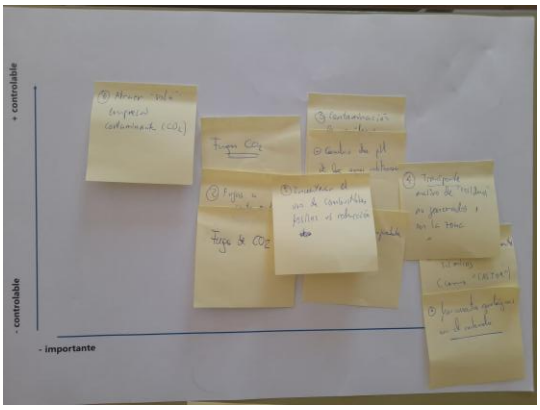

Figure 32 Ranking of risks perceived by group 2

Group 3

They mentioned in the first place "induced seismicity" in the same classification in which it has been positioned by all.

[5] Castor was a fault offshore gas storage project. Injection tests started at 2012 and produced induced seismicity onshore nearby. That created an important social alarm and national government decided to abandoned operation and storage site in 2013.

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On the issue of leaks, the group considered two options. First, the CO_2 leaks that could cause the contamination of aquifers that are drinkable, as well as leaks into the atmosphere. Participants in this group rated this risk as important but also more controllable.

Then they have also been concerned that the CO_2 injected is reactive, therefore, it could acidify the aquifer, as well as the unit where the CO_2 is injected, or the unit that can act as a seal. These aspects generate uncertainty for some of the participants of the group, and they assume that it will be part of the analysis of the project, specifically in relation to the geochemical alteration of the storage and the seal, and its effects on CO_2 mobility.

Continuing in this line of discourse, the participants of this group also reflected on the fact that CO_2 is not something that is extracted from the atmosphere, but comes from an industrial activity, where it has to be separated from other products that are generated in these processes. The uncertainty arises as to how these components can be separated. One stakeholder raised the following argument: *"Because, of course, when the* CO_2 *arrives here, perhaps not only* CO_2 *is stored, but also nitrogen and sulphur. So how can that affect the warehouse itself and in case there could be a leak."*

From a different perspective, another risk they were concerned about is a potential social divide between those who accept storage and those who do not accept it. Considering a small municipality, this has seemed very important to them, but also more controllable. Likewise, they mentioned the risk identified by another group that people would perceive the warehouse as a dumping ground and that it could discourage people in the area. Finally, they conclude that this is not very important, but they do not know how it will be controlled.

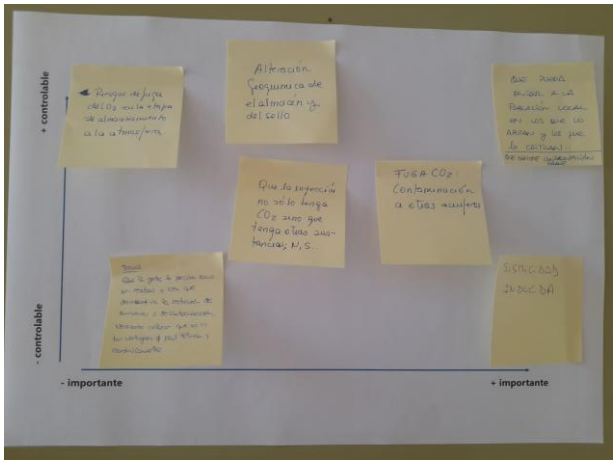

Figure 33 Ranking of risks perceived by group 3

A.1.2.2.3. Integrated analysis of the risks

The participants consensually identified many risks in all three groups. The first of these refers to *induced seismicity or earth movements*. Participants used different terminologies to refer to the same risk, but they agreed to classify it as being of greater importance and less controllable. In fact, in two of the groups, Castor was mentioned as an event that is still present in people (Figure 34).

The potential *leakage of* CO_2, as well as other polluting substances, is another commonly identified risk, although its perception of importance and controllability varied in different groups. Likewise, with respect to the contamination of other aquifers and hydrology in the region. The participants

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also mentioned the impact on flora, fauna and people, as well as on activities such as agriculture, livestock and industry. These risks were generally perceived as significant and more controllable.

In the middle of the two criteria, in terms of importance and controllability, some participants mentioned the risk of *geochemical alteration* of the carbon storage and the seal. As well as uncertainties about monitoring and even the paradox of incentivising the use of fossil fuels versus CO_2 reduction.

Finally, other risks that were also mentioned as less important and with different perceptions of controllability were: the possibility of *attracting "only" polluting companies*, the *identification as a "contaminated" area*, which could affect population fixation, and uncertainties about the real *technical and economic advantages* for the region.

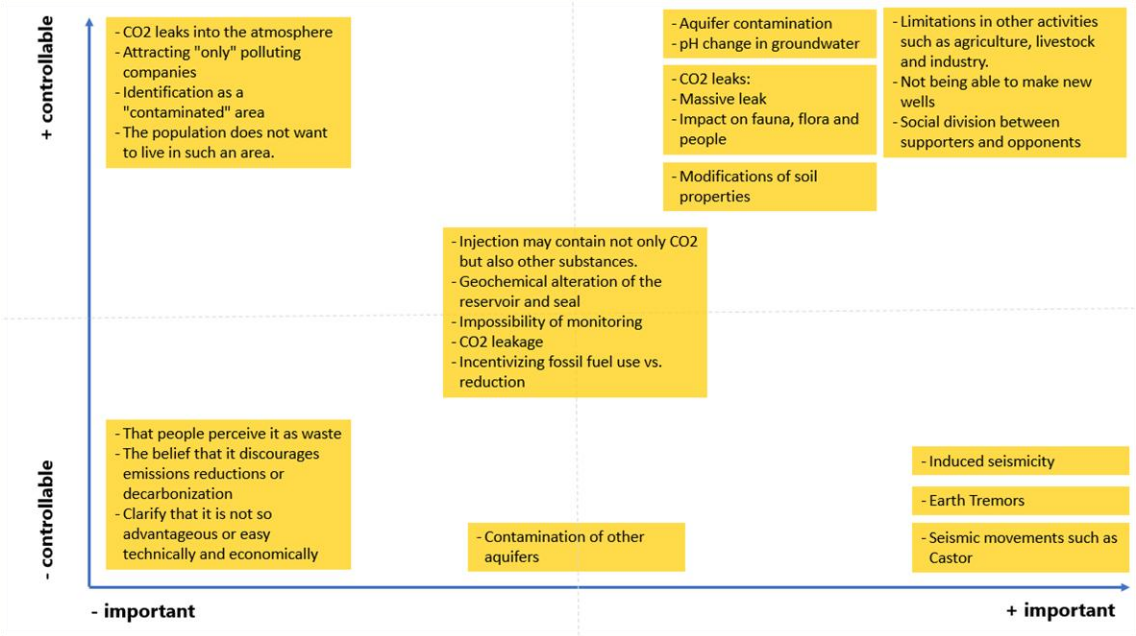

Figure 34 Integrated ranking of risks perceived

After the presentation of the risk mitigation actions by the Ebro Basin technical team, the participants discussed the following topics:

- **Seismic risk**: In relation to the seismograph net that are now being installed with the aim of getting a better detail of the natural seismicity of the area, questions arose whether they will be removed when the base seismicity is determined. So, when the project is up and running, will they be put back in? The technical team responded in the affirmative, pointing out that when the project is up and running, not only the seismometers, but a whole series of measures will be made to control the extension of the storage, with seismometers, with CO_2 detectors, fiber optic, monitoring wells, etc. It was also mentioned that the law is protectionist and if the project is proposed it is mandatory to propose a monitoring system plan, including measures of natural seismicity before injection and sensors net during operation.

  Technical team pointed out that a seismic risk analysis taking is a fundamental analysis of the project, where the first thing is the correct mapping of the faults as part of defining properly the structure. For a future injection, a 3D seismic survey of the area would be needed to identify

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faults down and reduce existing uncertainty about the structure at this point of the study. What we have now is a regional study with a preliminary geo-mechanical model, analysing the pressure regime of all the wells, the size of the faults, the stress regime of the faults is, and how a possible injection could change that stress regime.

- **Land ownership**: The question was raised as to whether the land where the technology could be implemented is public. The technical team explained that, in Spain, the land is in the public domain, and the operator asks a concession for using it. A permit would have to be requested from the Ministry to be able to store the CO_2 and what happens on the surface has to be negotiated with the owner of the land unless it is declared to be of public necessity. The stakeholder representative of the General Directorate of Energy and Mines of the Government of Aragon added that the owner is the owner of the land only, and the subsoil is in the public domain and is managed through the Geological Storage Law.
- **Economic viability**: The question arose as to whether, apart from the technical analysis, an economic analysis of the cost will also be carried out, which a priori seems to be going to be high. *"Capture, transport, injection, operation, maintenance, security control. Is this financially sustainable?"* The team noted that this is one of the questions the European Commission hopes to get with the results of the project, how much this technology would cost in the region and whether it would be cost-competitive. The technical team focuses on the warehouse and can evaluate a CO_2 reception facility, from what source, what impurities it may come with, and calculate the cost of CO_2 sequestration, the installations and what the well could cost. They also have to include how the CO_2 market is doing and compare it with what it costs to store. So, for example, it was commented that CO_2 capture is falling in price, and storage is hopefully too. Depends on. As we generate projects and improve "know-how", we will reduce costs like any other technology.
- **Benefits for the local municipalities:** Another important topic was the socio-economic benefit for the region, which a priori does not seem to be very clear. "*What are the benefits of* CO_2 *injection? Because we know that it generates these risks and we minimize them, we are studying them, but economic and social benefits in the region, except for technology and its development, we do not see that this is a benefit for the region".* It was replied that the project does indeed include a socio-economic analysis that will be carried out next year. In general, it could generate jobs for construction and maintenance, although little is needed afterwards. It could also be important for universities, given its relevance in geology and the importance of technological development in Zaragoza. Interesting opportunities could arise if a company in the area is able to respond by improving monitoring systems, injection well systems and materials systems.

  The Mayor of Quinto also asked what the specific benefits would be, for example for the region of Quinto or Belchite. "Would the company that manages the CO_2 storage facility pay anything to the municipalities to implement it there? Something per ton? Does any money reach the city council or the government of Aragon?" He stressed that apart from the technical and economic benefits, it is necessary to take into account the social risk of everything that this can generate, as is happening with photovoltaic and wind power. There are areas of Aragon where they are delighted to receive them and other regions that oppose them, because they generate impact, affect tourism, etc.

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> *"I think that such large and unknown projects can generate controversy. It is important: first, that people have all the information, second, that people can quickly visualise what the risks are, but what the benefits are. The risks should be as low as possible, but the benefits should be as high as possible".*

A stakeholder of the Government of Aragon also highlighted the importance of these technological innovations having some kind of specific study for the region, because then it could be identified the benefits for the region. An industry stakeholder replied that a benefit would be the industry or the new jobs, because considering transport is expensive, some industry could be set up near CO_2 storage to minimise transport costs.

> *"It would be nice what other examples there are in the world and what benefits the installation of a CO_2 storage has meant for the territory. If in the end it is a little bit of money to the councils or in the end, it really attracts the industry".*

Another important issue that also came up was the analogy of the economic return of a photovoltaic park for the region from the taxes received by the municipality.

> *"The four photovoltaic installations we have in the region generate taxes... With this I can think about my municipal development... Let's see what this brings to the region and not just to the owner of the well."*

In Aragon there is an old vindication, as very rich in territory, in space, and that is why it is very rich in photovoltaic and wind power, what has not been achieved is that this reverts to cheap energy in the territory because transport is saved. In this sense, it was commented that in Aragon much more electricity is generated than it is consumed, but they pay the same as other regions, which illustrates other line of benefits, as an issue that transcends the technical. It was also highlighted that the area of Lopín, which has undergone a process of depopulation, could be benefited as a way of fixing the population in the territory.

> *"If it were attractive for companies to set up here because transport is cheaper and it would be installed as an industrial hub... "We would have to go hand in hand with the General Directorate of Aragon so that it then generates economy and that people want to stay here."*

- **Lack of regulatory development:** As a precedent, the technical team also mentioned the latest modification of the Hydrocarbons Law where gas fields must provide a percentage of the profits of what they produce, apart from the fees paid directly to the municipality. The storage law in Spain has not a regulatory development, but it could go in this direction. In fact, a representative of the Government of Aragon commented that it could be linked (for example) to the Mining Law in which a surface fee was paid to the state for each concession.
- **Clear information to the population:** Some participants mentioned the need to explain very well to people, so as not to generate the feeling of "*nuclear waste".* All information regarding technology, and especially the benefits for the region, must be made expressly clear to avoid negative perceptions in this regard.

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"Although it is, an extreme example because the risks are different, but it can arise in the consciousness of the people who bring us here what they do not want in other places".

"We are going to have a nuclear cemetery here, we are going to eat what others do not want and we have nothing in return".

Another stakeholder representing the industry took up the idea of nuclear waste to add that where there is no one, is where this type of industry or technologies goes, because that is where there will be less social protest.

"So that will have to be made very clear, so that the assets for the territory can be defended".

A.1.2.2.4. Workshop evaluation results

An evaluation questionnaire was completed by participants (n= 11) after the first session. The results of the questionnaire were as follows:

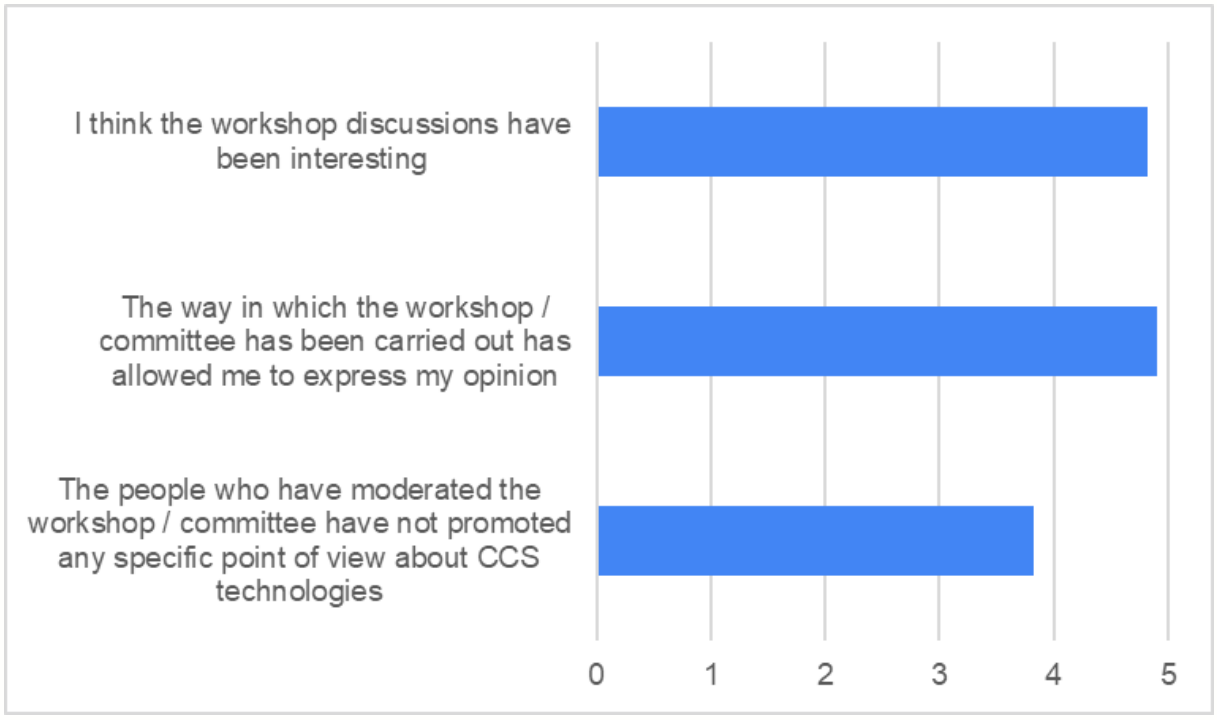

Figure 35 Questionnaire results

In addition, participants made several comments, mainly in relation to the importance of addressing the specific benefits of CCS technology for the region

- Address the benefits it would bring to the territory.
- Economic validation. Impact on the territory. Real appeal to the industry.
- Interesting final debate. Provide legal certainty.
- Good way to open projects. It is important to study the socio-economic benefits.
- I would need more detailed information to be able to evaluate everything better

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- It is interesting to discuss the benefits, especially local ones. I would need to understand the implications of not only CO_2 in the stream.
- It is very interesting to be able to discuss the subject, because it is a new topic that generates uncertainty. The risks and benefits must be put on the table
- Proposal for a debate on economic performance and impact on the territory
- Very interesting. Close attention should be paid to the impact on the territory.
- I think that next year a face-to-face meeting would also be interesting

A.1.2.2.5. Conclusion

The second meeting of PilotSTRATEGY's Regional Stakeholders Committee (RSC) in Spain was held face-to-face to discuss the potential health and safety risks of a potential CO_2 storage in the region. Stakeholders identified and assessed various risks, including seismicity, leakage, geochemical alterations, aquifer contamination, and impacts on flora, fauna, people, and activities such as agriculture. They also raised broader social and economic concerns. The meeting was a valuable step forward for the PilotSTRATEGY project, and the face-to-face format encouraged greater participation of the stakeholders and integration of the topics. It was proposed holding another in-person RSC in the second half of next year, and the Mayor of Belchite offered to host it.

A.1.2.3. Report of RSC 3

A.1.2.3.1. Introduction

The third meeting of the Regional Stakeholder Committee (RSC) for the PilotSTRATEGY project took place in Spain on 06 March 2023. The purpose of the meeting was to gather various local stakeholders, including representatives from industry, universities, research centres, public administrations, business associations and civil society, to discuss their views, expectations and concerns regarding the PilotSTRATEGY project. The objectives of this session were to present the importance of trust in CCS projects, assess the level of trust among participants in the context of a hypothetical CCS project, and identify the main actions that could promote trust in the development of CCS technology projects.

The meeting was held online as planned. To recruit stakeholders, the organising team followed the usual procedure from previous meetings and sent email invitations to all stakeholders who had been invited to the first and second meetings. Additionally, representatives from new stakeholder groups, such as communications and NGOs, were contacted to broaden participation. Alongside the invitation, we sent information brochures on the PilotSTRATEGY project and the Ebro basin region in Spain, as well as the informed consent form and the Frequently Asked Questions (FAQs) document. Participants returned the signed consent forms via email.

The third stakeholder meeting was designed to last an hour and a half and was conducted online through the Team's platform. The third regional stakeholder committee comprised 17 participants, with a higher number of women (N=10) than men (N=7). Table 16 shows the complete list of participants in the workshop. Additionally, the group welcomed nine new stakeholders, including three from industry, one from research and education, one from support groups, and four influencers.

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Table 16 Types of stakeholder representatives

Stakeholder type	Participants
Industry	7
Research and education	2
Public Administrations	3
Support organisations	1
Influencers	4
Total	**17**

The session followed a structured format. Firstly, three concise presentations were given on the objectives of the Regional Stakeholder Committee, updates on the PilotSTRATEGY project in the Ebro basin region of Spain, and the significance of trust in CCS technologies. The final presentation included real case studies demonstrating high and low levels of acceptance within the community, highlighting the crucial role of trust. Table 17 displays the meeting agenda.

Table 17 Agenda of the third RSC meeting

11:00	Welcome and objectives of the session (Lila Gonçalves, CIEMAT-CISOT)
10:10	Presentation of participants
10:20	PilotSTRATEGY Project update (Paula Canteli, IGME)
10:30	Trust in CCS projects (Christian Oltra, CIEMAT-CISOT)
10:40	Activity and discussion (all - Sergi López and Christian Oltra, CIEMAT-CISOT)
12:20	Conclusions (Christian Oltra, CIEMAT-CISOT)
12:30	Next steps and farewell (Lila Gonçalves, CIEMAT-CISOT)

The social research team applied Covello and Peter's[6] trust determination theory to both the content of the trust presentation and the subsequent activities presented to the participants to encourage discussion on the subject. According to the theoretical model, trust in risk communication is determined by four main factors: commitment, integrity, competence, and empathy, as shown in Figure 36.

[6] Covello, V. T., & Peters, R. G. (1996). The determinants of trust and credibility in environmental risk communication: an empirical study. In Scientific uncertainty and its influence on the public communication (pp. 33-63). Dordrecht: Springer Netherlands.

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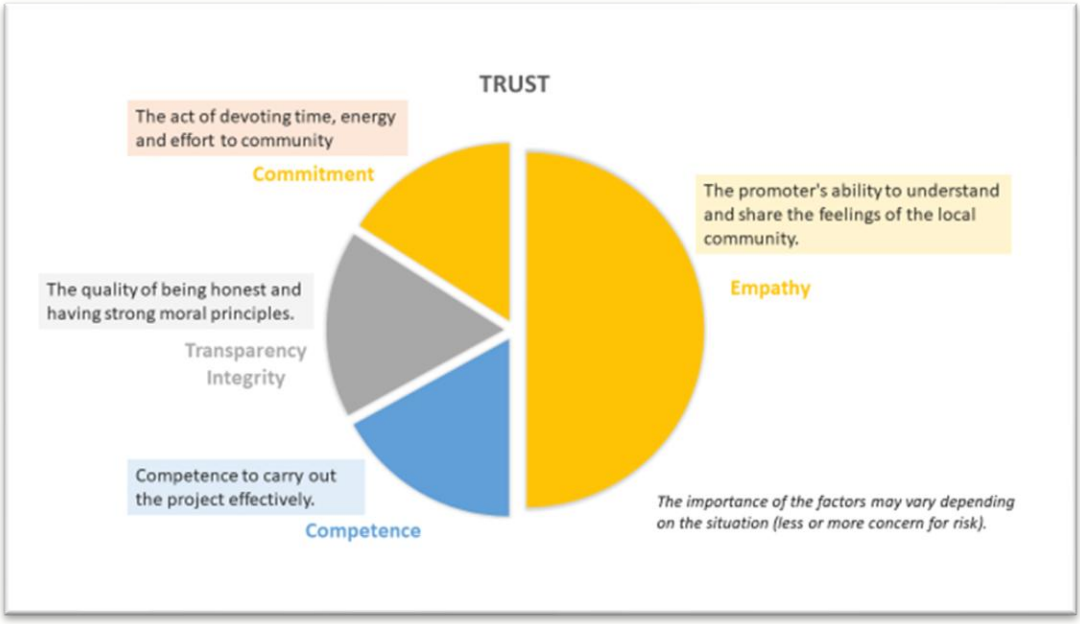

Figure 36 Theoretical model of trust

Following the presentations, participants engaged in an activity using the Mentimeter tool. They were asked to evaluate a **hypothetical scenario** involving the implementation of CCS technology in the region. Participants assigned scores to the level of expected empathy, honesty, transparency, and competence. Finally, participants were asked an open-ended question to reflect on specific actions that the promoter and other stakeholders could take to encourage local confidence in the project.

Table 18 Scenario: Capture and storage of CO_2 in a cement factory, province of Zaragoza

The cement company Cementum, located in the province of Zaragoza, has taken the initiative to implement a CO_2 capture and storage (CAC) project with the aim of reducing its environmental footprint and contributing to the fight against climate change.

CO_2 capture

- A capture system will be installed that uses a process to separate CO_2 from the plant's combustion gases.
- The captured CO_2 is compressed to a liquid state for easy transport.

CO_2 transport

- A 60 km pipeline will be built to transport liquid CO_2 from the cement plant to the storage point in Lopín.
- The pipeline will be designed and built with high safety standards to minimize the risk of leaks. A continuous monitoring system will be implemented

CO_2 storage

- The liquid CO_2 (about 500,000 tons per year) will be injected through a well in the rock of a deep geological deposit in Lopín, at a depth of 2,500m.
- The geological formation has been selected for its ability to store CO_2 safely and permanently.

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- Periodic studies and analyzes will be carried out using monitoring and tracking techniques to ensure the integrity of the storage.

Expected benefits of the project

- Contribution to the fight against climate change: Reduction of the cement company's CO_2 emissions that cannot be eliminated through other technologies (approximately 50% of the total).
- Job creation during the construction and operation of the project.
- Maintenance of jobs in the cement factory and local industries to meet environmental requirements.
- Valorisation of municipal waste through its use as an alternative fuel.
- Development of new technologies and knowledge in CAC.

The attendees contributed with a variety of actions to be implemented in this regard. The following section presents the results obtained.

A.1.2.3.2. Results

Perceived trust of the scenario

We first asked participants "How much would you trust the empathy, honesty and competence of the developer of a CCS project in this scenario? The results showed that participants generally had moderate to high levels of trust in the developer's empathy, with ratings concentrated around 3-4 out of 5. Perceived honesty and transparency were more variable but still tended toward the higher end of the scale. Technical competence inspired the highest levels of trust, with a majority giving it a 4 out of 5 rating. Specifically:

- Empathy: 46% of participants rated their trust in the developer's empathy as a 3 out of 5, while 23% rated it as a 4 out of 5. Only 8% rated it as a 1 (nothing) and 15% rated it as a 2.
- Honesty and transparency: Opinions were more divided, with 31% rating their trust as a 4 out of 5, 23% as a 3 or 5, and 15% as a 2. Only 8% rated it as a 1 (nothing).
- Technical competence: A majority of 54% rated their trust in the developer's technical competence as a 4 out of 5. 15% rated it as a 2 or 5, while only 8% rated it as a 1 (nothing) or 3.

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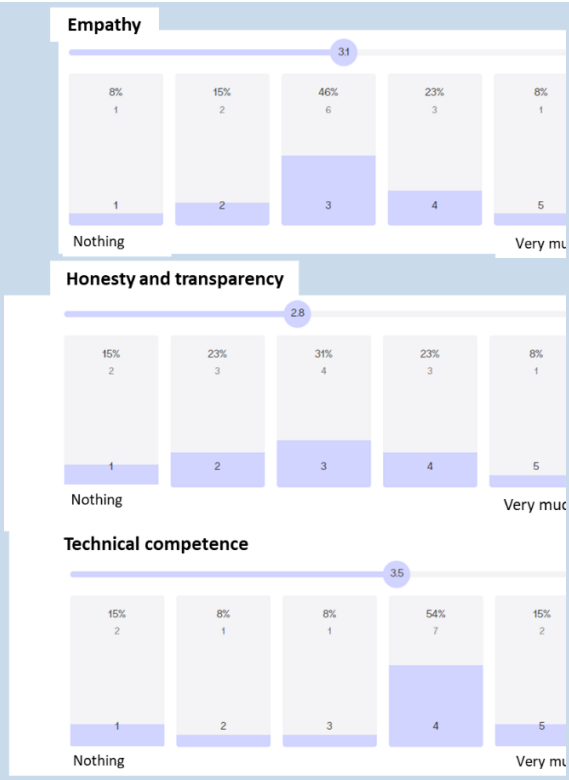

Figure 37 Trust perceived by participant

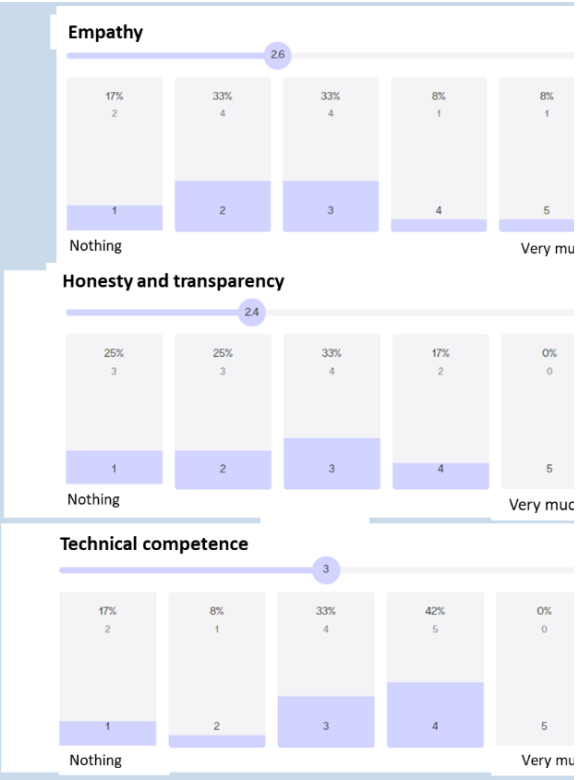

Figure 38 Community trust in the promoter as perceived by stakeholders

Then, we asked participants in the workshop "how much they think the local population would rate the empathy, honesty and competence of the promoter in the scenario?" As shown in the figure below, participants believed the local population would have lower levels of trust compared to their own ratings. For empathy, ratings were concentrated around the lower end of the scale (1-3). Perceived honesty and transparency were also lower, with the majority of ratings falling between 1-3. Technical competence was still seen as the strongest aspect, but with more ratings of 3 and fewer of 5 compared to participants' own views.

The territorial aspect emerged as a potential source of mistrust, given that Aragon is a sparsely populated region. Participants questioned whether there is genuine demand from local companies for carbon storage, which could generate economic activity and employment in the area, or if the companies involved are from outside the territory. One industry stakeholder expressed surprise that the chosen site is an empty area rather than being close to large emission sources like Repsol or Galp, which are promoting this type of project. They noted that this could be controversial and raise doubts about the true motivations behind the project. A public administration stakeholder emphasised that Aragon does not want to become a landfill or depository for anyone, suggesting a sense of protectiveness over the region and its resources. Participants stressed the importance of clearly explaining the rationale for implementing the project in empty territories instead of near emission sources to avoid misunderstandings and mistrust.

> *"The fact that it is implemented in empty territories instead of emission sources should be very well explained"*

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During the discussion, an industry stakeholder was struck by the fact that the companies promoting PilotSTRATEGY and similar projects in other countries appear to be exclusively oil companies. They argued that this needs to be thoroughly explained to avoid suspicions that it might be an attempt by fossil fuel manufacturers to greenwash their image and extend the use of fossil fuels instead of pursuing other measures to eradicate them.

A representative from the Government of Aragon countered that it makes sense for hydrocarbon companies to be interested in this technology due to their extensive experience in the field. They suggested that society should be informed about the expertise and advanced tools these world-leading companies possess.

> *"We are talking about a technology that has been in operation for more than 150 years where some of the most advanced tools in the world are used and that is why these companies that are world leaders are interested in participating, because they are the ones who know the most and are completely at the forefront in these issues. All this would have to be explained to society".*

The lack of detailed information about the scenario was another factor that prevented stakeholders from placing greater trust in the promoter. Participants expressed the need for more technical and economic details, an analysis of alternative decarbonisation methods, information on local benefits for the community, and technical specifications of the company. Industry stakeholders called for an economic report that outlines all associated costs and compares them with other alternatives to assess the short, medium, and long-term viability of the project. They also sought to understand the positive impact and benefits for the local population near the storage site. Stakeholders from both industry and public administration noted that the brevity of the information provided made it difficult to give higher trust ratings and answer questions confidently. They emphasised the need for much more technical information and data from the company to make informed assessments.

> *"I don't see, I don't understand what the benefit is, what the positive part is for a population that is right there in the place of storage". (*Industry Stakeholder).
>
> *"Much more technical information is needed."*

A.1.2.3.3. Actions to promote trust among the local population

Participants discussed various actions to promote confidence in potential carbon storage based on the presented scenario. The results are outlined below.

The company promoting the project must demonstrate a genuine commitment to decarbonisation by explaining thoroughly why it is resorting to this solution and cannot apply other technologies for the same purpose. Therefore, the management must provide a thorough justification for why CCS is the only feasible decarbonisation option after considering and ruling out other alternatives. During the Mentimeter session, multiple participants independently highlighted this action, and later in the debate, a representative from the government of Aragon elaborated on the importance of informing the public about this aspect so that they can form an opinion based on solid criteria. It is important to ensure that the cement company has thoroughly considered all technical and economic alternatives before proceeding with this option.

Additionally, the promoter should provide detailed explanations of the benefits of implementing a CCS project in the region to the community. This information must be conveyed transparently and accurately to the entire population involved, providing concrete data and similar examples from

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elsewhere. It is also important to specify employment opportunities with real data rather than 'happy data'. In this aspect, a stakeholder representative of an association for rural and integral development emphasised the importance of providing transparent information. They highlighted the need to avoid subjective evaluations and to ensure that information provided is factual and will be fulfilled. The minimum promised should be guaranteed. Policymakers also have an important role to play in offsetting benefits for the local population in the area where the carbon deposit is located

> *"It's going to generate money for the local population, how much? It's going to generate revenue for the city council, how much? Regarding employment opportunities, should be realistic. To say that a lot of jobs are going to be created is useless. It is necessary to say that a certain number of jobs are going to be created, specifying, for example, a guard guard, 3 engineers and two maintenance jobs. Because we are already used to photovoltaic and wind farms that promise by the news that they are going to create 1,000 jobs and it is a lie, there are 10 at most"*

To ensure complete and accurate information, it is suggested that information campaigns be implemented involving all agencies promoting the project, including public administrations. These campaigns should inform about the advantages of reducing CO_2 emissions, cost analysis in all phases from capture, and highlight the relevance of the cement industry for society. A representative of the Government of Aragon highlighted the lack of knowledge regarding the required volumes of mining raw materials for the daily development of society. As an example of success, the Tree Day campaigns were mentioned. The cement plant of Aragon was also cited as an example of mining activities involving citizens.

> *"I have focused on an information campaign to society, especially to local society, informing about the benefits of the Project in general by all the actors, telling that it is a mature technology".*

The developer is required to publish an environmental impact assessment report and present the technical information in a way that is understandable to all stakeholders. It was also noted that the use of municipal solid waste by cement companies could be a cause for concern due to the pollution they produce. This stakeholder argued that the cement company's interest in reducing CO_2 emissions by only 50% is not convincing unless serious measures are taken to reduce the consumption of fossil fuels. They emphasised that the burning of MSW is not sufficient and generates environmental concerns due to the air pollution it causes.

The use of precise technical information would help build trust. To provide technical information related to storage, it is crucial to have a website or other accessible means. All relevant project information must be clearly and transparently stated to uphold the value of trust. All relevant project information must be clearly and transparently stated to uphold the value of trust. This applies to all actors involved, including policy, ministry, and regional decision-makers.

Detailed studies are necessary. The implementation of carbon storage must be justified through a comprehensive analysis of all relevant technical, socio-economic, and environmental aspects based on real data.

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The developer must explain all safety measures related to the implementation of carbon storage, as well as their respective monitoring. These safety studies should consider all phases of the process chain resulting from CCS technology.

> *"Analyse the issue of safety and transportation, by road or pipeline to the storage site in the Lopín area. This needs to be explained very well to the population. What kind of security is there, what kind of transfer, what kind of roads have to be moved, what are the accesses to the location, etc. Safety, not only for the population, but also for the entire route until it gets there. That is fundamental".*

A.1.2.3.4. Workshop evaluation results

At the end of the session, an evaluation questionnaire was completed voluntarily by participants (n=8). In general, the participants positively valued the development of the third regional stakeholder committee. Figure 4 shows the quantitative results of the questionnaire were as follows:

The average score for the statement "The workshop discussions have been interesting" was 4.25 out of 5, with nearly all participants agreeing or strongly agreeing, and only one participant giving a neutral response (3). All participants strongly agreed (5 out of 5) that they were allowed to freely express their opinions during the workshop. Regarding the neutrality of the RSC moderators, participants gave an average score of 4.5 out of 5, indicating that they either agreed or strongly agreed that the moderators did not promote any specific point of view about CCS technologies.

Figure 39 Questionnaire results

In addition to the questionnaire results, participants provided some comments and suggestions:

One participant proposed that receiving information and results about the project between RSC sessions would be an improvement, stating, "In addition to the organisation of the Committees, it

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would be good to receive some information in between on the progress of the project and the technical information generated during its development."

Another participant expressed a positive outlook on the session and reinforced their commitment to participating in upcoming events, saying, "All very friendly, you can count on us. We will propose you to tell us more about Lopin, geological issues."

One participant suggested that the case scenario proposed in the third RSC activity could have been presented differently, noting, "Perhaps the example could have been different so as not to identify a specific company. Or even to have provided two examples, one from a company located in Aragon and the other from a company located outside".

A.1.2.3.5. Conclusion

The third regional stakeholder meeting of the PilotSTRATEGY project provided valuable insights into the factors that can influence public trust in carbon capture and storage (CCS) projects. The meeting brought together a diverse group of stakeholders, including industry representatives, researchers, public administrators, and community influencers, to discuss a hypothetical CCS scenario in the Ebro basin region of Spain.

Overall, the stakeholders expressed moderate to high levels of trust in the technical competence of the CCS project developer, but were more cautious about the developer's empathy, honesty, and transparency. Participants believed the local population would be even more skeptical, with lower levels of trust across all factors. Key concerns revolved around the siting of the project in an "empty" area rather than near major emission sources, the perceived dominance of oil and gas companies in CCS initiatives, and the need for more detailed technical, economic, and environmental information.

To address these trust-related issues, the stakeholders proposed several actions for the project developer and other stakeholders to consider. These included:

- Providing a clear and comprehensive justification for why CCS is the optimal decarbonisation approach for the cement plant, compared to other alternatives
- Transparently communicating the tangible local benefits of the project, such as job creation and revenue generation, using specific data rather than general claims
- Implementing broad-based public information campaigns involving all agencies involved in the project
- Publishing detailed environmental impact assessments and technical information in an accessible format
- Thoroughly explaining all safety measures and monitoring plans related to CO_2 transportation and storage

By actively addressing these trust-building measures, the PilotSTRATEGY project can work to foster greater acceptance and support from the local community and other key stakeholders in the Ebro basin region. Continuing to engage these groups in an open and transparent manner will be crucial for the long-term viability and success of the CCS initiative.

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A.1.2.4. Report of RSC 4

A.1.2.4.1. Introduction

The fourth meeting of the Regional Stakeholder Committee (RSC) for the PilotSTRATEGY project was held in Spain on 3 October 2024. The objective of the meeting was to convene a diverse group of local stakeholders, including representatives from industry, academia, research institutions, public administrations, business associations, and civil society, to engage in a constructive dialogue about their perspectives, expectations, and concerns regarding the PilotSTRATEGY project. The objectives of this session were threefold: firstly, to reflect on the importance of community compensations within CCS projects; secondly, to identify potential needs and compensations for the local community (near Lopín); and finally, to discuss the socio-economic impact analysis of the PilotSTRATEGY project.

To recruit stakeholders, the organising team followed the usual procedure of previous meetings and sent email invitations to all stakeholders who had been invited to previous meetings. In addition, representatives of new stakeholder groups, including representatives of the regional administration and the trade union, were contacted to broaden participation. Together with the invitation, information brochures about the PilotSTRATEGY project and the Ebro basin region in Spain were sent out, as well as the Frequently Asked Questions (FAQ) document. Together with the agenda, the informed consent form was handed out to each participant before the start of the session, and a signed copy was returned to the participants.

The fourth stakeholder meeting lasted two and a half hours and was held in person in Belchite. At this meeting, the committee had 13 participants, of which 9 were men and 4 were women. Table 19 shows the full list of workshop participants. In addition, the group welcomed four new stakeholders, one from the Directorate General for Climate Change and Environmental Education of the Government of Aragon, a new participant from the company Saica, and a representative of the trade unions.

Table 19 Types of stakeholder representatives

Stakeholder type	Participants
Industry	3
Research and education	0
Public Administrations	7
Support organisations	2
Influencers	1
Total	13

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The session developed according to the following structure. Firstly, the objectives of the Regional Stakeholder Committee (RSC) were presented, with a brief mention of the three RSCs previously carried out and followed by the specific objectives of the session for the fourth committee. An update on the PilotSTRATEGY project in the Spanish Ebro basin region and the importance of community compensations in CCS projects was then presented. Finally, a preliminary analysis of the socio-economic impact of the PilotSTRATEGY project was presented to participants. The agenda of the meeting is shown in Table 20.

Table 20 Structure of the third RSC meeting

10:00	Welcome and objectives of the session
10:10	Presentation of participants
10:15	PilotSTRATEGY Project update
10:30	Community compensation in CCS projects
10:45	Group activity and discussion
12:00	Socio-economic impact on the PilotSTRATEGY project
12:30	Concluding thoughts and next steps

During the presentation, the local team outlined the objective of community compensations, which is to achieve a balance between the negative impacts perceived by the local community and the benefits provided. This could contribute to local support. In particular, it encompasses the measures, actions and benefits that the project offers to the communities within its sphere of influence. The objective is to achieve a balance between the negative impacts and the positive effects, while fostering a mutually beneficial relationship. The various forms of community compensation can be grouped into the following categories:

1. Monetary incentives,
2. Environmental compensation
3. Culture and quality of life,
4. Socio-economic development,
5. Infrastructure and public services,

The CIEMAT-CISOT team conducted the following group activity. The first task was for each participant to identify the main needs of the region and write them individually on sticky notes. They were also asked to list the community compensations to a possible development of carbon capture and storage. The participants were then divided into three small groups to discuss the needs of the region and the offsets identified by each group. They were then required to locate the offsets according to the five criteria illustrated in Figure 40 and finally rank the best ones with stickers.

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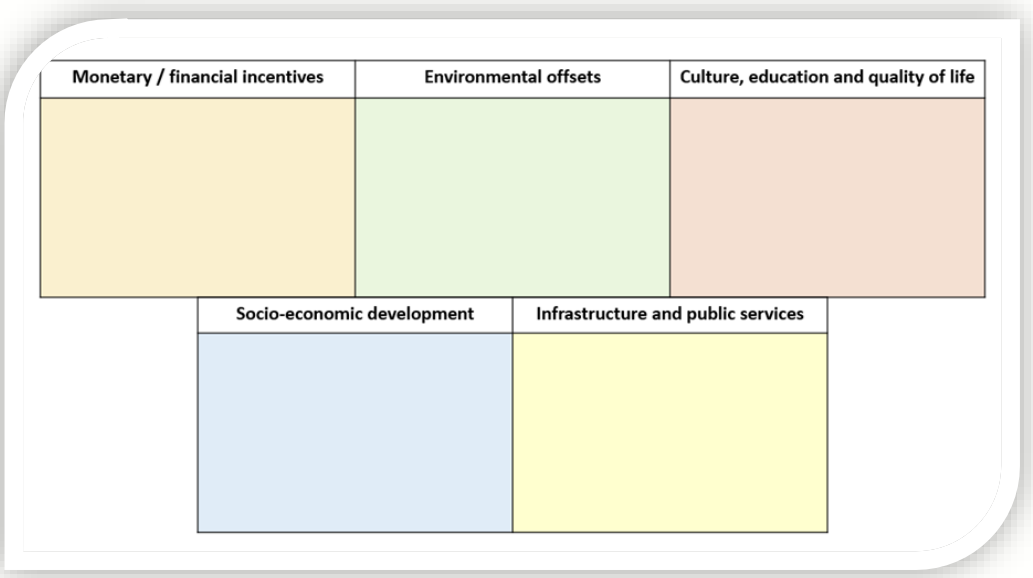

Figure 40 Criteria for the classification of community compensation

To conclude the activity, each group was required to present their results, including an analysis of the various potential compensations identified by the group, to all participants. Subsequently, the participants discussed the consensus reached and the additional insights provided by each group. As a result, a specific individual and group analysis, as well as an overall analysis of all stakeholders, was presented.

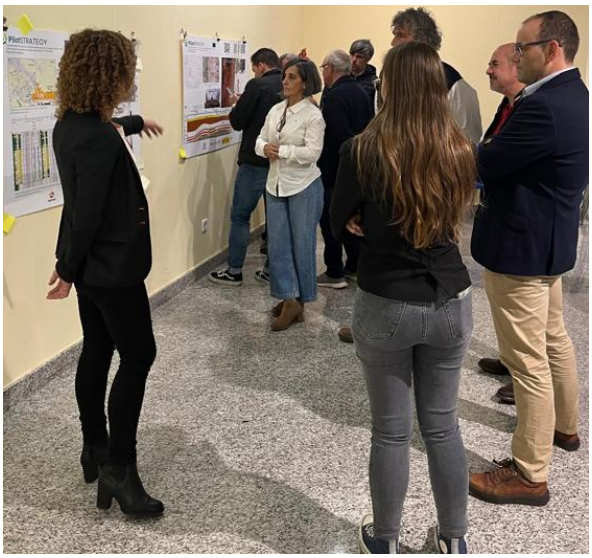

Figure 41 Poster presentation by IGME team

Following the group discussion, the CIEMAT energy systems analysis unit presented its preliminary results of the socio-economic impacts of the PilotSTRATEGY project. This was followed by a Q&A session with the stakeholders, during which they raised a number of questions and made a number of final reflections. Upon conclusion of the session, participants proceeded to the arranged visit to

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the Lopín area, where they had the opportunity to observe the region and provide feedback (Figure 42).

Figure 42 Team and stakeholder field visit

A.1.2.4.2. Results

Main needs of the region

Based on feedback from all three stakeholder groups, the region's primary development needs fall into two main categories:

Infrastructure and public services and culture and quality of life: The assessment revealed significant demands for improvements in healthcare facilities and services, educational institutions, cultural amenities, and social service programmes. These elements form the foundation of community well-being and sustainable development.

Economic development: Stakeholders emphasised the critical need for economic growth through the creation of stable, long-term employment opportunities. This includes implementing business attraction and retention initiatives, along with efforts to diversify the regional economy.

Project-specific requirements:

- Safety and environmental considerations: The project must prioritize safety through comprehensive risk assessment protocols. Environmental impact studies are required to evaluate effects on public health, flora and fauna, and land use patterns. Additionally, thorough analysis of CO_2 transport options, including both pipeline and vehicular solutions, must be conducted.

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- Communication strategy: Stakeholders identified the need for consistent and transparent project communication. This includes regular updates on project developments, forthright disclosure of both benefits and risks, and establishment of clear communication channels with local communities.

Table 21 presents a detailed breakdown of regional needs as identified by each stakeholder group.

Table 21 Needs of the region as identified by stakeholders

Group 1	Group 2	Group 3
▪ Settlement of the population ▪ Improve services (cultural, social, health, educational). ▪ Services (education, health) ▪ Improve connectivity ▪ More local economic activities ▪ More infrastructures for tourism. ▪ Training staff for professional development in business, industry, services, etc. ▪ Social awareness ▪ Community Support ▪ Communication	▪ Ensure that potential environmental risks are avoided ▪ Work with the SEO BirdLife: bird reserve located next to the injection area. ▪ Study the aesthetic impact on the steppe landscape. ▪ Analyze possible repercussions on flora and fauna. ▪ Study of the possible type of CO_2 transport, pipelines, trucks. ▪ Communication to society. ▪ Generate security and communicate the virtues of the project. ▪ Deposits safe, with minimum risks. ▪ Regulate that the commitment to reducing CO_2 emissions also applies to diffuse emissions. ▪ Consider the population (or depopulation) in the risk assessment. ▪ Ensure that immediate sanctions are imposed in case of seismic activity or contamination of water or land.	▪ Improvement of infrastructures and services ▪ Job creation ▪ Attracting companies ▪ Locating R+D+i centres in the area. ▪ Facilitate the technical training of the population. ▪ Rely on regional authorities for research, development and implementation (universities, CSIC). ▪ Stable employment ▪ Restoration of possible damage in the construction of the facilities. ▪ Knowing the impact in terms of health, environment, etc. ▪ Community information* ▪ Training. Job profiles ▪ Safety for the environment and people ▪ Respect for the rural environment.

After assessing regional needs, stakeholder groups evaluated potential community compensation measures for CCS technology deployment. The next section presents these findings.

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Compensation for communities in CCS projects.

The stakeholder groups identified and prioritised various compensation measures for the potential CO_2 storage project, which can be categorised into five key areas. The highest-priority financial measures included tax benefits and incentives for local entities, while environmental compensation focused on habitat restoration and green space development. In terms of socio-economic development, stakeholders emphasised local employment opportunities, business attraction, and the establishment of a decarbonisation-focused R&D center. Quality of life improvements centered on enhancing health and education services, along with specialised training programmes. Infrastructure priorities included transportation network improvements and the development of cultural facilities.

Table 22 Integrated analysis of Community compensations

Monetary / Financial incentives	Environmental compensation
▪ Helping people through scholarships. ▪ Financial incentives for local associations. farmers and the city council* ▪ Tax benefits* ▪ Electricity bill incentives.	▪ Restoration of degraded spaces* ▪ Creation of parks, gardens and plantations* ▪ Consider SEO Birdlife (bird reserve).

Culture, education and Quality of life	Socio-economic development
▪ Improvement of health, education, and elderly services* ▪ Technological collaboration with specialised institutions. ▪ Training Programmes* ▪ Project information campaigns* ▪ Dissemination of the region's values.	▪ Prioritising local employment* ▪ Attracting companies* ▪ Support home purchase or rental. ▪ R+D+i technology centre associated with decarbonisation* ▪ Favouring local industry*
Infrastructure and public services ▪ Public transport. Improve transportation routes such as roads and highways* ▪ Internet connectivity. ▪ Solve water problems. ▪ Electricity lines ▪ Build homes, schools, cultural infrastructures*.	

Notably, while participants identified numerous potential compensation measures, those marked with asterisks received the strongest support through a prioritisation exercise, indicating clear community preferences for specific initiatives within each category.

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Group 1

Financial and Monetary Incentives

Direct financial support was proposed for local residents, including targeted assistance for educational scholarships, elderly care programmes, and family support services. Additional recommendations included agricultural subsidies, municipal funding, and support for local associations. The group emphasised preferential treatment for local businesses and tax incentives, as illustrated by one participant: "Given our hosting of such a facility, we should receive tax benefits similar to those granted to depopulated areas."

Environmental Initiatives

Environmental compensation measures focused on two key areas. First, collaboration with SEO Birdlife, a prominent environmental organisation managing an extensive steppe bird reserve near or potentially within the proposed injection site. Second, rehabilitation of degraded natural spaces, with one participant noting: "Intervention is needed in deteriorated areas such as our river system and forest lands."

Education, Culture, and Quality of Life. Proposed investments included:

- Preservation and enhancement of village cultural heritage
- Healthcare service improvements
- Enhanced educational facilities and programmes
- Development of specialised vocational training aligned with project opportunities
- Establishment of technological partnerships between specialised centers and businesses

Socioeconomic Development. The group prioritised local economic growth through:

- Preferential hiring practices for local residents
- Business attraction initiatives
- Housing development programmes for both purchase and rental options

One participant emphasised: "Local residents should have priority access to employment opportunities generated by this project."

Infrastructure and Public Services. Critical infrastructure improvements were identified in:

- Public transportation systems
- Internet connectivity
- Electrical grid infrastructure
- Water management systems

Group 2

Economic Compensation. The stakeholders emphasised the importance of directing economic benefits to the local region rather than metropolitan centers. Key recommendations include:

- Municipal revenue generation from project activities
- Direct financial assistance for area residents
- Regional retention of corporate tax revenue
- Residential utility cost subsidies

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- Municipal tax relief programmes

As one participant emphasised: "Tax revenue should be retained locally rather than directed to Madrid."

Economic Development Initiatives

- Proposed development strategies encompass:
- Public investment support programmes and subsidies
- Technology park development
- Establishment of an R&D center specialising in decarbonisation technologies

Environmental and Community Enhancement. Environmental compensation measures focused on:

- Creation of new public green spaces
- Implementation of reforestation programmes
- Rehabilitation of environmentally degraded areas

Social and Cultural Development. Recommended community investments included:

- Municipal social, cultural, and sports programmes
- Specialised training programmes for local residents
- Enhanced educational opportunities

Infrastructure Development. Priority infrastructure improvements include:

- Residential housing development
- Educational facilities
- Cultural and community centers
- Enhanced telecommunications systems
- Transportation infrastructure upgrades

As noted by one stakeholder: "Investment should target comprehensive transportation infrastructure, including roads, highways, rural routes, and railway systems."

Group 3

The third group reinforced several recommendations from previous sessions while adding new perspectives:

- Municipal and individual financial incentives
- Environmental restoration initiatives, including river rehabilitation and reforestation
- Preservation and promotion of regional cultural, heritage, and anthropological values
- Educational transportation subsidies for youth studying in Zaragoza
- Comprehensive workforce development programmes
- Enhanced support for local development agencies like ADECOBEL
- Establishment of R&D facilities within the region

As one participant noted: "The region should become a hub for technological innovation, study, and research."

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Educational and cultural support. The group emphasised:

- Educational assistance programmes
- School meal services
- Cultural and educational resources
- Public awareness campaigns regarding facility impacts

Participants in this group expressed interest in the Ciudad de la Energía (CIUDEN) CCS project in Burgos, Spain. Key aspects of this initiative included:

- Substantial ministerial funding
- Local tax revenue retention
- Prioritised local employment
- Comprehensive public information campaign
- Energy museum development

A representative of the Government of Aragon proposed:

- Site visits to existing CCS facilities
- Expert presentations on operational experiences
- Access to published results via the ENOS project website

Finally, an industry stakeholder highlighted that Aragon's greenhouse gas emissions are predominantly from diffuse sources (80%) such as transportation and residential activities, while industrial sources account for only 20%. They emphasised the importance of addressing all emission sources: "While industry will fund these initiatives, we must not lose sight of the larger 80% of emissions from diffuse sources." On the other hand, another participant noted that while current regulations focus on industry, new regulations in 2025 will expand to include transportation, heating, and residential sectors, creating a more balanced approach to emissions reduction across all sources.

A.1.2.4.3. Reflections on socio-economic impacts and community trade-offs:

At the end of the session, each participant was invited to provide a brief reflection on the key takeaways from the session. The following were some of the final reflections:

Final reflections
Given the current lack of familiarity with technology, should this be achieved, it would require a significant investment in educational resources to support wider society. It is typical for changes to give rise to feelings of apprehension and uncertainty. It is essential to provide comprehensive and clear explanations to avoid social division. “In a municipality of our size, the worst that can happen is that people begin to position themselves half against and half in favour, but in a very fervent way.”
From a climate change perspective, the project is an interesting one. In terms of compensation, the financial element will be borne by the city council, with other investments also made. However, the project will generate only a limited number of local jobs, which will require highly qualified personnel. Some of the resulting employment opportunities would be local.
The primary local benefit is economic compensation, although this does not relate to employment. It will be necessary to provide an explanation to the public. “We already have the

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Final reflections
experience of the photovoltaic and wind farms, that offer thousands of jobs, and the reality is that there are very few".
I would like to thank for the transparency of the information provided in the project. It is important to ensure that this continues to be a priority in the future, to avoid any potential social unrest that could have a negative impact on the industry. "The more transparent you can be in providing data, the better we can evaluate and support it"
From an industrial perspective, the fundamental objective in terms of decarbonisation should be and it is to avoid emissions at source. "If we have to go towards carbon capture technology, then that would be for residual emissions and minimal emissions from our processes."
It is important to emphasise the positive aspects and the minimisation of risks involved in the project, and to communicate these points clearly to society. Transparency is fundamental to this process. Maximise the benefits of this project, both globally in terms of the environmental impact and regionally in terms of technology, industry, local university collaboration and economic development, which will facilitate population growth in these disadvantaged regions.
The administration, as well as some companies, are starting to demonstrate interest in these **CO_2** storage facilities. The technology is viable, but we must demonstrate to the public that it is a low-risk, socially beneficial enterprise. "I would not want a repetition of what happened with fracking, where there was social rejection, or with the injection in CASTOR."
It would be beneficial to gain further insight into the success stories. If a visit to Burgos is not feasible, a representative from the town council could provide insights from a local and technical perspective. The information provided by the CEIDEN project team would be invaluable in communicating the project to the public. "Burgos is a very close case, and they could tell us how they transmitted it locally. Their problems and how they solved them."
There is considerable satisfaction with the progress of the project overall. However, there are concerns that the next phase, at the level of private initiatives, may not encourage the development of this style of participation. It is crucial to consider whether this methodology will be sustained throughout the project's implementation. Without clear and comprehensive legislation to align these guidelines, maintaining the necessary standards and criteria may prove challenging. "¿Is this next phase going to be carried out with similar criteria, in this spirit? Because everything we are talking about, ends with the pilot phase, and then the private initiative does things in its own way".
The technical team has indicated that the primary objective of PilotSTRATEGY is to provide guidance to the administration on the lines of work to be pursued and to the promoter on how to proceed. It was emphasised that in order to be successful, all aspects must be taken into account.

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Final reflections
Despite the existence of a storage law, there is currently no regulation in place. It is still in draft form. This may be an opportunity to collaborate with the Ministry to ensure that the regulation is clear and comprehensive.

A.1.2.4.4. Workshop evaluation results

At the conclusion of the session, participants (n=10) were invited to complete an evaluation questionnaire on a voluntary basis. Overall, participants expressed positive sentiments regarding the fourth workshop of the regional stakeholder committee. **Figure 43** illustrates the quantitative results of the questionnaire, which are as follows:

The workshop discussions were considered highly engaging by all participants, who also indicated that they were able to express their views freely. This aspect of the workshop was rated the highest (5 out of 5). One participant provided a low rating for the item 'moderators did not promote any specific views on CCS technologies', while the majority of participants provided high ratings, resulting in an average score of 4.

Figure 43 Questionnaire results

In addition to the results of the questionnaire, participants provided some comments and suggestions. Three participants proposed contacting and meeting with representatives of the town of Burgos, where the CIUDEN pilot project is already operational. "A potential visit to the Burgos storage facility, or an alternative presentation, could be arranged." Other comments indicated satisfaction with the meeting organisation and discussions, as well as the resulting conclusions. The event was well organised and ran smoothly. The conclusions were interesting and we hope they will have a positive impact. Finally, other comments were directed at suggesting information that should be included in future CSRs. It is worth noting the stakeholders' interest in learning about successful cases of CCS technology implementation.

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A.1.2.4.5. Conclusion

The fourth regional PilotSTRATEGY stakeholder meeting provided valuable insights into local needs, potential compensations from a carbon capture and storage (CCS) project, as well as stakeholders' perceptions of the preliminary results of the PilotSTRATEGY socio-economic impact analysis.

Based on the activities of the session and as a result of the discussions generated in the group, we present the following conclusions:

- The highest-priority financial measures favoured by the participants included tax benefits and incentives for local entities, while environmental compensation focused on habitat restoration and green space development. In terms of socio-economic development, stakeholders emphasised local employment opportunities, business attraction, and the establishment of a decarbonisation-focused R&D center. Quality of life improvements centered on enhancing health and education services, along with specialised training programmes. Infrastructure priorities included transportation network improvements and the development of cultural facilities.
- A communication campaign to the population should be considered a priority in the event of a future implementation of this technology in the region. It is essential to communicate relevant project information in a transparent manner to avoid social fragmentation and encourage support for the technology. This should include information on the potential benefits and risks, as well as actual employment figures. It would be beneficial to disseminate information about successful projects in the vicinity (such as CIEDEN in Burgos) or further afield. It would be helpful to understand the impact these have had on local communities and the process of involvement.

In order to facilitate acceptance and support from local communities in the Ebro basin, it is essential to consider the specific needs of the communities involved and engage in dialogue with key stakeholders on the most suitable forms of compensation. One of the key objectives of the PilotSTRATEGY project is to engage with society in a transparent and proactive manner, which we believe is crucial for the long-term success of the CCS initiative.

A.1.2.5. Report of RSC 5

A.1.2.5.1. Introduction

On April 3, 2025, the PilotSTRATEGY project held its fifth Regional Stakeholder Committee (RSC) meeting online. The meeting brought together a diverse group of local stakeholders from Spain, including representatives from industry, academia, research institutions, public administrations, business associations, and civil society. The main goal was to foster a constructive dialogue about their perspectives, expectations, and concerns regarding the PilotSTRATEGY project. Specifically, this session aimed to explore the Hontomín CO_2 storage pilot project and identify lessons applicable to the Ebro Basin.

The organising team recruited stakeholders by emailing invitations and the meeting agenda to individuals who had attended previous meetings. Eight people (five men and three women) participated in the one-hour online meeting conducted via Teams. Table 23 shows the list of workshop participants.

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Table 23 Types of stakeholder representatives

Stakeholder type	Participants
Industry	4
Research and education	0
Public Administrations	3
Support organisations	0
Influencers	1
Total	8

The session began with an overview of the general objectives of the Regional Stakeholders Committee and a mention of the four previous RSC meetings. The core of the meeting focused on presenting and discussing lessons from the Hontomín CO_2 Project relevant to the Ebro Basin. An update on the PilotSTRATEGY project preceded a detailed case study of the Hontomín CO_2 experimental storage project, covering both technical and social aspects. See Table 24 for the meeting agenda.

Table 24 Structure of the fifth RSC meeting

11:00	Welcome, objectives of the session, and presentation of participants
11:05	PilotSTRATEGY Project update
11:15	Case study: Hontomín CO_2 storage pilot project
11:30	Discussion
11:55	Concluding thoughts and next steps

The Hontomín Case Study

The presentation on Hontomín started with a brief project history. Initially, the project aimed to capture CO_2 from the Compostilla thermal power plant for commercial storage in Tierra de Campos, while running an experimental storage site in Hontomín. However, at the end of 2013, the project team decided not to proceed with the commercial components (Compostilla and Tierra de Campos), focusing instead on the Hontomín experimental site (Figure 44).

The potential storage site boundary was clearly defined (Figure 45), illustrating the designated storage area and monitoring systems. The plan included extending data collection to surrounding areas, incorporating various monitoring and safety measures. These measures featured a 3D seismic network and wells equipped with surface water monitoring systems to detect any potential CO_2 migration.

In 2013 and 2014, the team drilled two wells over approximately six months: one for CO_2 injection and another for monitoring. After this period, they removed all related equipment, leaving the area

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clean. For CO_2 injection, the project sourced CO_2 externally and transported it to tanks on-site for injection, rather than having a direct CO_2 capture system integrated with a local industrial source for the experimental phase. Figure 46 demonstrates the small footprint of the installations. The injector well itself is about 1.6 meters. While the Hontomín site includes cabins as an additional protection measure, such structures are often unnecessary. The monitoring system, operational since its installation, continuously tracks the injected CO_2 plume.

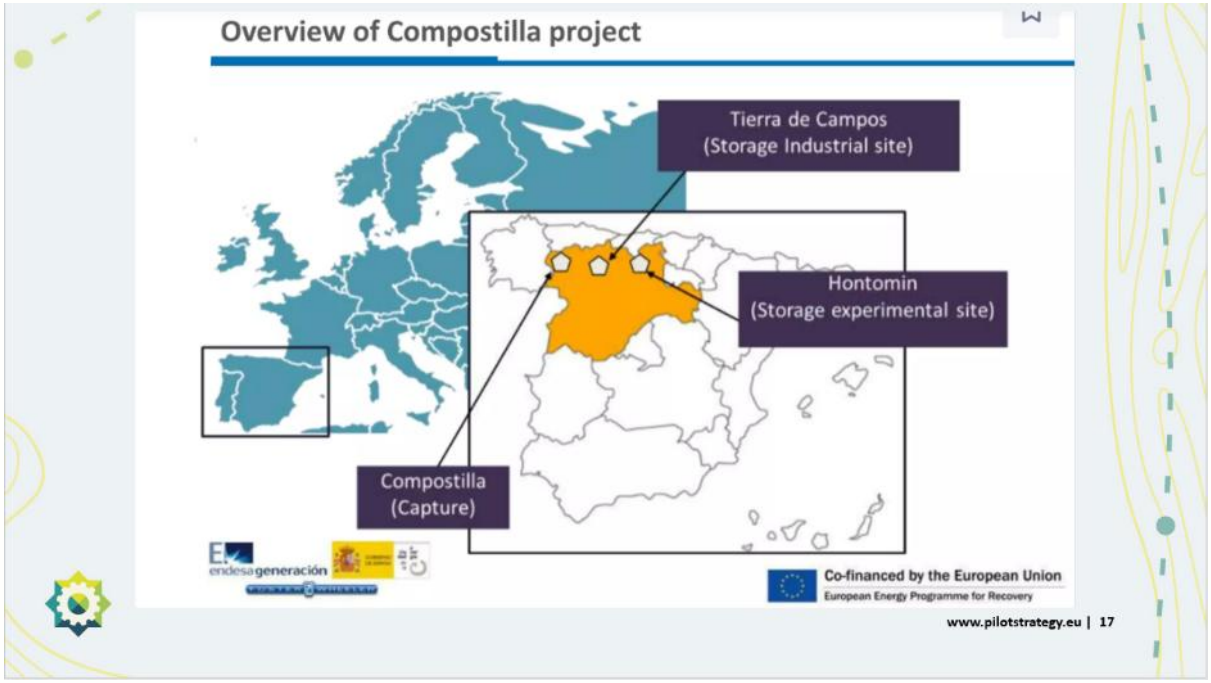

Figure 44 Initial scope of the project

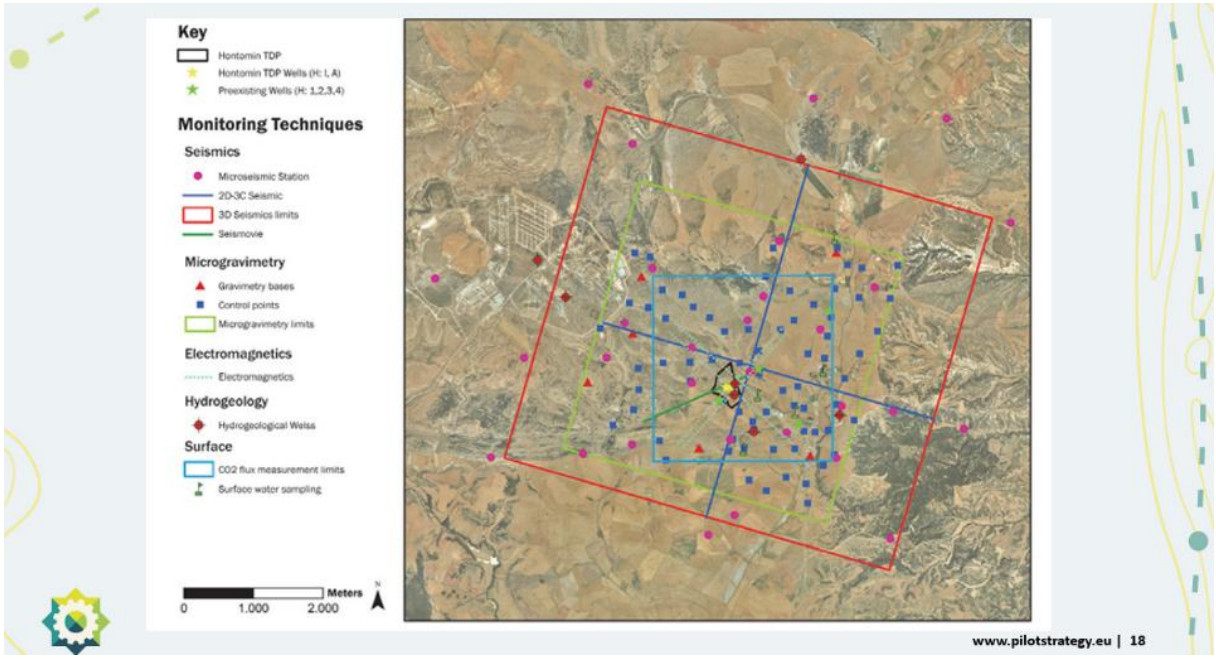

Figure 45 Storage area and monitoring systems

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Figure 46 Hontomín experimental CO_2 storage facilities

From a community engagement perspective, the Hontomín project became an important reference for CO_2 storage in Europe. This success stemmed largely from early and transparent engagement with all stakeholders, including the local community and regional government. The project team conducted numerous activities (see Figure 47) to maintain continuous contact with everyone, from the Neighborhood Council to city councils and locally hired installation workers. These efforts fostered strong local receptivity and a positive community attitude towards the project from the outset.

Key social lessons included the importance of:

- Early involvement of diverse local stakeholders.
- Transparent communication from the project's beginning.
- Building local receptivity.
- Developing collaborative compensation schemes in partnership with residents.

As Figure 48Figure 47 illustrates, these elements helped build trust to the point where most residents felt the project was beneficial and considered it "theirs." These social achievements, combined with excellent technical execution from injection to safety monitoring, made the project a pioneer in both Spain and Europe.

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Figure 47 Citizen engagement activities

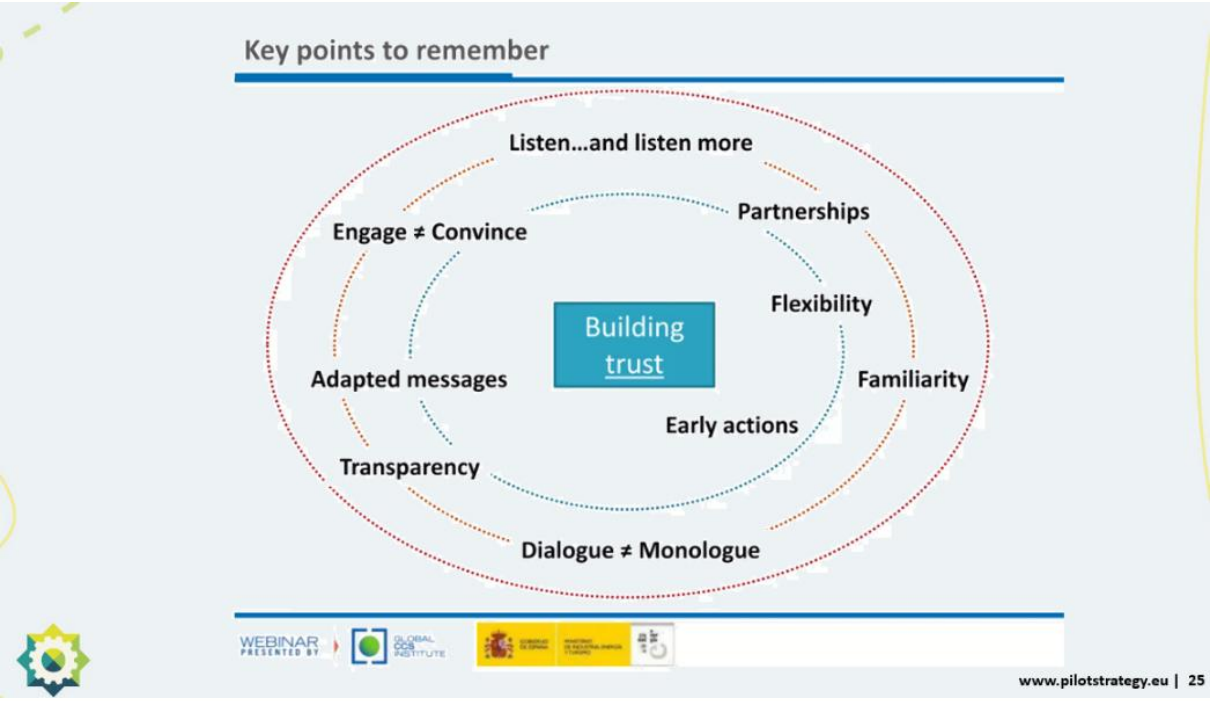

Figure 48 Lessons learned from a social perspective

A.1.2.5.2. Workshop discussion: Lessons for the Ebro Basin

To encourage idea exchange, the workshop organisers posed a question to participants: "After learning about the experimental carbon storage experience in Hontomín, what key lessons do you believe are essential to apply or avoid in our pilot project in the Ebro basin?"

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Summary of the discussion

A representative from the General Directorate of Energy and Mines of the Government of Aragon emphasised that while technical aspects are vital for safety and control, the social component is equally important. They stressed that communication and transparency with local communities are fundamental for any initiative's success, noting the difficulty of implementing a carbon storage project without proper local engagement. Another public sector representative agreed, highlighting that strong relationships with local authorities are crucial, citing examples from the mining sector where projects failed due to poor communication or lack of community agreements. This underlines the need to foster a favourable reception among the local population and encourage their active participation.

Regarding legislation, Spain's 2010 Law on Geological Storage of CO_2 regulates this activity. Several companies in Aragon and other regions have shown notable interest in establishing carbon storage technology, reflecting growing attention to climate change mitigation solutions. Currently, two projects are proposed in different areas, based on previous studies by the IGME (Spanish Geological and Mining Institute).

A participant from the UGT Aragón trade union identified security and resident confidence as primary concerns. Echoing sentiments from previous Regional Committees, it was emphasised that local inhabitants must feel the project is safe and offers them advantages to facilitate acceptance. The Hontomín experience of the community embracing the project as "their own" was particularly impressive and seen as a key success factor. Therefore, building trust and capitalising on the opportunities such initiatives offer should be overriding objectives.

A public administration representative from the Quinto mayor's office reaffirmed the importance of minimising public doubts, as mistrust can breed controversy. When citizens feel uninformed or uninvolved, negative perceptions can arise, potentially leading to conflict if they feel initiatives are imposed upon them. To mitigate this, the representative stressed effective communication and citizen participation to ensure residents feel engaged, understand the project's benefits, and are confident that potential risks are minimal. Clarity on economic benefits, like job creation and regional development, is also essential.

This representative also highlighted "ownership," as demonstrated in Hontomín, as a key lesson for future local implementations. The goal should be to minimize risks while demonstrating that benefits, such as skilled and unskilled job creation leading to significant economic development, outweigh disadvantages. Both this speaker and the UGT Aragón representative agreed that creating a climate of trust and confidence among citizens is crucial for successful project implementation, with transparency and inclusivity being key to alleviating doubt and fostering community engagement.

A participant from the Confederation of Aragon Businessmen emphasised the need to control social and environmental impacts. They pointed out the importance of considering benefits for host communities and facilitating social acceptance. Beyond direct employment, providing incentives and added benefits for the host community is essential.

Another industry representative presented a duality: while CO_2 storage offers significant potential for companies needing it, both companies and local communities have safety concerns. Even if

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economically viable and sustainable, safety must be a carefully addressed priority at every project stage. They underscored the importance of transparency, clear communication of all findings, and ensuring companies have access to relevant data to form informed opinions. The views of neighbours and the community potentially affected by such projects must also be considered.

Furthermore, this representative raised important questions about CO_2 transportation to the Ebro Basin area, suggesting two possible methods: road tankers or pipelines. Both options present different potential territorial impacts, leading to a debate on feasibility. Road transport could increase truck traffic, depending on CO_2 sources. Pipeline systems, while potentially more efficient, would also have environmental impacts and transport risks, requiring considerable infrastructure for safety and operability. They stressed the need for a thorough analysis of CO_2 transport, considering technical, economic, social, and environmental impacts on communities and ecosystems, and called for transparency in results and communication about these impacts.

Finally, another industry representative questioned the benefits of CO_2 storage for local communities, particularly when CO_2 is sourced from other areas: "I find it hard to see the benefit for local communities of bringing CO_2 from other areas." The PilotSTRATEGY Project's Ebro Basin coordinator clarified that Hontomín was a pilot project sourcing CO_2 externally, but the plan for full-scale implementation is to store CO_2 near its generation point. Future storage projects will depend on each developer's decisions. A representative from Aragon's Directorate General of Energy and Mines added that benefits will accrue to local companies, enabling them to reduce emissions and contribute to global climate change efforts. They emphasised CO_2 storage as crucial for decarbonisation objectives, which renewables alone cannot achieve.

Key discussion takeaways:

The discussion highlighted several critical factors for the successful implementation of CO_2 storage projects, emphasising the need for a balanced approach that considers technical, social, and environmental aspects:

- Prioritize community engagement:
  - Active participation from local communities is imperative for project success.
  - Fostering a positive reception and a sense of local "ownership" of the project among the population is essential.
- Implement effective communication:
  - Clear, accessible, and ongoing communication is vital to prevent conflicts and misunderstandings.
  - Projects must ensure the local population easily understands the objectives, processes, and benefits, instilling confidence that the project is advantageous and not merely imposed.
- Build and maintain trust:
  - Establishing trust within the community is fundamental for project acceptance.
  - Transparency, particularly regarding project data and results, is crucial for building and maintaining confidence throughout the project lifecycle.
- Address safety concerns proactively:
  - Safety is a primary concern for local communities and must be treated as a top priority.
  - A comprehensive assessment of CO_2 transport methods to the storage site is necessary to identify and minimize potential impacts.

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- Conduct Environmental Impact Assessments:
  - All CO_2 storage projects must undergo rigorous environmental impact assessments to identify, mitigate, and manage potential ecological effects.
- Deliver tangible community benefits:
  - Projects should actively explore and deliver economic and social benefits for host communities.
  - Incentivizing social acceptance can be achieved through additional benefits such as local job creation, infrastructure improvements, or other community-focused programmes.
- Acknowledge and navigate technological and perceptual Challenges:
  - While CO_2 storage technologies offer significant climate benefits, their implementation involves addressing specific challenges.
  - Openly discuss and clarify the real benefits to local communities, especially addressing concerns when CO_2 might be sourced from non-local companies.

A.1.2.5.3. Conclusion: Moving forward in the Ebro Basin

Both technical proficiency and robust social engagement are crucial for the success of carbon storage projects in the Ebro Basin. The Hontomín experimental CO_2 storage case demonstrates that strong relationships with local communities and effective communication are key to achieving positive involvement and acceptance. It is vital to learn from these experiences and adapt future approaches accordingly, always aiming to ensure not only project safety and efficiency but also community well-being.

A primary challenge is managing perceptions of safety and building trust among local residents. Therefore, project proposals must clearly demonstrate their safety and tangible benefits for both the local population and the environment. Transparent communication remains a cornerstone for overcoming these challenges and fostering successful CO_2 storage initiatives.

A.1.2.6. Report of RSC 6

A.1.2.6.1. Introduction

The sixth meeting of the Regional Stakeholder Committee (RSC) of the PilotSTRATEGY project was held in Spain on 29 October 2025. The purpose of the regional committees is to bring together a diverse group of local stakeholders — including representatives from industry, academia, research institutions, public administrations, business associations, and civil society — to engage in a constructive dialogue about their perspectives, expectations, and concerns regarding the PilotSTRATEGY project.

In this final session, the research team aimed to co-create a community engagement plan in anticipation of a potential carbon capture and storage (CCS) project in the region. Two specific objectives were set for this meeting: first, to foster dialogue between stakeholders and the technical team; and second, to work collaboratively on the development of a community engagement plan focused on the following key aspects:

1. Safety and Monitoring
2. Transparency and Communication
3. Benefits and Compensation (Local Development)

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To recruit participants, the organising team followed the standard procedure used in previous meetings, sending email invitations to all stakeholders who had been invited to earlier sessions. Additionally, on this occasion, an open public session was designed and announced, which was attended in full by all invitees.

The sixth stakeholder meeting lasted two hours and took place in person at the Directorate-General for Energy and Mines of the Government of Aragon, in Zaragoza. The committee gathered a total of 9 participants, including 6 men and 3 women. Table 25 presents the full list of workshop participants.

Table 25 Types of stakeholder representatives

Stakeholder type	Participants
Industry	2
Research and education	0
Public Administrations	5
Support organisations	2
Influencers	0
Total	9

The session followed the structure outlined below. First, the objectives of the Regional Stakeholder Committee (RSC) were presented, including a brief overview of all previous RSC meetings. This was followed by an introduction to the specific objectives of the current (sixth) committee session. As in previous meetings, an update on the PilotSTRATEGY project in the Spanish Ebro Basin was also provided. Before beginning the main activity, a short round of introductions was held, allowing each participant — both stakeholders and members of the project team — to briefly introduce themselves to the group. Finally, the activity was explained, and once the World Café exercise concluded, participants were invited to evaluate the session.

The agenda of the meeting is presented in Table 26.

Table 26 Structure of the sixth RSC meeting

10:00	Welcome and objectives of the session and presentation of participants
10:05	PilotSTRATEGY Project update
10:20	Group activity: World Café (3 rounds, 15’ + 15’ + 15’)
11:05	Plenary Discussion
11:25	Concluding thoughts and next steps
11:30	Coffee break
12:00	Open public session

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A.1.2.6.2. Methodology

The session employed a World Café methodology, designed to encourage open dialogue, collaborative learning, and the co-creation of ideas among participants. Attendees were divided into three working tables, each composed of a mix of stakeholders and members of the PilotSTRATEGY technical team, including professionals from IGME, REPSOL, and CIEMAT (representing Work Packages 2, 3, 4, 5 & 7). Each table was assigned a specific thematic focus aimed at exploring key aspects of a potential carbon capture and storage project in the region:

- Table 1 – Safety & Monitoring,
- Table 2 – Transparency & Communication,
- Table 3 – Benefits & Compensation.

To guide the discussion, each group was provided with a template designed to help them develop a community engagement plan, in which participants were asked to define three specific commitments, with the responsible parties involved and the means of communication through which each commitment would be shared with the community.

Table 1 — Safety and monitoring

What information will be published, and how the community will be informed about safety and monitoring activities. Examples: newsletter, site visits, emergency drills, and incident notifications. **Instruction:** Draft up to three clauses. Each clause should include: Commitment, Responsible party, and paths of communication. Use clear language and realistic timelines.

Commitment 1 (what we will do):	Commitment 2 (what we will do):	Commitment 3 (what we will do):
Responsible party/parties:	Responsible party/parties:	Responsible party/parties:
Means of communication (channel/format):	Means of communication (channel/format):	Means of communication (channel/format):

Table 2 — Transparency and communication

How should the community be involved? What kind of project information would you like to have accessible? Active channels and clear formats. Examples: municipal website/portal, notice board, newsletter, public forums; response times.

Instruction: Draft up to three clauses. Each clause should include: Commitment, Responsible party, and Means of communication. Use clear language and realistic timelines.

Commitment 1 (what we will do):	Commitment 2 (what we will do):	Commitment 3 (what we will do):

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Responsible party/parties:	Responsible party/parties:	Responsible party/parties:
Means of communication (channel/format):	Means of communication (channel/format):	Means of communication (channel/format):

Table 3 — Benefits and compensation

Commitments related to training, local employment, and support for community projects or services, and how these will be communicated.

Instruction: Draft up to three clauses. Each clause should include: Commitment, Responsible party, and Means of communication. Use clear language and realistic timelines.

Commitment 1 (what we will do):	Commitment 2 (what we will do):	Commitment 3 (what we will do):
Responsible party/parties:	Responsible party/parties:	Responsible party/parties:
Means of communication (channel/format):	Means of communication (channel/format):	Means of communication (channel/format):

Within these groups, participants reflected collectively on the challenges, expectations, and opportunities related to their respective topics, fostering a constructive exchange between the technical and social dimensions of the project. After the group discussions, a spokesperson from each table presented the reflections and conclusions developed by their respective groups to the full assembly of participants. This plenary exchange allowed for a comprehensive overview of the different perspectives and fostered dialogue among stakeholders and technical team members. The outcomes of the exercise were highly enriching, providing valuable insights into community expectations and potential strategies for engagement. Figure 1 illustrates moments from the group work session.

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Figure 49 Stakeholder group activity: World Café

A.1.2.6.3. Results

A.1.2.6.3.1. Safety and Monitoring

Commitment 1: Continuous and Accessible Monitoring of Sensitive Variables

Description: It is proposed to implement a permanent monitoring system for all variables that may raise public concern, including:

- Air and water quality
- Seismic activity
- Potential environmental impacts

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The information should be transparent and available in real time for any citizen.

Responsible parties: Project developer and competent authority (Directorate-General for Mines).

Proposed communication channels:

- Mobile application and website providing open and continuous access to data.
- Clear and user-friendly visualisations accessible to non-technical audiences.

Commitment 2: 24-Hour citizen support line

Description: It is proposed to establish a direct communication channel through which any individual may raise questions or express concerns related to project safety.

Responsible party: Project developer.

Channel characteristics:

- Available 24 hours a day.
- Accessible by phone, online, or through the project's website.
- Operated by trained technical staff.

Commitment 3: Social monitoring and participation committee

Description: It is proposed to create a social committee with representation from public administrations, social stakeholders, and the general public.

This committee would be coordinated by the Directorate-General for Mines and would aim to oversee project safety, promote transparency, and facilitate communication with the community.

Responsible parties: Directorate-General for Mines, project developer, local councils, and social representatives.

Participation formats:

- Regular public assemblies
- Informative talks
- Public notice boards in municipal spaces
- Dissemination through local councils

A.1.2.6.3.2. Transparency and Communication

Commitment 1: Early and targeted communication with key local stakeholders

Description: Before initiating any project activity, it is considered essential to provide direct and clear information to those actors with the greatest influence and relevance in the territory, including:

- Municipal councils (mayors and councillors), as key political and social interlocutors.
- Agricultural unions, due to their mobilising capacity and representation of the primary sector.
- Environmental NGOs, such as SEO/BirdLife, which have an active presence in the area.
- Residents as the final recipients of both the potential impacts and benefits of the project.

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Responsible party: Project developer.

Proposed communication channels:

- Specific information meetings with municipalities and agricultural unions.
- Open talks for the local population.
- Public information panels in squares and community centres.
- Social media profiles for inquiries and dissemination.
- Official project website.

Commitment 2: Transparency in monitoring and data availability

Description: During the implementation phase, it is proposed to ensure public access to monitoring data from the facility, to reduce uncertainty and strengthen public trust.

Responsible party: Project developer.

Proposed measures:

- Continuous publication of data in clear and understandable formats.
- Interactive dashboards, mobile application, or website providing access to information.
- Designation of a technical contact person (not affiliated with the municipality) to respond to questions or incidents.

"Ensure that data on the progress of the installation is always transparent, so that people do not feel afraid. Additionally, there should be someone available to address any questions that may arise."

Commitment 3: Annual communication of project benefits

Description: It is proposed to carry out an annual communication campaign to highlight the economic, environmental, and social benefits generated by the project, addressed to both municipalities and the wider community.

Responsible parties: Project developer and local councils.

Suggested formats:

- Posts on social media and the project website.
- Dissemination through local media (press and community outlets).
- Accessible reports including:
  - Revenue generated for municipalities.
  - Tonnes of CO_2 stored.
- Social collaborations (e.g., sports, cultural, or community initiatives).

A.1.2.6.3.3. Benefits and compensation

Commitment 1: Local hiring and professional training

Description: Participants emphasised the need for major investments in rural areas to generate stable employment rooted in the territory. The proposal is for the project to commit to hiring the

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highest possible percentage of local personnel, supported by training programmes tailored to local profiles.

Specific Actions:

- Set a minimum target for local hiring (e.g., 70% of staff).
- Develop continuous training programmes: scholarships, workshops, technical courses.
- Coordinate with municipalities and local action groups to identify needs and profiles.

> *"To maximise local hiring within the required workforce. If 70% of the staff can be sourced from the region, this target should be pursued. The commitment must include continuous training for local personnel, implemented through mechanisms such as scholarships, structured training workshops, and specialised courses."*

Responsible Parties: Project developer, involved municipalities, and local action groups.

Communication: Local dissemination in affected municipalities through social media, municipal websites, and regional press.

Commitment 2: Annual call for social, cultural, and environmental initiatives

Description: Propose the creation of an annual grant or award program to support projects led by local entities in areas such as culture, sports, environment, and historical-artistic heritage.

Specific Actions:

- Establish different award categories with financial allocations.
- Include heritage protection projects, particularly relevant in areas such as Belchite and Quinto.
- Create an evaluation committee to select beneficiary projects each year.

Responsible Parties: Project developer, municipalities within the area of influence, and local action groups.

Communication: Local dissemination through social media, municipal websites, and regional press.

Commitment 3: Economic collaboration agreements with affected municipalities

Description: Propose signing agreements between the project developer and municipalities whose territories are impacted by underground storage, ensuring direct and proportional economic compensation.

Specific Actions:

- Establish a compensation percentage (e.g., 1.5% of revenue or profit), similar to energy distribution fee models.

> *"Energy, electricity, gas, and telecommunications providers are subject to a line usage fee, through which municipalities receive 1.5% of their annual turnover. Although this mechanism is not widely known, it constitutes a significant source of funding for local governments."*

- Consider criteria such as affected surface area or population size.

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- Include all involved municipalities, even if visible infrastructure is located in only one.

Responsible Parties: Project developer, affected municipalities, and the Government of Aragón as institutional guarantor.

Communication: Public signing ceremony with regional media coverage, municipalities, and representatives of the Government of Aragón.

Additional proposal: Annual monitoring committee

Description: Propose creating a monitoring committee to oversee the implementation of Commitments 2 and 3, particularly regarding calls for proposals and agreements.

Suggested Composition: Representatives from the project developer, municipalities, local action groups, and other relevant stakeholders.

A.1.2.6.4. Workshop evaluation results

At the end of the session, participants were invited to voluntarily complete a brief evaluation questionnaire on a scale of 1 (strongly disagree) to 5 (strongly agree). Overall, participants expressed positive opinions about the sixth regional stakeholder committee workshop. Figure 50 illustrates the quantitative results of the questionnaire, which are as follows:

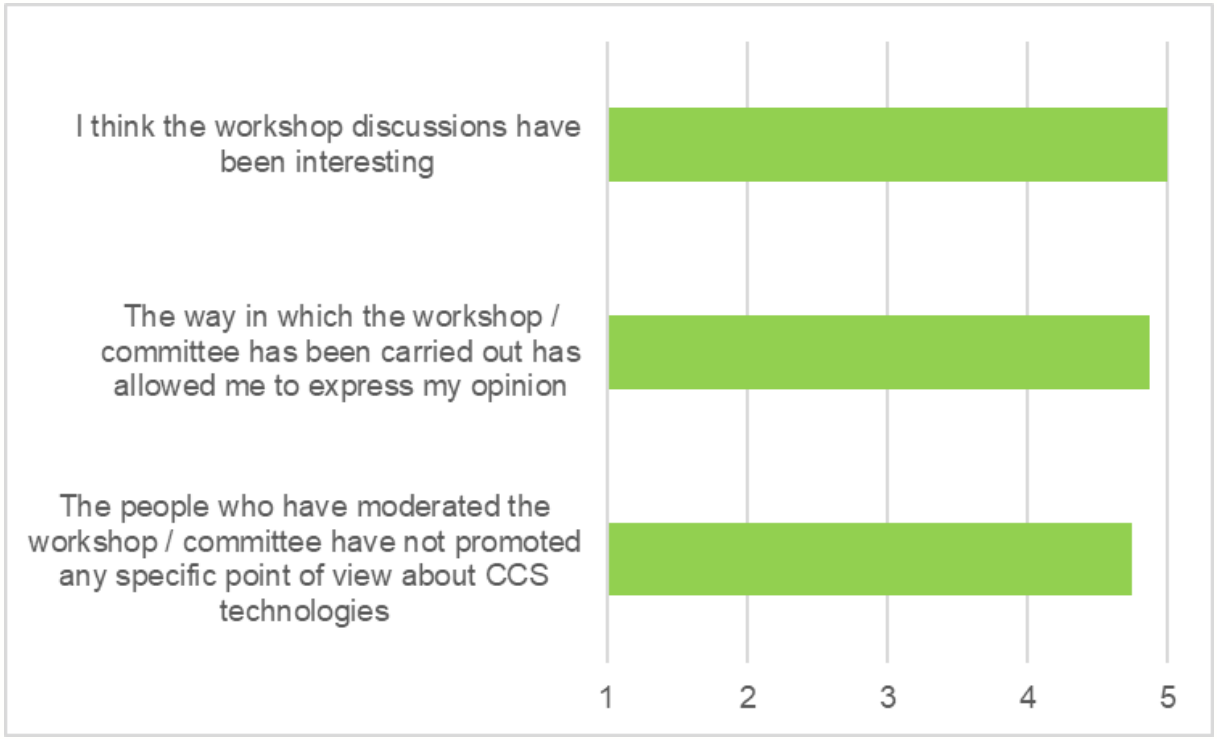

Figure 50 Questionnaire results (N=10)

The qualitative feedback collected from participants during the brief evaluation questionnaire reflects a highly positive perception of the 6th Regional Stakeholder Committee. Respondents highlighted the excellent organisation and collaborative environment of the meeting, as well as the

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relevance and usefulness of the project discussed. Comments such as "*Great atmosphere*" and "*Very interesting and valuable project*" indicate strong engagement and satisfaction among stakeholders, while remarks like "*Everything was perfect*" reinforce the overall success of the event in meeting expectations and fostering constructive dialogue.

A.1.2.6.5. Conclusion

The 6th Regional Stakeholder Committee proved to be an exceptionally enriching experience, both for the PilotSTRATEGY project and for the participants involved. The interactive group activity between stakeholders and various members of the technical team fostered a reflective dialogue that bridged expert perspectives on technology with the views and concerns of the local community. This exchange of ideas provided valuable insights and laid the foundation for collaborative understanding. Based on this dialogue, the following conclusions summarize the key findings from each working group session.

- **Safety and Monitoring:** Participants agreed that project safety must be accompanied by clear, accessible, and continuous communication. Transparency of data, direct engagement with citizens, and active participation of local actors were identified as key elements to build trust and legitimacy throughout the process.
- **Transparency and Communication:** Effective communication is a fundamental pillar for achieving social acceptance of the project. Timely communication, clarity of messages, and accessibility of information were identified as key elements for building trust, fostering understanding, and preventing potential conflicts.
- **Benefits and Compensation:** It was broadly recognised that the benefits of the project must be clearly demonstrated, fairly distributed, and sustainable for local communities. Local hiring, support for social initiatives, and direct economic compensation remain essential to securing community acceptance and long-term integration of the project within the region.

The insights gathered during the 6th Regional Stakeholder Committee underscore the critical importance of ensuring that any future carbon capture and storage (CCS) project in the region delivers tangible, equitable, and sustainable benefits for local communities. Practical considerations include prioritising local employment and training, establishing mechanisms for direct economic compensation, and supporting social, cultural, and environmental initiatives that strengthen community engagement. Equally significant is the role of inclusive dialogue among technical experts, project developers, and a diverse range of stakeholders, representing public administrations, industry, civil society, NGOs, support organisations, academia, and research institutions. This collaborative approach not only enhances transparency and trust but also ensures that technological solutions are aligned with societal expectations and regional development priorities.

A.1.3. France

A.1.3.1. Report of RSC 1

A.1.3.1.1. Introduction

The **Reflection Group "Adaptations and Territory" (GR AT)** is organized by the French team of the European project PilotSTRATEGY, represented by the partners BRGM and SYMLOG. It is a participatory research and dialogue mechanism similarly implemented in Spain, Portugal and France.

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These are the three countries in which a site characterisation is being conducted to understand the conditions (physical, environmental, socio-economic) in which the technology of **carbon dioxide (CO_2)** capture and geological storage could be applied.[7]

The project refers to the groups as a "Regional Stakeholder Committee" (RSC) and the following description is given by a Portuguese colleague: “The purpose of the RSCs is to gather together national and local stakeholders in order to engage them with the project, to collect the viewpoints of the local community, to create a network that will live on after the project, to work together to prepare a feasible proposal for **CCS [CO_2 capture and storage]** in [a given region], and to keep them informed of the developments of the project."[8]

In France, the designation "Reflection Group" is retained to better convey its research character, and distance any false notion of a decision-making mandate.

A.1.3.1.2. Recruitment and preparation

The invitation describing the specific objectives of the group, and of the meeting held on March 10, 2023, is presented in **A.1.3.1.7.** The invitation was addressed to about 30 people met during the previous European project coordinated by BRGM, STRATEGY CCUS[9] (which also had a regional stakeholder committee feature), or during the 3D seismic measurements collection campaign conducted by the present project in 2022 in the Grandpuits area (Seine-et-Marne, France) [10]. Intensive email follow-up yielded 26 agreements to participate, including further colleagues or associates recruited by persons already registered.

SYMLOG managed this email correspondence over the course of two months and proposed to each new registrant the possibility to talk by video conference or phone in the weeks before the group meeting in order to respond to questions and to gather ideas and expectations. BRGM also fielded a call to provide detailed technical information about CCS and the project. Altogether, 13 persons were involved in a total of nine preparatory calls, each lasting from 10 to 30 minutes.

In February, BRGM and SYMLOG circulated a list of internet resources to learn more about CCS (including reports from both PilotSTRATEGY and STRATEGY CCUS, as well as from third parties).

In the week prior to the meeting, the agenda (A.1.3.1.8) and a confidentiality form were provided to all registrants by email, as a means of final confirmation of their participation. The form requested agreement with the project’s personal data protection and handling. It also presented the Chatham House Rule as a binding agreement of mutual confidentiality, intended to ensure that each and every participant could freely express themselves without fear of public citation[11].

[7] The objectives of PilotSTRATEGY are described on the project website. A short presentation sheet is available in project languages, including in French.
[8] A. Delicado, Université de Lisbonne, cited here : https://pilotstrategy.eu/news/pilotstrategy-reaches-out-stakeholders.
[9] https://www.strategyccus.eu/
[10] The project website includes a blog presentation of the 3D seismic measurements collection campaign, as well as the technical deliverable report of results.
[11] The French version of this classical confidentiality agreement is found here: fr.wikipedia.org/wiki/R%C3%A8gle_de_Chatham_House. The blank agreement form was provided by email, to be printed, signed, scanned and returned; alternatively, several individuals wrote a formal email explicitly accepting the terms of data handling and confidentiality.

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Two persons (local association) who had intended to participate withdrew prior to the meeting. On the day of the meeting, five other persons (local industry, environmental association, administration) who had intended to participate were unable to attend. Thus 19 stakeholders were in attendance during the virtual meeting on 10 March, alongside two scientists from BRGM and four scientists from SYMLOG all playing facilitation roles.

Table 27 provides a count by category and gender. Twelve organisations in all are represented.

Table 27 Number of stakeholder attendees by category, gender (= including two persons from the same organisation). Facilitators are presented for gender balance assessment (2:3, acceptable).*

Category (stakeholder participants present)	Female	Male
Local elected officials/local authorities	-	2
Farmers, land owners	-	1
Local business associations	-	2
National environmental NGOs*	1	3
National or decentralised public administration*	2	2
Local industry*	3	1
Scientific and technical organisation*	-	2
Total stakeholder participants (19)	**6**	**13**
Plus facilitators	*4*	*2*
Final number present for the call	*10*	*15*

A.1.3.1.3. Short synthesis report of the France meeting

A.1.3.1.4. Process and topics discussed

The first meeting of the Reflection Group "Adaptations and Territory" is conducted remotely (by Zoom) for a duration of one hour and forty-five minutes. The introduction by SYMLOG welcomes the participants and reminds them that in order to maximise the speaking time of each participant, the discussion in subgroups will be privileged.

A quick round of introductions follows. The 19 stakeholders come from a variety of roles and sectors. Among those directly related to the territory studied by PilotSTRATEGY are elected officials, farmers, a local business association. Local heavy/energy industry is also present (including a factory that currently captures CO_2 from its industrial process). In addition, several youth participants, business members, and energy experts attend the meeting, each associated with regional and national environmental NGOs. Regional and national officials participate; they are directly concerned with

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the national CCS (Carbon Capture and Storage) file or with industrial environmental compliance monitoring. Finally, two BRGM researchers (without specific tasks in PilotSTRATEGY) are present as stakeholders.

The PilotSTRATEGY coordinator Fernanda Veloso (BRGM) then presents the project[12]. In her introduction, she contextualizes the research with information on the environmental presence and biological function of CO_2. She gives an overview of the technical practice of CCS, and shows that it is applied in several regions of the world. She situates the specific research of PilotSTRATEGY: indeed, the project is located at a precise stage of the development of the concept and practice of CCS, i.e. site characterisation. It carries out the preliminary work of data collection, analysis and modelling required for a permit application in pilot mode (see Figure 51). F. Veloso also recalls the territory considered in France (Figure 52), what the project has done to date, and future steps.

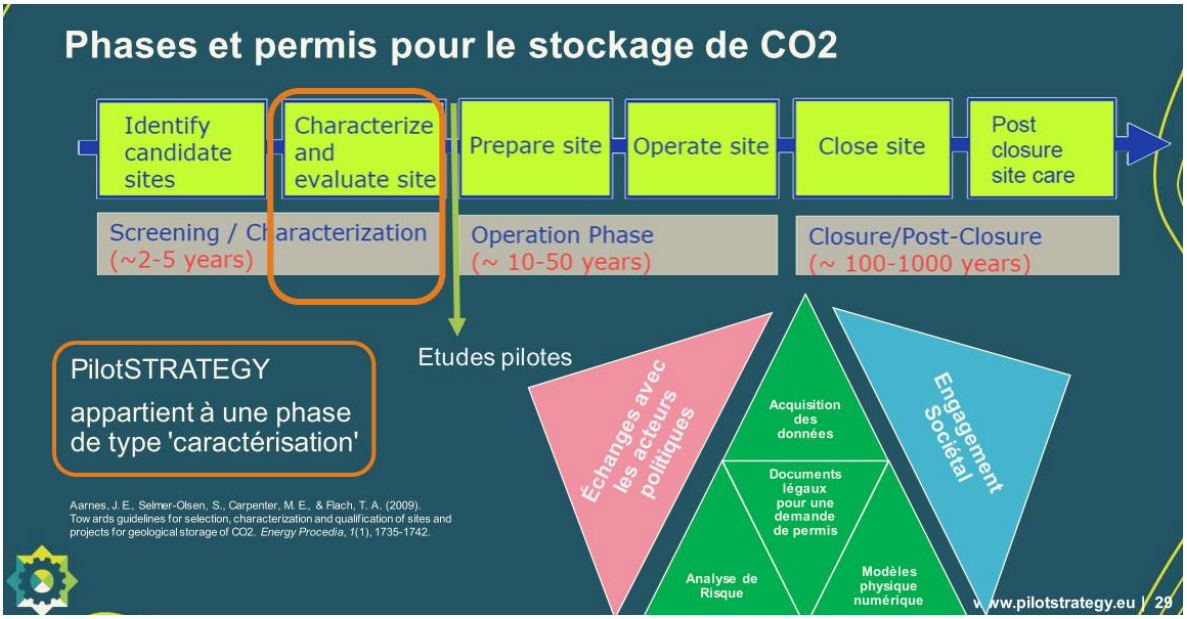

Figure 51 Situating PilotSTRATEGY on the generic timeline of development of a carbon storage project

[12] Each slide contains scientific references to consult (articles, videos), some with their Internet link. The document was distributed to the participants after the meeting, and can be downloaded - like the present document - from the project website: [https://pilotstrategy.eu/about-the-project/explore-the-regions] *(select France, then choose the desired downloads in the pop-up window).*

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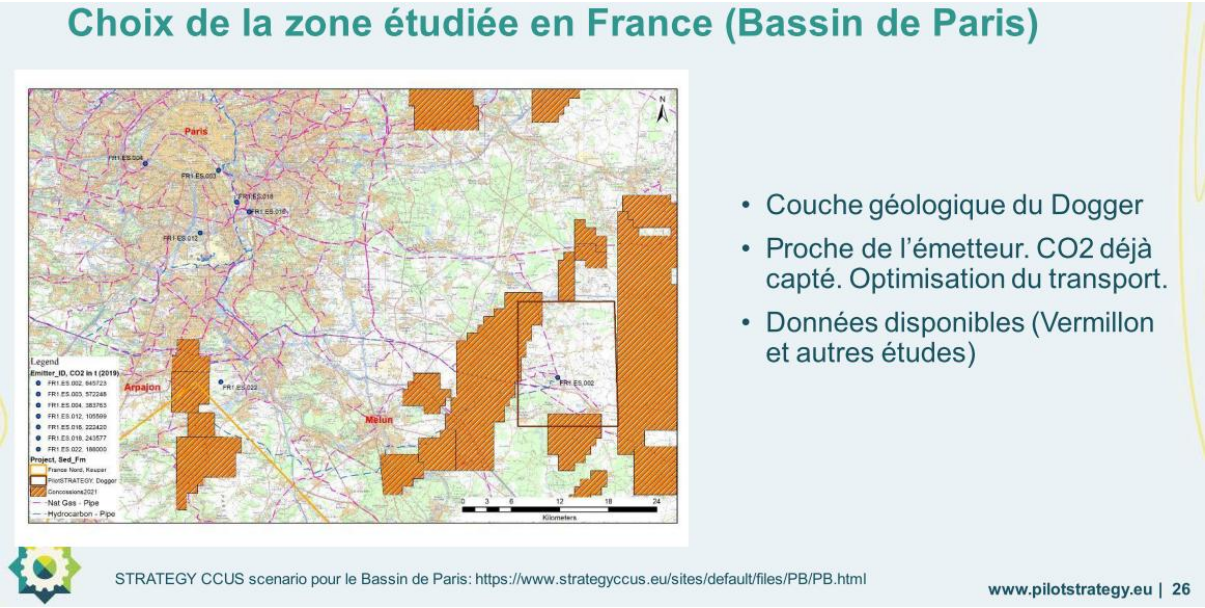

Figure 52 Zone studied in the Paris Basin, France by PilotSTRATEGY (rectangle at right)

After the formal, deliberately short presentation, the virtual conference is divided into three discussion subgroups (moderated and reported by six members of the French project team, belonging respectively to SYMLOG and BRGM).

The debate is structured first around the "central points" of the presentation as pointed out by the participants. Then questions are identified, as well as the actors to whom they are addressed. These two steps, followed by a free discussion period, are conducted in a brainstorming style. Rather than receiving immediate technical answers, the points and questions voiced are explicitly noted in view of a future meeting of the Reflection Group. The various remarks, questions and points suggested for future reflection are detailed in the full French-language report[13], grouped under topical headings proposed by the moderators. These headings, and the topical remarks, are fully reflected in the summary presented below in Table 28.

The organisers state that a subsequent meeting will be held locally on a face-to-face[14] basis and can be opened to new participants identified by the current members. Experts (from PilotSTRATEGY, or others) may be invited upon request, and their input will be accompanied by participatory discussions.

Among the subjects earmarked as particularly of interest for future development by the Reflection Group, with the support of experts and the necessary new participants, are:

- technical, environmental and economic explanation of the CCS option, including consideration of how citizens can be involved in analysing these criteria;
- risks and benefits; and feedback from actual experience of the technology.

[13] The report may be downloaded via the pop-up on https://pilotstrategy.eu/about-the-project/explore-the-regions

[14] For information, an Open Doors meeting is proposed on a weekday evening in June 2023 (date to be confirmed), at the Salle polyvalente in Grandpuits. This is thanks to the local elected officials who want to give this opportunity to any citizen to come and learn about the project and to express their feelings if they wish. The recommendations of the Reflection Group summarized in Table II will be taken into account to formulate the program.

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Table 28 Topics to be developed during future meetings or events

CONSIDERING CO_2 STORAGE IN A CONTEXT OF CLIMATE EMERGENCY:

- Comparative methods for evaluating technologies and interventions (reduction at the source of emissions? or reduction of their impact?), in order to fully appreciate the sustainable contribution of CCS, and to be aware of all the complementary approaches needed to reduce the risks of global warming
- Knowledge of existing geological resources and the "competition" between them
- Review of the benefits of the CCS option, the ecological and industrial opportunities it opens up

TECHNICAL ISSUES:

- The CCS technique, its functionality, its realisation
- Detailed feedback on the results of the local 3D seismic campaign
- Feedback from completed installation projects (elsewhere in France and in the world); knowledge of the conditions for implementation, and the obstacles

RISKS:

- Environmental risks; impacts on other underground resources
- Risks, physical or otherwise, for the host area
- Concerns of local residents, including farmers

ECONOMIC ISSUES:

- Industrialists' point of view: interest of the method, conditions for its implementation
- Costs and benefits of the approach
- Financing and distribution of costs
- Local economic consequences (positive and negative)

GOVERNANCE AND LEGAL ISSUES:

- Processes and procedures for implementing a storage project
- Levels of decision making
- Stakeholder roles, interactions, and coordination
- Legal ownership and liability

CITIZEN RECEPTION AND PARTICIPATION:

- Local perceptions and underlying drivers
- Knowledge of impacts on landscape, land use
- Clarification of the vocabulary used
- How to involve the citizen in the decisional analysis (comparisons, etc.)
- Consideration for the social recognition of the host territories

A.1.3.1.5. Stakeholders to be involved in future meetings

Participants were asked to identify other stakeholder roles and sectors to invite to future face-to-face events. They emphasised the need to renew the call to farmers and their organisations, as well as to local citizens (including local environmental groups, and elected officials). It is also important to

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ensure that these guests feel motivated and that access to the events is easy. The Reflection Group requests the involvement of national non-governmental organisations particularly mobilized in regard to the energy transition. Finally, it would be interesting to invite more CO_2 emitting industries (e.g., cement manufacturers), and CCS project managers, to share their experience.

A.1.3.1.6. Post-meeting evaluation

An anonymous questionnaire offered after the meeting was used to collect evaluations. Only 13 of 19 persons chose to use this online form. Several evaluations were instead formulated by email in the participants' own words or transmitted by phone. In all, 17 evaluations were received (although it is not possible to tell whether some persons filled out the form and then manifested themselves again by a second channel).

Overall, the combined evaluations showed that the quasi-totality of participants appreciated the opportunity to participate in this reflection group. The discussion in small groups was especially well regarded. Everyone felt they had the opportunity to express themselves, in a discussion that was considered (very) interesting by the great majority of the group. Regarding the question contained in the form, "The facilitators did not try to promote a single point of view on CCS issues," 10 of 13 online form respondents (strongly) agreed; three disagreed, but not "strongly". All but one of 17 received evaluations indicated willingness to participate in a future meeting.

Among the open-ended comments received:

- Disappointed by a very formal and overly structured agenda, which could only lead to simple rounds of discussion
- The presentation of the project could have lasted a few minutes longer, especially to better explain the progress of the project. A mention of the question of risks would also be appreciated; it is a pity to omit it when it is the basis of much opposition to CCS
- [Let's obtain] feedback from a project already in operation
- For the moment, nothing more: we have to digest this first stage... But I will not fail to let you know my thoughts on the subject as I go along... Thanks

A.1.3.1.7. Appendix I: Emailed stakeholder invitation (untranslated)

Par email, le 5 janvier 2023

Madame, Monsieur,

Nous vous invitons à **participer au Groupe de réflexion « Adaptations et Territoire »** organisé par le projet de recherche européen PilotSTRATEGY. Ce projet coordonné par le BRGM/Service géologique national concerne un potentiel pilote de stockage de CO_2 dans la région de Grandpuits (77).

Dans son dernier rapport, le GIEC a inscrit **la capture et le stockage du** CO_2 (**'CCS'**) parmi les options prioritaires pour lutter contre le changement climatique. Les recherches en géosciences et en ingénierie, mais aussi **les points de vue des acteurs du territoire** (élus, administrateurs, industriels, société civile et riverains) sont importants pour évaluer ce potentiel.

Nous réunissons ainsi un Groupe de réflexion autour du site pilote pour la France, afin d'explorer les données de recherche générées par le projet et de les confronter aux savoirs, réflexions et perspectives des participants.

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- La première réunion du Groupe de réflexion (env. 20 personnes) est prévue en **février/mars 2023** en distanciel (1h45). A l'ordre du jour : présenter le projet PilotSTRATEGY et son avancement ; échanger sur les perspectives territoriales en présence et les éventuels compléments à rechercher ; identifier des sujets (techniques, socio-économiques…) à approfondir.
  Merci de bien vouloir indiquer vos disponibilités dans ce sondage : https://doodle.com/meeting/participate/id/elxzlAle

- La deuxième réunion aura lieu en face à face début mai 2023 *[replaced by an Open Doors meeting in June 2023]*
- Trois autres réunions (en visio ou en présentiel) seront à prévoir avant la fin du projet PilotSTRATEGY en avril 2026.

En espérant vivement que vous accepterez cette invitation compte tenu de vos compétences et de l'enjeu climatique, je reste à votre disposition pour toute information supplémentaire.

Avec nos meilleurs vœux pour l'Année 2023,

Claire Mays

Animatrice du GR, pour l'équipe France de PilotSTRATEGY

P.J. : Feuille d'information PilotSTRATEGY

A.1.3.1.8. Appendix II - Agenda for the Virtual meeting of 10 March 2023 (untranslated)

Heure	**Activité**	**Reponsables**	**Notes**
13h50	Accueil des participants dans la salle d'attente. Connectez-vous par ordinateur via le lien : **https://harvard.zoom.us/j/98840948416**	Fanny Karat, Sean Hardy (SYMLOG)	En cas de difficulté de connexion, vous pouvez contacter Fanny ou Sean.
14h00	Bienvenue ; Rappel de l'ordre du jour et des principes du Groupe de Réflexion « *Adaptations et Territoire* » (GR AT)	Claire Mays, Marc Poumadère (SYMLOG); Tous	Tour de table : Présentez-vous de façon très succincte : Votre nom, votre affiliation et/ou votre « collège » de parties-prenantes : chercheurs, riverains, agriculteurs, élus locaux, associations locales ou nationales de différents profils, industrie, administrations publiques….
14h20	Présentation du projet PilotSTRATEGY	Fernanda Veloso (BRGM)	Nous ne prendrons pas de questions à cette étape.

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Heure	**Activité**	**Reponsables**	**Notes**
14h35	Objectif et consignes pour les sous-groupes	Claire + Fanny	Nous serons répartis en 3 sous-groupes mixtes d'environ 7p (+2 animateurs), pour identifier les questions..
14h40	3 sous-groupes, partage et discussion	Claire + Fanny Marc + Fernanda Sean + Isaline Gravaud (BRGM)	Cette discussion permettra d'identifier des thématiques sur lesquelles travailler en détail lors de réunions futures. Les travaux sont enregistrés en audio par l'animateur. 2 questions à renseigner individuellement dans un document partagé en ligne – *Après la présentation de Fernanda – en quelques mots :* Quel est le point central que vous avez retenu ? Quelle est la question principale que vous voudriez poser ? et à qui ?
15h20	Aperçu des travaux, par les 3 animateurs	Claire, Marc, Sean	Retour en plénière pour une évocation des contenus partagés.
15h30	Discussion en plénière : Prévoir la suite du GR.	Claire + Fanny	2 questions à renseigner dans le nouveau document en ligne, ou dans le tchat : Ce groupe de parties-prenantes vous paraît-il complet, suffisamment diversifié ? Quels autres participants souhaiteriez-vous inviter ?
15h40	Clôture des travaux	Fanny	Tour de table ; le mot de la fin de chacun
15h45	Fin officielle de la réunion		

A.1.3.2. Report of RSC 2

A.1.3.2.1. Acknowledgements and report availability

The second meeting of the French PilotSTRATEGY Regional Stakeholder Committee, named "GR AT – Groupe de réflexion Adaptations et Territoire", took place in a township of great importance to the project. Grandpuits-Bailly-Carrois, located some 50 km south-east of Paris, is within the project seismic investigation zone and includes the site of LAT-Nitrogen, the industry volunteer for testing geological storage of CO_2.

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The meeting was hosted at a municipal building thanks to the generosity of the township's elected officials, who consider it important to learn about the research and to offer local citizens the same opportunity. The township had previously hosted the June 2023 "open doors" event open to all regional stakeholders. The meeting was supported as well by the president of the Brie Nangisienne "community of communes", the local administrative union of townships whose territory overlays much of the investigation zone.

After the meeting, the full French-language report of the meeting was sent to participants for approval, then made available on the public website for download. A two-page simplified summary also was provided for download.

A.1.3.2.2. List of stakeholder categories in attendance

Seven stakeholder categories were represented among the 21 persons present (organisers and participants) at the GR AT of 26 September 2023. Table 29 provides a count by category and by gender.

Table 29 Number of stakeholder attendees by category, gender. Red ink indicates new participants. Asterisk (*) indicates that the people attended from the same organisation.

Category (stakeholder participants)	Female	Male
Local residents		1
Local elected officials/local authorities	1	2
Local farmers, land owners		2+1
Local branch of national environmental NGO		1
National or decentralised public administration		1
Local industry*	1	3
Scientific and technical organisation*		2
Total stakeholder participants (15)	**2**	**13**
Plus presenters and facilitators	***4***	***2***
Final number present	***6***	***15***

Among the stakeholders who attended this meeting, six already attended the first (online) RSC meeting in March 2023. Five more persons had attended the live "open doors" event in June 2023. Four people attended for the first time, three being representatives of local industry. In fact, all four local industry participants work for LAT-Nitrogen which has very recently joined the PilotSTRATEGY consortium.

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Aside from the PilotSTRATEGY project partners who had to travel by car or train to attend this face-to-face meeting, four stakeholders came from afar. The organisers had taken care of the train itinerary, and these participants were shuttled by car to and from the local train station.

A.1.3.2.3. Summary of the workshop

Annex 1 (agenda) shows that the meeting consisted of four segments and a break. Annex 2 (summary tables) reviews the exchange of information, structured according to stakeholder questions and expert replies.

A.1.3.2.4. Introductory segment: Chronologies

During the first short segment, after round table introductions, PilotSTRATEGY lead investigator/coordinator Fernanda Veloso briefly presented the overall chronology of a typical pilot site permitting process, and the specific chronology of our project, using this slide (Figure 53):

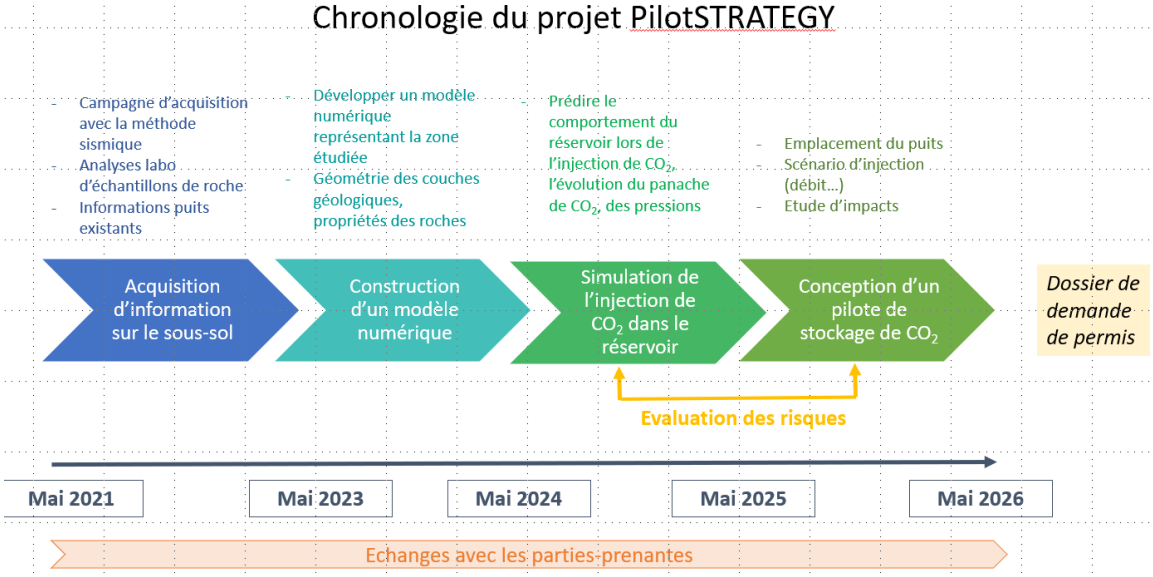

Figure 53 Chronology of the project

After the meeting, the online evaluation questionnaire received two requests to return this information and detail it further during the next GR AT meeting.

A.1.3.2.5. First main discussion segment: Knowledge of the underground

The next segment included a presentation by IFPEN partners Luca Mattioni and Alina Christ, with questions and debate taking place throughout. The purpose of the segment was to examine knowledge of the subsoil in view of piloting a CO_2 geological storage facility, and to deliver the results of the seismic reflection measurement campaign conducted in 2022 in the local Brie Nangissienne investigation zone.

The segment started by examining the question of how we represent the subsoil. Both personal and social representations held by the participants, and the scientific images developed by the project, were considered. The presentation went on to detail the PilotSTRATEGY modeling approach, focusing on both data collection and interpretation. This gave further insight into the large field task achieved, with the authorisation of local landowners, during the 2022 seismic reflection

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measurement campaign. This was necessary information to share with the GR AT members, since some local residents had previously expressed impatience, having assumed that the 3-D results of the campaign would be rapidly delivered in a format readable by any person or smart phone/computer. (For the information of all interested people, a link to the technical report of the seismic reflection campaign was provided in all email communications concerning this September 2023 meeting, and it was stated that this meeting would delve into the results.)

The presentation was very pedagogical and lively. Manipulation of actual rock samples (see Figure 2) allowed all participants to form a more concrete idea of the permeable and impermeable media present below ground in the zone, and of their potential functionalities in view of creating a safe geological storage facility. At the end of the day, it was agreed that the large poster prepared for the GR AT could be kept and potentially displayed by the town hall, both to inspire interest in residents and also to help provide some replies to their questions.

Figure 54 Photograph of a participant's "practical experimentation" with the permeability of different rock samples from the investigation zone (at top: marl; at bottom: oolite). (A video also was made available at the time of publishing the summary.)

A.1.3.2.6. Second main discussion segment: Safety and risk assessment

In the ensuing segment, Isaline Gravaud (BRGM) presented the logic and approach used for predictive assessment of the safety and performance of CO_2 geological storage. The aim of assessment is to ensure that storage under the proposed operating conditions does not create

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unacceptable risk to health or the environment. The presentation also covered the strict European and French regulatory framework and decision-making processes. Conditions and obligations governing the granting of exploration or production licenses were set out.

While there is currently no CO_2 storage in France, real cases (including France's many geological storage sites for natural gas) provide knowledge and feedback. Gravaud explained that a dedicated safety study is carried out for each CO_2 storage project to take full account of the context of the site under consideration.

For each site-specific study, characteristics revealed by the geological studies and models are assessed from a strategic perspective: can the "cover" rock effectively play its containment role? The stability of the geological environment is verified. The impermeability of existing wells is assessed. Scenarios for the construction and operation of the repository are examined, systematically asking the questions: what could go wrong? How likely is this? What could be the consequences? What preventive actions or remedies can be put in place to reduce the probability and/or the consequences?

A.1.3.2.7. Stakeholder conclusions

The following remarks were recorded as conclusive aspects of a risk/benefit discussion inspired by the "assessment" segment.

A.1.3.2.7.1. Ministerial comment: Decarbonisation of industry

> *"CCS is about maintaining industrial activity in the region. A manufacturer that emits CO_2 in its production process must pay a tax calculated per tonne of CO_2. Following the scheduled end of offsets in 2034, the amount of the tax will be much higher.*
>
> *"Manufacturers will then be able to maintain their activity if they have found solutions to reduce their emissions and also to control the cost of unavoidable emissions.*
>
> *"CCS is one of the strategies supported by the government, as it enables us to drastically reduce the carbon footprint in certain sectors (e.g. chemicals). As part of France 2030 and the calls for decarbonisation projects, funding will be conditional on carbon capture and storage being part of an overall decarbonisation strategy for the site and the group, calling on a range of levers".*

A.1.3.2.7.2. Industry comment: Production alternatives to reduce CO_2 emissions

> *"Looking ahead fifteen or 20 years, there are many pressures to think about alternative production methods. For a manufacturer, it will be necessary to put a figure on the budgets and evaluate the two alternatives - capture/storage and process modification. CCS is not a wasted investment, since by applying it the industry will have time to modify production gradually, depending on the availability of energy.*

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"CCS is not a wasted investment, since by applying it the industry will have time to gradually modify production, depending on the availability of the necessary infrastructure and resources (electricity, water, etc.). Secondly, the solution will be sustainable in any case, as carbon neutrality in 2050 will mean capturing the residual CO_2 emissions due to modified processes".

A.1.3.2.8. Elected official's comment: Comparative data for regional decision-making

"With a view to regional consultation, some comparative data are of interest to elected representatives. For example: what is the volume of CO_2 emissions in the region at a given time? What percentage of the CO_2 emitted would be sequestered in geological storage?

"Such information would have an impact on collective decision-making, whether by elected representatives or the general public. In fact, if you explain to local residents that pollution in the area will be reduced as a result of CO_2 storage, that could be an argument in favor of accepting the project itself. As elected representatives, we need comparative data to be able to make a decision. What will these solutions do for our region? If it can be proven to us that we can actually reduce emissions in our area by this much or that much, that could be a convincing argument."

Furthermore, a stakeholder closed the "knowledge of the underground" segment with an interesting remark: "*The size of the Paris Basin means that we're not the only ones concerned*." This observation could provide the opportunity in future to discuss social solidarity and responsibility in facing risks and safety and also form a bridge to discuss social recognition of CCS hosts.

A.1.3.2.9. Results of the evaluation/feedback questionnaire

The Google Forms exit survey was sent by email the day after the meeting. One reminder yielded 12 responses (out of the desired 15). The scale was 1 to 5, starting at "Absolutely" and ending with "Not at all".

Ten people replied that they found the discussion interesting, that they were able to express themselves, that they enjoyed participating in this reflection group, and that they would like to participate in the upcoming meetings. Of the two people remaining, one chose a neutral midpoint, and another expressed disagreement or strong disagreement.

Eleven agreed that the facilitators/presenters did not seek to promote a unitary view of CCS issues, whereas again one person strongly disagreed.

Participants were asked to rate the element they most appreciated, and those they least appreciated.

- Most appreciated were the presentation-debate concerning knowledge of the underground, and the unstructured exchanges that concluded the day.
- The "ritual of two key words to remember", a quick roundtable at the end of the day, was least appreciated (probably because it was disrupted by the departure of travelers to catch the train).

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The evaluation questionnaire also solicited free remarks, including advice for what should be improved, and themes that could be explored in future meetings.

- The participant who gave overall negative evaluations stated their disappointment to see that there were "insufficient young people and non-elected people" attending[15].
- Two people requested that the PilotSTRATEGY chronology be presented once again in greater detail (detailing steps, decisions that would need to be taken to allow the project to move into its next stage, and the relevant dates).
- The other free comments were positive encouragement from the PilotSTRATEGY team to continue this kind of stakeholder activity.

Facilitators received another reflection after the meeting (below). The in-depth scientific and technical reply developed by project members was gratefully received and was circulated in a small NGO network.

"My training as a chemist led me to wonder about the chemical aspect of the water/CO_2 mixture.

1. *I'm wondering about the long-term CO_2 fixation reactions in the reservoir rock: what are they? I'd be grateful if you could send me any studies on this subject.*
2. *There is microporosity in the impervious layers, which I was unaware of. Does the chemical action of the mixture lead to precipitation (a favorable event, as it seals the rock) or dissolution (a very unfavorable event, as the sealed rock risks leaking over time)?*
3. *To my knowledge, concrete is highly alkaline. The water/CO_2 mixture is acidic. So there's a very good chance of a reaction. Does this lead to swelling?*

a) *If it's significant, is there a risk of deforming the casing, which I think is likely to be corroded at points, leading to points of fragility around the circumference, and therefore points where a bend/break may be more likely to form?*

b) *If, on the other hand, the reaction is in the direction of volume reduction, the joint is no longer watertight. Volume variations increase the risk of leakage from pre-existing sealed wells.*

c) *If there is no change in volume, there is little increase in the risk of leakage."*

A.1.3.2.10. Lessons learned and future activities

A.1.3.2.10.1. Balancing technical information and participants' views

During the meeting, the PilotSTRATEGY team combined structured transmission of highly technical information, and a constant attention to how people were receiving it.

Stakeholders who were looking for straightforward scientific and technical information said they were well served. One professional said that she was "impressed by the level of technicity", appreciating the quality of the presentations and the serious consideration given to questions.

Centering on stakeholder reception meant that the primary facilitator frequently asked the participants what they thought about each part of the technical presentations, and which questions and remarks they had. This allowed many stakeholders to express themselves and to get clarification without having to interrupt the speakers. Substantive questions by the facilitator, such as "Is this type of risk assessment familiar to you?" meant that stakeholders with different levels and areas of

[15] The organisers acknowledge that five persons in attendance were of retirement age, although each is still conducting professional activities. On the other hand, the elected sphere was present with only three persons of 15.

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expertise could weigh in and compare the PilotSTRATEGY approach to their own field of knowledge (in this example, a stakeholder made a comparison to danger studies classically led on industrial sites). All presenters, as well as the facilitators, showed their willingness to focus on participants' understanding and interests, creating a very positive atmosphere. Some jokes and humor were traded as well, showing that most participants felt at ease.

A.1.3.2.10.2. Taking stakeholder questions into account

Acknowledging the value of stakeholder interests and concerns to structure exchanges, the public report of the meeting prepared by Symlog includes tables detailing participants' questions and the replies received. Summary tables are included here in Annex 2.

Because the agenda foresaw two significant presentations for which sufficient time would be needed, the primary facilitator tried to keep the discussion moving along when slightly off-topic questions and answers sometimes inspired very lengthy exchanges. The facilitator cut in at those times, promising that questions that were not answered today were recorded as candidates for the development of subsequent meeting agendas.

Nonetheless, the principal investigator chose to address one or two spontaneous questions in detail, acknowledging their importance for the audience or for the questioner. Follow-up information on these points was provided after the meeting and was included in the synthesis report.

Perhaps because of this serious openness to questions, one participant did not hesitate to send very technical reflection by email subsequent to the meeting (see section 4 above). The queries raised were scrupulously addressed, requiring several hours' work by 4 BRGM agents and 2 social scientists.

A.1.3.2.11. Developing the next meetings

Improving attendance

The timing of the GR AT meeting was tight, partly because certain participants had to get a regional train home to Paris. Nonetheless, a great deal of material was covered. High engagement and interest were seen in the free exchange among all the attending stakeholders and project partners.

To improve the comfort of future meetings, the agenda will include fewer subjects. Certain aspects of interest can be covered simply by providing two-page flyers with basic information and links to suggested further reading. A reduced agenda also could allow the meeting evaluation to be completed before leaving, using a paper-based questionnaire.

Some people who had been present at the 1st GR AT meeting (online, March 2023) did not attend the second, face-to-face meeting in September. For some Paris-based officials it was difficult to schedule time to travel (approx. 45 minutes by train). Three NGO representatives informed us they are presently assigned to other thematic dossiers and are no longer active on the CCS issue. Finally, some people did not react to the email invitations sent in July and August. When they replied to the email reminder in early September, they noted they were (by then) busy at the chosen date. The lesson learned is to organize autumn meetings in October at earliest, so that if email communications are overlooked during the traditional summer break there is still latitude to settle appointment calendars.

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In agreement with the Grandpuits town hall, a third GR AT meeting was scheduled for a Saturday morning in March 2024. It was believed that a weekend meeting might make it easier for a broader range of citizens to attend. However, there was insufficient enrolment, and the meeting was cancelled.

Again, through discussion with the town hall, it was therefore decided to schedule a larger public reception to take place on a Friday evening, 31 May 2024. Based on the success of the June 2023 open doors event, this convivial occasion can inform a new segment of citizens and prepare the way for the 3rd GR AT meeting to be rescheduled in Fall 2024.

Topics

In the weeks following the 2nd GR AT meeting, the team discussed the items that sparked particular interest from the stakeholders. In light of project milestones, a promising topic was identified for upcoming discussions: participative elaboration and prioritisation of location criteria for CO_2 injection wellheads. Governance and decision-making also focus on stakeholder interest.

These topics and others can be considered for the public May 2024 event, or for the in-depth 3rd GR AT meeting to be held in Fall 2024. The open event will host a prestigious short lecture by a BRGM researcher who is a member of the IPCC, examining the international panel's views on CCS as a climate mitigation strategy. All meetings will be designed to offer participative opportunities on selected research topics. Short flyers will be developed on peripheral subjects, such as the role of methanisers; reuse of captured CO_2.

The project lead investigator furthermore has responded to requests from local elected representatives by brokering technical meetings with industry and with ministries, to take place in Spring 2024.

A.1.3.2.12. ANNEX 1: MEETING AGENDA IN FRENCH (2pp)

Groupe de réflexion « Adaptations & Territoire »[16]

Deuxième réunion – de 16h à 19h, le 26 septembre 2023

En face à face, à Grandpuits-Bailly-Carrois

Salle de fêtes à Bailly-Carrois - Ancienne Mairie, 9 rue St Eloi de Baaly

Facilitation des arrivés et des départs pour les participants voyageant en train.

Ordre du jour

Horaire	Sujet	Qui
15h50	Arrivés (dont les passagers des navettes) et mise en place	Tous

[16] Le **Groupe de** réflexion **"Adaptations et Territoire" (GR AT)** est organisé par l'équipe France du projet européen PilotSTRATEGY, représentée par les partenaires BRGM et SYMLOG. Il s'agit d'un dispositif participatif de recherche et de dialogue.

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Horaire	Sujet	Qui
16h00	**Bienvenu –** Groupe de Réflexion « Adaptations et Territoire » (GR AT)	F. Veloso BRGM M. Poumadère Symlog C. Mays Symlog
16h10	Table ronde des présentations	Tous
16h20	**Introduction** – Chronologies: • Quel processus pour proposer un site pilote de stockage de CO_2 ? Etapes de recherche, d'évaluation ou d'instruction, et d'autorisation • Le projet PilotSTRATEGY, son avancement scientifique	F. Veloso BRGM
16h35	**Présentation-débat** – La connaissance du sous-sol pour piloter une installation de stockage géologique du CO_2. Retour sur la campagne de mesures par réflexion sismique dans le Brie nangissien. • Comment se représenter le sous-sol ? Images humaines et scientifiques • Approche de modélisation : collecte et interprétation de données • Ce que nous apprenons du sous-sol caractérisé	A-B. Christ IFPEN L. Mattioni IFPEN Tous
17h30	**Pause**	
17h40	**Présentation-débat** – Risques et sécurité. • Identification des impacts locaux d'un stockage de CO_2 • Approche d'évaluation de la sécurité d'un stockage • Surveillance • Devoirs et garantis – règlementation, recherches et actions	I. Gravaud BRGM T. Le Guenan BRGM Tous
18h30	**Table ronde –** Impressions, messages à retenir, sujets à approfondir.	C. Mays Symlog Tous
19h00	**FIN de réunion - Départ des navettes**	

Les participants évalueront la réunion au moyen d'un questionnaire en ligne.

(*Agenda page 2*) Rappel des sujets d'étude identifiés par le GR AT le 10 mars 2023

Les sujets touchés par la réunion du 26 septembre 2023 sont surlignés.

ENVISAGER LE STOCKAGE DE CO_2 DANS UN CONTEXTE D'URGENCE CLIMATIQUE :

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- Méthodes comparatives d'évaluation de technologies et d'interventions, afin de bien apprécier l'apport durable du CSC, et de prendre conscience de toutes les approches nécessaires pour diminuer les risques du réchauffement climatique (réduction des émissions à la source ou de leur impact…)
- Connaissance des ressources du sous-sol et de la "concurrence" entre celles-ci
- Bénéfices de l'option CSC, des opportunités écologiques et industrielles ouvertes par elle

QUESTIONS TECHNIQUES :

- La technique du CSC, sa fonctionnalité, sa réalisation
- Retour détaillé sur les résultats de la campagne locale de mesures sismiques 3D
- Retour d'expérience de projets d'installation menés à terme (ailleurs en France et dans le monde) ; connaissance des conditions de mise en place, et des freins

RISQUES :

- Risques environnementaux ; impacts sur les autres ressources du sous-sol
- Risques, physiques ou autres, pour le territoire d'accueil
- Les préoccupations des riverains, dont les agriculteurs

QUESTIONS ECONOMIQUES :

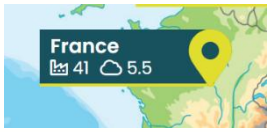
- Point de vue des industriels : intérêt de la méthode, conditions pour la mettre en œuvre
- Coûts et bénéfices de l'approche
- Financement et répartition des coûts
- Conséquences économiques locales (positives et négatives)

GOUVERNANCE ET JURIDIQUE :

- Processus et procédures pour mener à bien un projet de stockage
- Niveaux de décision
- Rôle, interactions, et coordination des parties prenantes
- Propriété et responsabilité juridiques

RECEPTION, ET PARTICIPATION, PAR LES CITOYENS :

- Perceptions locales et ressorts sous-jacents
- Connaissance des impacts sur le paysage, l'emprise au sol
- Clarifier le vocabulaire utilisé
- Comment impliquer le citoyen dans l'analyse décisionnelle (comparaisons, etc.)
- Envisager la reconnaissance sociale des territoires d'accueil



La synthèse des travaux du GR AT (réunion du 10 mars 2023) est publiée sur le site du projet PilotSTRATEGY : [https://pilotstrategy.eu/about-the-project/explore-the-regions] – *sélectionner **France** pour faire ouvrir une fenêtre "pop-up" et choisir les téléchargements (fiches de présentation, résultats d'étude, etc.).*

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A.1.3.2.13. ANNEX 2: SUMMARY TABLE OF QUESTIONS AND REPLIES

The two main "presentation/debate" segments of the September 2023 meeting were summarized by noting the participants' remarks and questions in chronological order, along with the associated replies by project experts (*in italics)*. Summaries are presented below. The French-language report presents this material in much greater detail.

A.1.3.2.13.1. "Knowledge of the underground" segment

Slides used by research presenters are downloadable here.

Facilitators: How do you imagine what is underground ?
- When I hear "water table", I visualize underground rivers - An underground lake - Underground springs, to feed the water table - Are there cavities? - Clay - Microbes - Hard rock, porous rock - Drains and pipes, made of ceramic (terracotta) or plastic. *The remark concerning the drains refers to (agricultural) soil, at a shallow depth; Pilot refers to a depth of 2,000 m.* *The project's geologists share an expertise concerning a period of hundreds of millions of years; local residents share an expertise concerning installations 1.60 m deep and two centuries old. We need to bring this knowledge into common to talk to each other.* *In 2022, PilotSTRATEGY already organized specific collaborative research to verify the integrity of the historic drains after the measurement campaign (which used vibrating trucks). The drains were seen to be unharmed.*

Graphical results of local seismic reflection data analysis - Reading the horizontal lines
- We see horizontal lines, of different thicknesses, and either light or dark. *These are strata or subterranean layers of rock that are more or less porous (allowing reflected waves to pass through quickly) or compact (delaying the return of waves). At the depth we're interested in for a CO_2 reservoir (2000 m below ground), we see a light-colored layer. Just above it is a layer at least twice as thick and very dark. This is "cap rock", a denser cover that prevents the upward circulation of fluids. It is therefore a favorable element for CO_2 containment.*
- Is there any water ? *This "ultrasound" method does not detect water. None of the strata in the image represents a "river".* *But there is water: it's stored in the pores of the rock.*

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- The underground "photo" shows a very regular, highly organized image (more so than anticipated). We would have expected cavities or holes, and a less compact texture overall.

Yes, this part of the Paris Basin is well organized, quite horizontal, stable and without any notable faults or ruptures on this scale (which would be due to tectonic forces, which are very weak in this basin).

The height of the visible strata is, depending on the case, around 150 to 300 meters or more. No cavities are visible, but the rocks are of varying porosity and permeability.

Core analysis results; knowledge of boreholes and wells

-Isn't clay a highly water-saturated material? How can it be said that clay is "impermeable"?

-What are the names of the rocks involved?

How much water is in the rock? Porosity describes the number and size of pores in a rock. Permeability describes how easily water penetrates more or less compact rock. Taking these and other features into account, "lithology" measurements describe the rock in question.

The dark layer of "cap rock" is in this case argillite, a consolidated clay. It is also known as marl, a highly compact and hard material, rich in waterproof clay.

The light layer is composed of white oolite.

-We see a kind of vertical tube on the image.

This is a borehole.

-Are old wells (boreholes) inventoried?

-Do you have access to data on the years of exploitation of the region's oil-bearing subsoil?

Absolutely. All PilotSTRATEGY research is based on established knowledge and methodologies, gathering and exploiting the maximum amount of available data (databases, scientific publications, etc.), and combining it with freshly collected data to form and interpret a detailed model of the context.

-Do wells deform under underground pressure?

No, because on the one hand, a steel casing is left in place to sheath the well, and on the other hand, the relative lack of tectonic activity in the Paris Basin means that the shafts are not "ovalized".

The tunnels at Bure or under the English Channel hold in place with a casing, and with cement to ensure complete watertightness.

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-Is the rock in the area watertight?

In principle, water circulates very, very slowly in rock. For this to happen, pores must be connected. This means we assess the size or volume of the pores (porosity), and their connectivity (permeability).

Remember that the pressure underground is far greater than that at the surface, which determines the flow of water as seen by the naked eye.

Practical experiment

Samples are passed from hand to hand and examined under a magnifying glass. Tap water is poured over samples of oolite, which is pale in color, porous and weighs little, and marl, which is dark, compact and hard, and heavy. The behavior of the water is observed: it immediately penetrates, or alternatively beads on the surface. **Photo**

A symbolic (and humorous) "test" is performed with natural carbon dioxide: by pouring Perrier on the white oolite. Bubbles are formed by the gas left on the surface, while the water is rapidly absorbed. To force the gas in, you'd need to inject it under pressure. **Video** [no longer available]

Further free remarks and questions – Concerning the extent of underground area implicated in CO_2 storage

-What is the "political" zone, i.e., what populations might be affected?

-You have the same situation as with oil production, but in reverse. You can see the derrick, which is where the oil comes out, and the surrounding community reaps substantial benefits; yet the oil originates in a much wider underground zone. With CO_2 storage, we can see the point of injection, but the gas will diffuse much further.

-There is an economic argument to be made for doing this work next to a CO_2-producing plant.

That's why we need to make all these models, and other specific ones, so that we can properly answer questions that may be of concern to surrounding populations, such as: "You're going to inject for 30 years; where will your CO_2 go; won't it come out in the water?" We need to be able to demonstrate to the authorities that displacement of the plume will be limited to the area for which the permit would be granted.

It's true that it's in our interest to reduce surface transport. If the subsoil is suitable and a permit can be granted, injecting the gas directly next to its source of production is an ideal configuration.

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-How could a chimney to the surface potentially be formed? In other words, is a carbon dioxide explosion possible? -How far does the oolitic reservoir zone of the Paris Basin extend? -What is the potential extent of horizontal diffusion of injected gas? -What would be the area potentially affected by a fault or leak? *[Questions to be addressed in a subsequent meeting.]*
-Where does water enter? *The rock formation in question outcrops in Lorraine and Le Havre. Between the two, the rock is in the shape of a curved underground basin: this is the Paris Basin. Water can enter the outcropping, and because it has very weak mobility it takes approximately 10,000 years to migrate from Lorraine to the zone where we are here. Thus it is very laden with minerals, and is very salty.*

A.1.3.2.14. "Safety and risk assessment" segment

Slides used by research presenters are downloadable here.

The presentation explored the safety objectives of geological storage of CO_2 and the testing of various strategies to meet those objectives. The seasonal storage of natural gas was detailed as an example from which safety and risk knowledge can be drawn.

The table below presents *only* those aspects that drew specific questions from the stakeholders. The French-language report contains the full proceedings in detail.

CO_2 **storage safety: design of wells and their impermeability**
- How many existing wells are found in the Grandpuits zone at this time? How is their location determined? *Wells are engineered elements that provide a link between the surface and the reservoir (slide 5). During drilling, a metal tube is inserted to prevent the well from closing. Between the tube and the rock, there is necessarily a small gap, which is cemented to ensure that the structure is watertight.* *The oil wells currently present in the region under study will enable PilotSTRATEGY to acquire a wealth of data on the subsoil, while at the same time they represent a potential escape route to the surface for the stored CO_2. The project must therefore check the condition of these wells and take into account the degree of porosity of their cementing. Their location is well known and in the public databases. There are 5 wells in the 10 x 10 km zone studied by PilotSTRATEGY.*

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The Grandpuits zone as a potential storage site

- Would Grandpuits be the site of injection of CO_2 for storage?

PilotSTRATEGY studies a 10 km x 10 km area centred on Grandpuits. We are carrying out studies to evaluate the various possible injection points and to identify criteria for choosing the most optimal one. At the next meeting of the GR AT in 2024, we hope to be able to present the various approaches identified and start a discussion on the traditional or specific criteria involved.

- Would there be any nuisances, such as tanker traffic transporting CO_2 to be stored from other companies in France?

PilotSTRATEGY does not concern a site to store CO_2 for the whole of France, but rather a pilot site in the immediate vicinity of a single company that is already capturing its CO_2. This approach avoids the need for road transport.

Risk analysis and prevention

- The PilotSTRATEGY risk analysis looks like classical danger analysis used in industry.

-Two types of question need to be distinguished: Risks faced during the exploitation period, and, the probability of long-term leaks.

Risk analysis involves building scenarios and asking the following questions:

- *What could happen differently from what is planned?*
- *How likely is this?*
- *What might the consequences be?*
- *What can be done to reduce the probability and/or the consequences?*

This is a fairly widespread approach in companies. In accordance with the ISO 31 000 standard, we imagine all the risk scenarios that could occur, based on the literature and feedback from experience. We assess the credibility of the scenarios. We quantify the risks in terms of probability and impact. Actions to prevent or reduce these factors are identified. For example:

- *How would CO_2 move through the reservoir?*
- *Is there any chance of it reaching another well in the greater area?*
- *What is the state of wells found in the greater area? How likely would they be to leak?*
- *Then, according to fixed criteria: Is the risk acceptable?*
- *If not, what action should be taken to avoid, reduce or control the risk?*

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Strict European and French regulations
- How strict is the regulation? *An application for a geological storage permit is made under the Mining Code, whereas the injection of CO_2 requires authorisation under the Environmental Code.* *European and French regulations are more stringent than those for geothermal energy or hydrocarbon production, setting out a large number of conditions and obligations regarding e.g. :* • *the granting of a permit for the exploration part of the reservoir ;* • *methods for remedying any risks;* • *the closure of the storage facility (after 30 years) and the post-closure monitoring plan.* - Is the PilotSTRATEGY study area large enough to obtain valid results? *Yes, the area is the right size.* *By taking into account the volume of water on the surface, the porosity of the rock and other criteria, an approximate calculation of the potential storage volume has been made.* *Calculation exercises for the industrial site providing CO_2 show around 300,000 tonnes of annual emissions (production), which would render, over a period of around 15 years, a total volume of 4-5 million tonnes injected.* *However, the objective of the PilotSTRATEGY project is more modest: to prepare a research pilot aimed at injecting a maximum of 100,000 tonnes of CO_2 into the underground reservoir.*

Questions on risk and nuisances (sample)
- What are the dangers of CO_2 gas? Is it flammable? Is it explosive? Is it toxic to breathe? - If there is a leak from the storage facility, is there any danger to the public? If there is a leak or fault, is there a way of plugging it quickly enough? *The danger of breathing CO_2 depends on its concentration. We are currently breathing it in.* *Given the depth of the repository (1800 m), it is unlikely that a leak of CO_2 would reach the surface. If it did, it is also unlikely to cause a dangerous concentration due to dispersion in the air.*

Regarding climate change and energy transition
- The storage solution must not be allowed to exonerate companies from reducing their CO_2 output!

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Indeed, all these development efforts are NOT devoted to serving "business as usual" and letting things continue as before. CCS is a technology for the transition to a low-carbon economy. It mainly targets so-called irreducible CO_2 emissions, intrinsic to certain industrial processes (e.g. cement manufacturing), which cannot be reduced by other means (such as improved processes, energy savings, electrification, etc.).

Decision making and responsibility
- Who would be the repository operator, and who would manage storage over time? The industry? How would the authorities be involved? *The scientific, technical and industrial partners in the European PilotSTRATEGY project are preparing the detailed studies needed to set up a pilot storage project under the safest possible conditions. These study data are made public. Any decisions to apply for a licence or to operate the facility are not the subject of the research, and are not the responsibility of the PilotSTRATEGY team.* *For the record, national and regional ministerial officials (DGEC; DDT; DRIEAT) are members of the GR AT. The DGEC is present today. Specific information meetings have already been held between the project and the ministerial officials.*

A.1.3.3. Report of RSC 3

A.1.3.3.1. Short Summary

The European PilotSTRATEGY research project (2021-26), coordinated by BRGM, addresses the objectives of the green transition. The studies conducted should provide an answer to the question: could a pilot site for *geological CO_2 storage* be developed? Research in France focuses on a 100 km² area around the Grandpuits industrial site producing nitrogen-based products like fertilizer (located in the Brie Nangissienne federation of municipalities, 77-Seine-et-Marne).

In France, the **"Adaptations et Territoire" (GR AT) reflection group** brings together national and local stakeholders to keep them informed of the project's progress, gather the views of the local community, create a network that can continue after the project, and work together to shape a feasible proposal for **CCS [carbon capture and storage]**. The *3rd meeting of the GR AT* (18/11/2024) brought together 18 stakeholders and 7 researchers and addressed four topics, as summarised below.

A.1.3.3.2. Introduction: CO_2 emissions and the CCS sector worldwide.

The introductory presentation provided detailed answers to several questions identified at the last public meeting. The annual global volume of carbon dioxide emissions (2022 figures) amounts to 37 billion tonnes (gigatonnes, **Gt)**; 3.4 Gt in Europe; and almost 300 million tonnes (**Mt**) in France, i.e.

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less than 10% of the European volume. Emissions are generated across several sectors with distinct profiles and corresponding governmental policies:

- For transport (32% of France's total emissions) and agriculture (19%), emissions must be reduced at the source.
- CO_2 capture and storage technology targets certain sectors: industry (18%), waste management (4%), and energy production (in France, this is highly decarbonised, accounting for 11% of total emissions).

To limit global warming to +1.5°C, the Intergovernmental Panel on Climate Change (IPCC) recommends several strategies to be implemented in parallel.

- Reducing emissions at the source alone would require drastic lifestyle changes.
- CCS is considered essential to capture and store approximately 665 **Gt** of CO_2 globally by 2100.
- In France, the strategy aims to capture 4-8 Mt CO_2 /year from industry by 2030, 12-20 Mt CO_2 /year by 2040, and 30-50 Mt CO_2 /year by 2050.

The theoretical global capacity for CCS is, in principle, well above requirements. Worldwide, 41 facilities are in operation, 26 are under construction and 325 are in development (figures as of July 2023). France has geological storage potential in three major sedimentary basins: Paris, Aquitaine and South-East. Six industrial projects are being rolled out in France. The PilotSTRATEGY research project studies the characteristics of a potential 7th area.

A.1.3.3.3. What might a pilot or permanent facility in this area look like?

The presentation by Geostock showed underground storage techniques and typical surface facilities associated with pilot operations. This PilotSTRATEGY partner examined scenarios for a theoretical pilot project, locating the injection well within the Grandpuits plant perimeter or outside the site, and serving either the local plant alone, or the plant and other CO_2 emitting industries in the region. Objectives/criteria include: attracting investment; minimising the surface footprint; promoting local development; and providing a world-class demonstration.

These scenarios consider transporting the captured CO_2 to the injection site either by truck (with upstream liquefaction and surface buffer storage) or by carbon pipeline (compressing and drying the gas upstream to transport it at a pressure of 100 bar). The pilot well would be drilled to a depth of approximately 1.8 km in order to inject the gas into the Dogger formation. The technique used is that applied for geothermal energy, with well-controlled risk. After the pilot period (e.g. 3-4 months), the rig and wellhead can be dismantled, leaving little trace.

The GR AT discussion focused on royalties that would be owed to local authorities hosting a pilot (see the example of hydrocarbons, Appendix II of the full report of this meeting) and on relations with the LAT Nitrogen plant. The current situation is complicated: the shutdown of production at the Grandpuits plant is affecting local communities in terms of employment and is impacting the research programme with regard to certain parameters. Researchers must adapt the models to the realities on the ground. Insofar as PilotSTRATEGY aims to enlighten Europe on modelling and feasibility assessment methods, the analysis of the Grandpuits area remains relevant.

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A.1.3.3.4. What is a “favourable location”? What criteria and priorities should be considered?

IFPEN researchers presented a dynamic simulation of fluid (water, CO_2) evolution in the subsurface following a pilot injection. Geological storage of CO_2 requires the injection of CO_2 into a permeable rock zone, where fluids can flow through the rock pores: this is the case in the deep subsurface studied around Grandpuits. The dynamic 3D behaviour over time of 100,000 tonnes of CO_2 and the brine initially present in the subsurface at a depth of 1,800 metres is modelled. The computer model takes into account the heterogeneity of the reservoir and the cap rock (which is impermeable, preventing the CO_2 from rising). An injection well is cemented along its entire length, preventing the CO_2 from escaping into the layers above the reservoir. At the bottom, at the chosen depth, the CO_2 leaves the well and enters the rock. During a pilot injection phase (four months), the CO_2 that has reached the bottom under excess pressure penetrates the pores of the rock, displacing the water, and migrates laterally. The simulation shows that after one year, the lateral extension of the CO_2 at a depth of 1,800 metres is centred on the injection well and is equivalent to the length of six football pitches. After the injection phase, the CO_2 slows down its migration and being lighter than the water in the pores, spreads vertically to a depth of about 80 m (slightly higher than the 1st floor of the Eiffel Tower, still below the impermeable cap). At the same time, the CO2 dissolves in the water, where it can interact with the rock with two possible effects. Either the permeability of the rock is increased by the dissolution of minerals, or it is decreased by the precipitation of minerals. These effects are studied in the laboratory on real rock samples to make predictions for the injection phase and in the long term.

Figure 55: Key criteria

1. IFPEN then presented its reasoning based on multiple criteria that would enable the location of a wellhead to be optimised (*see* Figure 55). The study area is divided into 60-m squares, each of which is characterised according to these criteria, which concern both the subsoil and the surface. Certain criteria are given priority (e.g. distance from existing wells, whose potential risk of leakage must be monitored). This screening is a preliminary study that helps to identify locations that may warrant detailed assessment.
2. During the discussion, stakeholders identified two types of essential criteria: **population** (the number of people living in the area who may be affected) and **environment** (biodiversity and quality of life).

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A.1.3.3.5. Relations with citizens: What information and support should be provided over the next 18 months of the PilotSTRATEGY project?

The GR AT and open house meetings have been in existence since 2023. However, the attendance represents a small group, and it is possible that different opinions and perceptions exist in the 100 km^2 area covered by the PilotSTRATEGY studies. A questionnaire survey conducted in 2022 with a sample of 243 people living in the area can give insight into these opinions. PilotSTRATEGY partner Symlog presented some striking images from the survey. Two specific questions were formulated after the first local meeting on the 3D seismic measurement campaign. The overwhelming (almost unanimous) nature of the responses were striking:

- The importance for the acceptability of CO_2 storage of social recognition for communities contributing to climate change mitigation (>99% *yes*, including 77% "*very important*" or "*important*").
- "To what extent would you be proud to see your sector contribute to climate change mitigation through underground CO_2 storage?" (>93% *yes*, including 60% "*very proud*" or "*proud*").

These attitudes provide food for thought for the GR AT, elected officials and local residents regarding forms of compensation that may be of interest to the community. *(The subsequent 4th GR AT online meeting enabled members to discuss the questionnaire and the data in detail and plan an even more detailed survey for spring 2025.)*

A.1.3.4. Milestone Report of RSC 4

On 20 February 2025 a virtual meeting of the PilotSTRATEGY Regional Stakeholder Committee (RSC) was held in France. The RSC is called, in France, "Groupe de réflexion Adaptations et Territoire" (GR AT). This was the 4th meeting of the GR AT and the second one held virtually. It was organized as a follow-up to the face-to-face meeting of the GR AT held in the study zone on 18/11/2024. As the full-length report of that November meeting highlights, the group had a short discussion regarding results from the PilotSTRATEGY WP6 social acceptability survey of 2022:

> *"The GR AT and Open House meetings have been running since 2023. Nevertheless, this represents a small group, and it is possible that different opinions and perceptions exist within the 100 km^2 area covered by the PilotSTRATEGY studies. A survey carried out in 2022 on a sample of 243 people living in the area can provide an insight into these opinions. Partner Symlog presents some of the survey's key findings. Two specific questions were included in the French version of the survey, after the first local meeting on the 3D seismic campaign. The massive (almost unanimous) nature of the responses to these two questions as collected by the survey captured the researchers' attention:*

- The importance for the acceptability of CO_2 storage of social recognition for contributing to climate change mitigation (>99% yes, including 77% "very important" or "important").
- How proud would you be to see your sector contribute to climate change mitigation through underground CO_2 storage? (>93% yes, including 60% "very proud" or "proud").

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These attitudes provide food for thought for the GR AT, elected representatives and local residents, regarding forms of compensation that could be of interest to the community. To deepen reflection on this point, the members of the GR AT were invited to join a webinar to discuss the 2022 data in detail, and to **input to planning an even more detailed survey to be carried out in 2025**."

Preparation of the virtual meeting

- Announcement of the opportunity during the 18 November 2024 face-to-face meeting of the GR AT.
- Invitation sent by email on 3 February 2025 to 19 individuals (local or national level) who have attended prior GR AT meetings, and who have signed the Chatham House Rule applied in our meetings.
- Virtual meeting link sent on 18 February to 9 persons who responded "yes" to invitation, along with the lightly revised short French-language report of the 2022 survey.

Attendees

Some extra persons (associates, designated by "+") attended the webinar, as well as 3 project scientists.

Elected officials: 3+1	**Local residents and farmers: 1**
Local administrative officials: 1+1	Local members of national NGO: 2
Industry: 1	National administrators: 1

Discussion

- Strong requests to explain and justify the 2022 sampling strategy (panel), the quality of the sample (demography, representativeness), and the format of the short report (presenting majority percentages, leaving the remainder minority values to be calculated by the reader).
- Debate on the pertinence of the questions and replies; requests to include new questions in 2025.
- Consideration of how to improve and enlarge the 2025 sample (town halls to publicize survey link?)

Outcomes

The short report was revised to include the full text of each questionnaire item and % responses. Along with the meeting evaluation (positive), it was sent to all 19+ invitees with permission to disseminate it further.

The WP6 team then worked throughout March and April to integrate new, requested questions in an updated survey instrument in conformity with the state of the art. In close collaboration with local administrators, a new extended and tiered local sampling pool was determined.

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A.1.4. Greece

A.1.4.1. Report of RSC 1

A.1.4.1.1. Short summary

The first Regional Stakeholder Committee Workshop of Western Macedonia, Greece, for the European project PilotSTRATEGY, was held in person on September 25, 2022, at C.E.R.T.H./C.P.E.R.I.'s premises in Ptolemaida. The workshop was attended by 19 stakeholders of 8 organisations (see Table 30) from the area's scientific, professional, and political sectors. 5 stakeholders were women, 14 were men. 3 stakeholders already attended a stakeholder committee of the previous EU project STRATEGY CCUS, the others attended for the first time. Furthermore, 9 PilotSTRATEGY project team members of CERTH organized and participated in this meeting.

Table 30: Participants by stakeholder types

Stakeholder type	Participants	Organisations
Research and education	3	2
Industry	1	1
Politics and policies	4	2
Support organisations	8	2
General Public	2	-
Tourism	1	1
Total stakeholder	**19**	**8**
Plus project team	*9*	*1*
Final number present	**28**	**9**

The workshop agenda comprised registration for each participant, greetings, and the presentation of PilotSTRATEGY, as well as the concluding discussion. The key themes of the session were the results of the PilotSTRATEGY team's surveys on CCS social acceptance and the discussion of these results.

Agenda

11:00 Registration
11:15 Greetings
11:30 Presentation for the PilotSTRATEGY project
12:15 Discussion
13:15 Closure

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The workshop started at 11:00 a.m. (EEST). The CERTH group began by introducing themselves. Mrs. Rania Karametou took the stand and greeted everyone at the RSC session, reading a short speech by Mr. Micheal Papadopoulos, a Greek Parliament member (see letter below). Mrs. Eleonora Manoukian then spoke about CCS technologies. It should be noted at this time that some new attendees were unfamiliar with the project and/or the CCS technology. Mrs. Karametou handed the floor over to Mr. George Maraslidis, who presented a brief presentation on the previous STRATEGY CCUS project, highlighting the results from the regional scenarios and explaining CCS potentials to the stakeholders.

Following that, Mrs. Rania Karametou presented the PilotSTRATEGY project to the stakeholders, showed information regarding the geological storage potentials in Western Macedonia, and gave a brief introduction to the survey results. At this moment, the stakeholders had their first debate about the geological storage formations and a prospective future with CCS in the area. Following the conversations, Mr. Efstratios Giouvanidis went over the survey results in depth. The workshop concluded with a lengthy and in-depth discussion of the survey results among the stakeholders. They freely stated their views on CCS technology and whether they believe it is a realistic choice in the area. The online questionnaire was given at the conclusion, but due to internet connection issues, only half of them completed it.

A.1.4.1.2. Workshop Questions and Discussion Points

During the workshop discussion part, many questions were asked by the participants. Particularly,

1. Are you sure that CCS technologies will help the local community? Have you done any kind of cost-benefit analysis?
2. What will be the measurable impact? On health, on employment, on the environment?
3. Are you sure that the area's geology is suitable for CCS technologies? Have there been any field measurements or studies to prove that the geology of the area is suitable for carbon dioxide storage?
4. What are the plans for the Western Macedonia area if these geology basins exist?
5. Can we have access to the telephone survey questions?
6. What is the legal framework regarding CCS technologies in Greece?

A.1.4.1.3. Evaluation from CERTH perspective about the results of the online questionnaire

The results of the online questionnaire showed that the workshop was successful. More specifically, 77.8% of the participants found the discussion during the meeting very interesting and 22.2% found it quite interesting. Furthermore, all participants felt that the way the workshop was conducted allowed them to express their opinions and views. 55,6 % considered that the workshop leaders (CERTH) did not promote a concise view about CCS technologies, while of the others 22,2 % considered that these technologies were promoted by them to some extent, while only 11,1 % (one answer) stated that this was done to a significant extent. In addition, 66.7% were highly interested in participating in a future workshop. All attendees found the workshop interesting with 66.7% stating that it was highly interesting.

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The main points that workshop participants made are as follows:

> *"*A very interesting discussion on an issue of interest to the Region of Western Macedonia, especially in the decarbonisation phase*."*
>
> *"*A very good discussion*".*
>
> *"*We would like to learn more details about the pilots of other countries that are closer to the CCS technologies implementation*".*
>
> *"*Interesting discussion. CCS technologies could help to reduce CO_2 when using mainly thermal power plants. The question is the feasibility when promoting a continuous reduction of CO2 emissions by renewables technologies*".*

A.1.4.1.4. Evaluation from CERTH perspective about the effectiveness of the workshop

The survey results have been thoroughly discussed in the given time. Everyone understood from the presentation what PilotSTRATEGY aims for. It was a successful workshop based on the fact that all the attendees expressed their interest and benefits regarding CCS technologies. Moreover, all the attendees expressed their willingness to participate in the following workshop.

The attendees were eager to discuss PilotSTRATEGY survey results and CCS technologies and asked many questions during the discussions that occurred. Most of them found CCS, primarily, a solution to the problem of Western Macedonia's rapid decarbonisation and a viable way to keep existing power plants operating while leading to a smoother carbon-free transition. In addition, some of them expressed their concerns, regarding the potential of carbon storage in Pentalofos and Eptachori, and they were worried about the existence of such underground geological formations, proposing extensive research in these areas or possible other storage sites, like in the Ionian Sea or Prinos. Furthermore, the matter of social acceptance arose and all of them agreed that the local citizens of the area, close to the storage sites, should be approached with caution and should be well informed regarding CCS technologies, while receiving some benefits and motivation from the Greek Government, for their acceptance. Furthermore, the Greek government's construction of a legal and legislative framework for CCS technology was proposed and deemed necessary to evaluate Greece as a prospective storage location.

Following the event, attendees stayed at CERTH premises, divided into groups, and discussed CCS technologies, probable future stages in the research method, and strategies to promote them to the general public.

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Figure 56 Introduction and welcome

Figure 57 Presentation of PilotSTRATEGY project

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A.1.4.1.5. APPENDIX

The address of Mr. Michael Papadopoulos, Member of the Greek Parliament (ND Party), Regional Section of Kozani, is attached below.

Greek Parliament

Member of the Greek Parliament S. Kozani – New Democracy

Ptolemaida, 25 September 2023

Ladies and Gentlemen,

People of the organizing team of Dr. Koukouzas,

People of CERTH,

Official guests, good morning!

Thank you very much for the invitation, but scheduled commitments that keep me out of the Prefecture do not allow me to attend this very interesting event.

The 1st workshop of the PilotSTRATEGY project, entitled: Investigation and Evaluation of the Use of Carbon Capture and Storage (CCS) technologies in Western Macedonia, is an initiative to seek, reflect, and further train the research and technological community, investing in their education.

I warmly congratulate the organizing team of Dr. Koukouzas and all the scientific staff of the Centre for their pioneering and exemplary work in the field of research and innovation.

The topic of today's workshop is of particular interest as the socio-economic dimension of the application of Carbon Capture and Storage (CCS) technologies in Western Macedonia is of great importance, which provides solutions to our energy needs, especially in a time of crisis, when we are often called upon to change our planning, goals, and course of action.

At the same time, many thanks and congratulations to the management and scientific staff of the Research Centre in Ptolemaida for their support and promotion of research and development of applications, thus consolidating its role in the challenges facing our region.

In my concluding remarks, I wish you to always have the will and the opportunity to hold many brilliant events like this one because they best indicate progress and are necessary for professional development and education.

Yours sincerely,

Michael C. Papadopoulos

Member of the Greek Parliament (ND Party)

Regional Section of Kozani

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A.1.4.2. Report of RSC 2

A.1.4.2.1. Short summary

The second Regional Stakeholder Committee Workshop of Western Macedonia, Greece, for the European project PilotSTRATEGY, was a hybrid event held both in person and online via Zoom Platform on November 20, 2025, at C.E.R.T.H./C.P.E.R.I.'s premises in Ptolemaida. The workshop was attended by 36 participants from the area's scientific, professional, and political sectors. 11 stakeholders were women, 15 were men.

Table 31: Participants by stakeholder types

Stakeholder Type	**Participants**	**Organisations**
Research and education	8	3
Industry	3	1
Politics and policies	4	2
Support organisations	7	4
Local media	2	1
General Public	2	0
Tourism	0	0
Total stakeholder	**26**	**11**
Plus project team	*10*	*2*
Final number present	**36**	**13**

The workshop agenda included registration for each participant, greetings, the presentation of PilotSTRATEGY's results, along with other European-funded projects, and a concluding discussion on CCS in Greece. The key themes of the session were the results of the PilotSTRATEGY team's work on CCS in Western Macedonia, social acceptance, risks and a general discussion at the end.

Agenda

[10:45 – 11:00] Registration & Welcome Coffee [Organising Team]

[11:00 – 11:05] Introduction – Greetings [Ms. Eleonora Manoukian]

[11:05 – 11:20] Presentation of the PilotSTRATEGY Project [Dr. Nikolaos Koukouzas]

[11:20 – 11:35] Geological Approach and Field Research [Dr. Christos Stergiou]

[11:35 – 11:50] Seismic Data Processing in the Mesohellenic Trough [Dr. Dimitrios Ktenas]

[11:50 - 12:05] Coffee Break

[12:05 - 12:35] Presentation of Related Projects

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[Ms. Dafni Nalbant Sarikaki]

[Ms. Christina Karatrantou]

[12:35 - 12:50] What CO_2 Storage Really Means [Mr. Georgios Maraslidis]

[12:50 – 13:20] Interactive Session with Stakeholders [All Participants]

[13:20 – 13:30] Closing & Next Steps [Dr. Nikolaos Koukouzas]

The workshop started at 11:00 a.m. (EET). The CERTH group began by introducing themselves. Mrs. Eleonora Manoukian took the stand and greeted everyone at the second RSC session while managing all the talks through the entire meeting. Dr. Nikolaos Koukouzas then took the floor for the 1st presentation of the day to speak about the PilotSTRATEGY project and CCS technologies in Greece. The focus of his presentation was on developing Carbon Capture and geological Storage (CCS) technologies in Greece, with the primary objective of reducing greenhouse gas emissions. The presentation concentrated on Western Macedonia and the geological formation of the Mesohellenic Trough. The project, which was significantly funded by European funds, including the Recovery and Resilience Facility, involved collaboration with major European institutions and energy companies. It aimed to demonstrate the feasibility of safely storing CO_2 at great depths (over 800 meters) in suitable rock formations with impermeable sealing layers. Dr. Koukouzas highlighted the progress in the field, noting that large industrial plants, such as those in Agia Triada, Kamari, and Titan, were planning capture facilities. The discussion also covered the potential for transporting CO_2 by ship and explored international cooperation, such as with Egypt. The project in Western Macedonia was in the phase of preliminary geological studies and environmental licensing, promoting CCS technology as an essential and viable component for reducing greenhouse gas emissions. It should be noted at this time that some new attendees were unfamiliar with the project and/or the CCS technology.

Dr. Christos Stergiou presented the work of the geological characterisation team within the PilotSTRATEGY project. The primary objective of his work package was to acquire new geological data and knowledge about the geological environment of the Mesohellenic Trough in Western Macedonia. This involved multi-scale analysis, from remote sensing and detailed field mapping, which included collecting over 1,650 structural measurements and 115 rock samples to comprehensive laboratory testing. The analyses, such as geomechanical tests, petrophysics, mineralogy, and gas geochemistry, were conducted to evaluate the region's suitability for CO_2 storage. The results identified specific sedimentary formations, like the Pentalofos and Tsotyli units, with good porosity for potential storage reservoirs and others with very low permeability, making them effective sealing caprocks. The integrated studies concluded that the geological system is stable and showed no significant geochemical barriers for long-term CO_2 containment, leading to the development of a detailed conceptual geological model and a publicly available geospatial database.

Dr. Dimitrios Ktenas, was the 3rd speaker and presented the work of the Hellenic Hydrocarbons and Energy Resources Management Company (HEREMA) on the reprocessing of legacy seismic data within the PilotSTRATEGY project. As the national authority for licensing carbon storage projects, HEREMA's objective was to enhance the understanding of the subsurface in the Mesohellenic Trough by applying modern processing algorithms to old 2D seismic surveys from the 1980s and 1990s. The successful reprocessing significantly improved data quality, signal-to-noise ratio, and the clarity of geological reflectors. This allowed for a more secure geological and geophysical

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interpretation, leading to the identification of specific structural and stratigraphic traps, such as anticlines and pinch-outs, which are potential targets for CO_2 storage. The results contributed to a better assessment of the region's storage potential and supported the project's next steps toward detailed geological modelling and site characterisation.

Following that, Ms. Christina Karatrantou presented the CEEGS project, which examined the European regulatory landscape for integrated carbon storage and geothermal energy technologies. The project conducted a comparative legal analysis of 15 European countries to identify frameworks supporting or hindering carbon capture and storage (CCS) development. Key findings revealed that while most countries had mature legislation for geothermal energy, specific legal frameworks for CCS were often absent, leading to regulatory uncertainty and project delays. The analysis highlighted Greece, Germany, and Croatia as illustrative cases, with Greece showcasing a centralized permitting system through the Hydrocarbons Authority, Germany demonstrating a robust but complex federal structure, and Croatia utilizing existing mining laws for pilot projects. Common challenges included fragmented legislation, unclear definitions for energy storage, permitting bottlenecks, and a lack of market integration mechanisms for CCS. Based on these findings, the project proposed a regulatory roadmap towards 2030, aiming for harmonized permitting, accelerated environmental assessments, and full integration of CCS technologies into energy market mechanisms.

Ms. Dafni Nalbant-Sarikaki presented the EU-funded POMHAZ project, which developed a methodological framework for assessing multi-hazard risks in post-mining areas. The seven-stage methodology involved identifying site-specific hazards, analysing their interactions through matrices, creating multi-hazard scenarios, and calculating a combined Multi-Hazard Index. This was integrated with a social and physical Vulnerability Index and a quantification of exposed elements at risk to produce a comprehensive multi-risk evaluation. The project resulted in a GIS-based decision support system and was applied to real case studies in Greece, Germany, France, and Poland. The speaker concluded by noting the methodology's flexibility and its potential applicability for assessing risks in other subsurface activities, such as carbon storage projects.

Finally, the last presentation by Mr. George Maraslidis addressed common myths and public concerns regarding the safety and viability of carbon capture and storage (CCS) technology. He systematically countered claims about the toxicity and leakage risks of CO_2, seismic instability, groundwater contamination, transportation hazards, high costs, and social inequity. These counterarguments were based on decades of international operational experience, stringent EU regulatory frameworks, and evidence from existing projects like Sleipner and Quest, which demonstrated safe, long-term storage at great depths in suitable geological formations.

The subsequent discussion expanded on local concerns in Western Macedonia, focusing on the potential application of CCS for the region's legacy power plants, such as the CCS-ready Ptolemaida 5 unit, and debated the economic and environmental rationale for potentially reviving lignite operations with carbon capture. The dialogue also touched upon Greece's potential role as a regional CO_2 storage hub for neighbouring countries, citing international examples like Iceland.

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A.1.4.2.2. 2nd RSC Questions and Discussion Points

During the meeting's presentations, many questions were asked by the participants, particularly:

A.1.4.2.2.1. Technical Feasibility & Site Characterisation:

- **On Geological Suitability:** Attendees sought clarification on how surface geological observations (e.g., rock dips, water presence) correlate with conditions at great depths (2,500+ meters) intended for storage.
- **On Seismic Risk:** A specific question was asked about the potential for CCS operations to induce "substantial seismicity," with the speaker clarifying that no such phenomenon has been observed in real-world projects.
- **On Data & Legacy Infrastructure:** Participants asked whether the seismic data presented was from new surveys or reprocessed old data, highlighting interest in cost-effective methods. Questions also arose about the findings of past hydrocarbon exploration wells in the area and their implications for storage.

A.1.4.2.2.2. Safety, Environment & Public Perception:

- **On Leakage and Water Contamination:** A major point of discussion was the safety of drinking water aquifers. Attendees asked about the depth of these aquifers compared to storage formations and the mechanisms in place to prevent vertical migration of CO_2.
- **On Capture By-Products:** Concerns were raised about the fate of other captured gases (SOx, NOx) from the flue stream, questioning if they are also stored underground or require separate hazardous waste management.
- **On Public Trust & "Greenwashing":** The discussion revealed skepticism about whether CCS is a genuine climate solution or a "license" for fossil fuel companies to continue operating. The need for absolute transparency and independent oversight in permitting was emphasised.

A.1.4.2.2.3. Regulatory & Economic Viability:

- **On Permitting Challenges:** Participants questioned which European countries face the most difficulties in obtaining CCS permits, noting that administrative complexity and public opposition are significant factors beyond just the legal framework.
- **On Integration with Renewables:** A direct question was posed about the frequent legal pairing of CCS with geothermal energy in the presentations, seeking to understand the regulatory and technical synergies between the two fields.
- **On Project Economics & Scale:** The drastic reduction in CCS cost projections (from ~€100/ton to ~€30-40/ton) was highlighted as a potential game-changer. Attendees questioned if this new economic reality, combined with the identified local geology, could justify a re-evaluation of energy strategies, such as retrofitting now-closed lignite plants.

A.1.4.2.2.4. Local Application & Strategic Vision:

- **On Utilising Existing Assets:** A poignant discussion emerged about the missed opportunity to develop CCS for Greece's former lignite plants. Participants debated whether new technical and economic data warrants a renewed political and strategic discussion on using indigenous resources with CCS.

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- **On Regional Hub Potential:** Looking beyond national needs, attendees explored Greece's potential to become a CO_2 storage hub for the Balkans or Eastern Mediterranean, using its geological capacity and strategic location, similar to projects in Iceland or Norway.
- **On Practical Methodology:** For the risk assessment methodology (POMHAZ), a practical question was asked about where to access the published framework and the GIS-based decision support tool online.

A.1.4.2.2.5. Infrastructure & Logistics:

- **On CO_2 Transport:** Questions focused on the primary mode of transport (pipelines vs. ships) and the local impact of truck traffic, especially during the construction phase of projects.

These points illustrate an engaged audience grappling with the complex interplay of **science, regulation, economics, and social license** that underpins the deployment of CCS technology. The discussion moved from technical details to broader strategic and ethical considerations, reflecting the multifaceted challenges of implementing such projects.

A.1.4.2.2.6. Evaluation from CERTH perspective about the results of the online questionnaire

At the end of the workshop, the attendees were asked to scan a QR code or visit a link in order to give their feedback on the 2nd RSC workshop. The five questions of the online questionnaire were the following:

1. I found the discussion during the workshop interesting. (scale 1-5, totally disagree - totally agree)
2. The way the workshop was conducted allowed me to express my opinion. (scale 1-5, totally disagree - totally agree)
3. I believe that the workshop organizers (CERTH/CPERI) did not promote a particular view on CCUS issues. (scale 1-5, totally disagree - totally agree)
4. Are you interested in participating in the final event of the PilotSTRATEGY project? (scale 1-5, totally disagree - totally agree)
5. Overall, how much did you enjoy this workshop? (scale 1-5, totally disagree - totally agree)

The results of this online questionnaire showed that the workshop was successful. More specifically, regarding the 1st question, 78.57% of the participants found the discussion during the meeting **very interesting,** and the remaining 21.43% found it **interesting**. Furthermore, for the 2nd question, 78.57% participants **totally agreed** that the way the workshop was conducted allowed them to express their opinions and views, 14.29% **agreed**, and a remaining 7.14% **neither agreed nor disagreed**. In addition, for the 3rd question, most of them, with 64.29% **totally agreed** that the workshop leaders (CERTH) did not promote a concise view about CCS technologies, 14.29% **agreed**, 14.29% **neither agreed nor disagreed,** while the remaining 7.14% considered that these technologies were encouraged by the speakers to some extent. In addition, for the 4th question, 78.57% were highly interested in participating in the final event, with 14.29% interested, and a remaining 7.14% neither **interested** nor **not interested**. Finally, the majority of the attendees found the workshop **very interesting**, with 71.43% and the remaining 28.57% found it **interesting**.

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A.1.4.2.3. Evaluation from CERTH perspective about the effectiveness of the workshop

From CERTH's perspective, the workshop was highly effective in achieving its core objectives of disseminating cutting-edge research and fostering a critical, multi-stakeholder dialogue on Carbon Capture and Storage (CCS). The sequential presentations successfully constructed a comprehensive narrative, moving from the specific geological promise of the Mesohellenic Trough and the advanced methodologies used to characterise it, to the evolving European regulatory landscape and robust risk assessment frameworks. This structured approach provided attendees with a solid, science-based foundation, effectively transitioning the conversation from theoretical potential to tangible project development. The depth of technical detail, coupled with clear explanations, demonstrated CERTH's leadership in the field and equipped participants with the necessary knowledge to engage in informed discussion.

The workshop's effectiveness was further underscored by the quality and nature of the audience engagement. The questions and discussion points revealed that participants, ranging from local stakeholders to technical experts, were not just passive listeners but actively synthesized the information, probing into practical implications, safety trade-offs, and strategic opportunities for the region. The direct addressing of public "myths" in the final presentation, followed by the pragmatic debate on the future of local energy assets, confirmed that the workshop successfully created a rare forum where scientific data confronted public concern and economic reality. For CERTH, this generated invaluable real-time feedback on societal perceptions and technical concerns, while clearly identifying the need for continued dialogue and precise next steps in stakeholder mapping and communication, thereby solidifying the workshop as a crucial milestone in the project's path toward potential implementation.

A.1.4.2.4. Photos from the event

Figure 58 1st presentation on the PilotSTRATEGY project by CERTH's Director of Research, Dr. Nikolaos Koukouzas.

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Figure 59 2nd Presentation by Dr. Christos Stergiou on the Geo-characterisation results.

Figure 60: CERTH team on the premises of CERTH/CPERI during the 2nd RSC. Dr. Christos Stergiou, Dr. Nikolaos Koukouzas, Ms. Eleonora Manoukian, Mr. George Maraslidis (from left to right).

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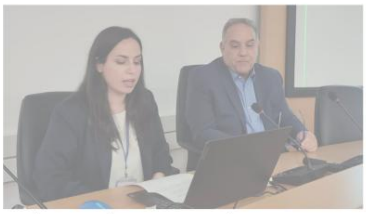
Ν. Κούκουζας Είναι η κατάλληλη στιγμή για την Ελλάδα να ανέβει στο άρμα της Αποθήκευσης CO2

- 2η Ημερίδα του έργου PilotSTRATEGY στην Πτολεμαΐδα

Με μεγάλη επιτυχία πραγματοποιήθηκε η 2η Ημερίδα του έργου PilotSTRATEGY, με θέμα: «Διερεύνηση και αξιολόγηση χρήσης τεχνολογιών Δέσμευσης και Αποθήκευσης Διοξειδίου του Άνθρακα (CCS) στη Δυτική Μακεδονία» στις εγκαταστάσεις του ΕΚΕΤΑ/ΙΔΕΠ στην Πτολεμαΐδα. Το έργο ξεκίνησε το 2021 με χρηματοδότηση από το Πρόγραμμα Horizon 2020 της ΕΕ για την Έρευνα και την Καινοτομία. Η αποθήκευση διοξειδίου του άνθρακα σε Βαθείς Υφάλμυρους Υδροφορείς είναι ζωτικής σημασίας για τη μετάβαση σε μηδενικές εκπομπές CO2 και η περιοχή της Δυτικής Μακεδονίας εντάχθηκε στις έρευνες για τις επιλογές αποθήκευσης μέσω του PilotSTRATEGY.

Ο επιστημονικός υπεύθυνος του έργου Δρ. Νικόλαος Κούκουζας μιλώντας στο e-ptolemeos.gr ανέλυσε την περίπτωση του Πρίνου, όπου το έργο αποθήκευσης διοξειδίου του άνθρακα και βρίσκεται σε φάση περιβαλλοντικών αδειών και θα προχωρήσει με στόχο την αποθήκευση 1 εκ. τόνων διοξειδίου του άνθρακα ετησίως, με ευρωπαϊκή χρηματοδότηση. Επίσης, μεγάλες βιομηχανίες στην Ελλάδα έχουν επενδύσει στην δέσμευση του διοξειδίου με



σκοπό να το παρέχουν στον Πρίνο για αποθήκευση. Η ωριμότητα των τεχνολογιών φαίνεται και από το οργανωμένο σχέδιο των επιχειρήσεων που επιταχύνει τις διαδικασίες πραγματοποίησης των ερευνών.

Για την περίπτωση της Δυτικής Μακεδονίας, ο Νίκος Κούκουζας ανέφερε ότι η περιοχή της Μεσοελληνικής Αύλακας που καταλαμβάνει περιοχές της Καστοριάς, των Γρεβενών και ευρύτερα της Δυτικής Μακεδονία μελετάται με αυτό το έργο για τη γεωλογική καταλληλότητα για την αποθήκευση διοξειδίου. Οι γεωλογικοί σχηματισμοί που υπάρχουν στο υπέδαφος της Μεσοελληνικής Αύλακας που εκτείνεται μέχρι και τα Μετέωρα μπορούν να υποστηρίξουν την αποθήκευση διοξειδίου του άνθρακα. Μεγάλες βιομηχανίες πετρελαίου και τσιμέντων θα πάρουν ευρωπαϊκές χρηματοδοτήσεις άνω των 2 δισεκατομμυρίων ευρώ για τη δέσμευση. « Είναι η κατάλληλη περίοδος για την Ελλάδα να επενδύσει στις καινοτομίες αποθήκευσης διοξειδίου με εφαρμοσμένη έρευνα ως εξέλιξη της μεταλιγνιτικής εποχής.», ανέφερε ο Νίκος Κούκουζας.

Το συγκεκριμένο έργο φτάνοντας στο τέλος του συνέβαλλε στην ανάπτυξη της γεωλογικής έρευνας και την αξιολόγηση της χωρητικότητας αποθήκευσης και ακεραιότητας των υπό εξέταση θέσεων.

Στην ημερίδα παρουσιάστηκε το έργο συνολικά, ενώ άλλοι συμμετέχοντες αναφέρθηκαν σε θέματα γεωλογικής προσέγγισης και έρευνας πεδίου, αποθήκευσης CO2 και συναφή έργα που ασχολούνται με αυτές τις τεχνολογίες με πολύ ενδιαφέρουσες εισηγήσεις.

Figure 61: Article in the local news regarding the 2nd RSC workshop organised by CERTH/CPERI.

A.1.5. Poland

A.1.5.1. Report of RSC 1

The first RSC workshops on the Pilot Strategy project were held face to face at the CCTW GIG-PIB headquarters in Katowice. 20 representatives of various industries were invited, of which 10 expressed their willingness to participate in the workshops. Despite resending invitations to the remaining guests, they were not interested in participating in the RSC of the Pilot Strategy project. We were particularly interested in the participation of representatives of authorities from areas potentially affected by CO_2 sequestration, but despite repeated e-mail and telephone invitations, none of the representatives of local authorities decided to take part in the event. The question arises why there is so little interest and involvement of the public or local authorities, and the reason is that probably no one takes seriously the possibility of creating a CO_2 storage facility. Out of 10 people who declared their participation, 3 did not arrive at the meeting due to unforeseen circumstances (illness, more important professional obligations). Ultimately, the meeting was attended by 7 stakeholders (including 4 for the first time) and 6 people from the GIG team, including 6 women and 7 men. Seven stakeholders represented various branches (industry, public administration, local authorities, policy makers, civil society organisations and scientific community). All stakeholders signed the consent forms. The meeting began with a brief introduction of the participants (name, institution, a brief view of CCS and reason for interest in CCS).

Since all invited guests have at least a communicative level of English, it was decided not to translate the slides into Polish (except for the early sent agenda), but to leave them in the original. Two additional presentations ('Determining the CO_2 storage potential in the region' and 'The current legal status of CC(U)S in Poland') were presented in Polish. In the next step moderator briefly presented the Pilot STRATEGY project updates. After presentation of a short summary of the results regarding social acceptance, the following questions and doubts from participants appear:

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- Did the surveyed people have previously been provided with information about CC(U)S? Answer: Yes, they were briefly explained what CCS is.
- Why is there so much support for CCS technology in Poland (58%), if a large percentage of people (46%) have not encountered this issue before? Answer: Perhaps due to ignorance and low awareness; doubts arose whether people would respond equally enthusiastically to CCS technology if its implementation in the immediate vicinity became a fact. Then social protests should be expected.
- The online formula of conducting the survey means that it is, by definition, addressed to a specific group of people with a higher social status who have access to a computer and the Internet.
- Why is there greater opposition in other countries to storing CO_2 offshore than onshore? These results are different from those reported by, for example, Eurobarometer. Answer: Perhaps the inhabitants of coastal areas still remember the great ecological disaster of 2002, when the bow part of the "Prestige" tanker with 70,000 tons of oil in its tanks sank near the cost of Spain, and fishermen had to stop fishing, and maybe that is the reason why for example in Spain, there are still more concerns about CO_2 storage at sea (offshore).

After a discussion on the survey results, the participants were presented with the current status of key research for planning the CCS pilot in Poland ('Determining the CO_2 storage potential in the region'). The discussion after the presentation included investments planned in the country, e.g. CO_2 sequestration in the Polaris deposit in the Barents Sea planned by Orlen from 2028/2029, and the construction of a CO_2 terminal in Gdańsk. Ultimately, in its strategy until 2030, the Orlen concern assumes sequestration of a total of 3 million tons of CO_2 and plans to launch CO_2 sequestration under the bottom of the Baltic Sea after gaining experience in the Barents Sea. The participants were interested in whether the areas in Podkarpacie with inexhaustible hydrocarbon deposits (Kraków-Niepołomice region) were taken into account in the project? There was also a proposal to minimize potential social conflicts, e.g. by building a CCS installation next to an existing refinery - then only the plant's infrastructure is expanded, and CO_2 is used on site, without the need for transport, which eliminates the associated costs (compression, tanks, etc.).

The next presentation met with particularly great interest among the audience because it concerned current changes in legislation ('The current legal status of CC(U)S in Poland'). EU directives (ETS - 2003/87/EC of October 13, 2003 and CCS - 2009/31/EC of April 23, 2009) are intended to be a driving tool for the development of CCS technology, but in Poland there is no comprehensive regulation in one legal act. CCS issues are regulated by the provisions of the 'Geological and Mining Law' (2013) and the 'Energy Law' (1997). The 'Geological and Mining Law' has recently been amended, and the new act is to come into force in October. However, it is still the competent minister who determines the place of CCS storage, and it is still limited to marine areas. The 'Energy Law' has not yet been changed and only allows CCS for the purpose of carrying out a carbon capture and storage demonstration project. The EU directive makes it possible to exclude small CCS installations from the full licensing obligation, providing for the total storage of less than 100 kilotons of CO_2, however, the Polish legislator implementing EU regulations in 2013 did not take advantage of the possibility of introducing facilitations in the field of starting and carrying out activities related to CO_2 storage in volumes not covered by the Directive CCS. The so-called small pilot CCS installations are currently not regulated, and consequently each CCS installation must be implemented as part of a

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demonstration project, following the full licensing path, including obtaining the opinion of the European Commission. An important change in the legislation, but impossible to introduce without changes in other legal acts, is the provision that 'The activity of extracting hydrocarbons from deposits, carried out on the basis of a license for the extraction of hydrocarbons from deposits or an investment decision, may be carried out in connection with underground storage of carbon dioxide.' (e.g. Lotos Petrobaltic investments).

The amendment to the 'Geological and Mining Law' forces the amendment of the 'Energy Law' in the near future. The current provisions of the Energy Law specify the conditions for the transmission of carbon dioxide for underground storage only as part of a demonstration project.

It is necessary to complete actions regarding legal regulations, especially in the area of transport and storage. CO_2 storage is still limited to the Cambrian Reservoir in the exclusive economic zone of the Republic of Poland, which significantly limits the development of technology in Poland. It is important to regulate the issue of transport: Transport in the CCS Directive (Article 3, point 22) is defined only in the form of pipelines, and although other forms of transport are not expressly excluded, they remain unregulated. Regulations are necessary to enable the implementation of linear CO_2 transport investments and the licensing of landfills ('Energy Law'). It is necessary to appoint CO_2 transport and storage operators, preceded by the adoption of adequate implementing regulations to the changes introduced in the 'Geological and Mining Law'. It is necessary to actively participate in the creation of new implementing acts so as not to block the possibility of technology development, perhaps by creating a lobby that influences the provisions in the amendments to legal acts and the implementing act (e.g. in terms of unblocking CO_2 storage sites on land and regulating the issue of transport).

One of the participants confirmed that the ministry is considering the possibility of storing CO_2 on land, but the established consulting team is still working, and introducing changes will probably take longer than expected due to the current electoral calendar in Poland and the results of the parliamentary elections on October 15, 2023.

The next part of the RSC meeting was a workshop concerned with the development of CCS technology in the region - transformation paths and strategies.

Workshop participants were randomly divided into two groups. The main focus of the discussion was the issue of the common goal ‘Planning of a potential CCS pilot in Upper Silesia‘, what are the key steps and resources required to achieve the goal and when will it be achieved. After brainstorming, each group selected its representative who presented the most important conclusions on the board. The discussion was followed by a short summary (take-home messages) presented by the workshop moderator.
The results presented during the summary by representatives of each group were very similar. Under the current legislation, it does not matter whether a pilot or commercial installation is taken into account, the requirements and preparation path are exactly the same in both cases, but the difference is in the scale of the project and the mechanism of financing the installation (the pilot must be financed by an external body, e.g. from the EU, and the commercial installation is carried out by a profit-oriented investor).

The most important issues when planning the construction of a CCS pilot in Poland are:

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a. Security of the CCS process

Geophysical examination of existing wells for their use for monitoring or CO_2 injection (disadvantage: generating additional costs),

- Monitoring the landfill area during and after operation,
- Modeling of injection in terms of storage capacity,
- Overburden tightness testing,

It should be considered whether a pilot CCS installation should be established on the site of a large installation, with the possibility of expanding the scale. Will injection on a small scale (pilot installation) give an adequate answer regarding pressure, selection of holes, etc. The safest way would be to verify it in a specialized laboratory, but due to high costs, the research should be limited to detailed field tests and modeling based on accurate test results of injection structures and overburden.

b. **Economic aspect (investment and operating costs)**

- CO_2 source and distance from the storage site,
- Transport costs,
- Road infrastructure,

Monitoring after completion of the CO_2 storage process - at whose expense? Co-financing? The division of profits from the constructed CCS installation should take into account the income for municipalities and local communities, as is the case with waste storage.

c. **Social aspect**

- Social campaign - building awareness of residents and decision-makers. Incentive (economic), job creation, safe location,
- Interest of authorities at national and local level,
- Consultations with "technical" people, i.e. professionals at every stage of the project.

d. **Legal and administrative issues**

- Obtaining consents (building permits, environmental decisions),
- The need for a special act (lack of regulated transport issues).

The meeting participants decided that the vast majority of activities should be started as soon as possible (especially activities related to legislation, a social and information campaign aimed at creating good PR regarding CCS, detailed geophysical reconnaissance of the area, the possibility of monitoring, obtaining EU funds or other sources of financing (unlikely), to identify whether a CCS pilot installation could be upgraded to a larger scale installation). The delayed action may be the installation design.

Stages of planning a CCS installation, for example CCS pilot on a scale of up to 100,000. tonnes of CO_2/year (limited due to current legislation), i.e. approx. 20 tonnes per day:

I. Within 5 years

- Geological modelling - completion of research; 3D seismic research; narrowing the area; additional wells.

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- Effective cooperation with local politicians, involvement of the local community (representatives of offices, residents).
- A social campaign combined with repeated surveys of the population from storage sites (conducting a social information campaign, necessarily in Polish, which guarantees greater accessibility for residents of small communes and local government employees; involvement of staff from the departments of mining, geology, environmental protection, and environmental management).
- Identification of the socio-economic benefits of CCUS for the local municipality (based on mine experience; fee share, ETS savings vs. tax losses).
- Risk identification (mining exploitation in the Upper Silesia region - felt rock bursts, visible mining damage and destruction of buildings caused by current and completed coal mining - significant impact on public fears regarding storing CO_2 underground; necessary microseismic monitoring during and after CO_2 injection).
- Identification of potential losses (impact on local property prices).
- Selection of a CO_2 emission source (exclusion of exports) aimed at maintaining industry in Upper Silesia (steelworks, waste incineration plants) and contributing to increasing social acceptance of the investment.
- Preparation of initial infrastructure (road construction) necessary to transport heavy equipment (drilling rigs, then CO_2 tanks).
- Transport modelling; pipelines – social acceptance of the pipeline route (underground); pipeline monitoring.
- Construction of a pilot installation.

II. Within 10 years
   i. Establishment of an industrial installation and its monitoring.

III. Within 50 years
   ii. Monitoring after closure of a CCS landfill
   iii. Popularisation of technology and the possibility of obtaining financing with national support, e.g. from the Provincial Fund for Environmental Protection and Water Management (WFOŚiGW).

A.1.5.1.1. Take-home messages:

- It is necessary to conduct a large-scale social campaign aimed at providing residents with reliable information about CCS issues. The information should be specific and provided by reliable people who enjoy social trust and, due to their competences, may constitute an authority for people. At the moment, there are no authorities based on which public trust in CCS can be built.
- Another detailed survey of the inhabitants of the areas considered for CO_2 storage after selecting specific locations.
- Regulation of legal issues and involvement of national and local authorities in the development of CCS technology.
- Finding a source of financing for the project (planning and creation of the Pilot; in the case of an industrial installation, it will probably be easier to find investors).

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- A comprehensive approach to the issue and the involvement of competent people at every stage of the project, starting from legislators through professional employees responsible for the technical side (geologists, designers, etc.).

At the end of the meeting, participants were asked to evaluate the workshop (they received a QR code), some people did it immediately, and some asked to send a link to the survey by e-mail. The meeting ended after the planned three and a half hours. Participants are much more active in direct discussions, which creates a better opportunity to exchange views and verify emerging doubts. Formal issues (consent forms, evaluation questionnaire) are also much easier to enforce in a direct form. Overall, we assess the workshops as rather satisfactory, as they were carried out as planned and the participants received specific information.

A.1.5.1.2. Evaluation questionnaire summary

All seven external participants completed the workshop evaluation questionnaire. Participants found the discussion during the workshops interesting (average 4.4 on a five-point scale) and assumed that the way the workshops were conducted allowed them to express their opinions (avg. 5.0). All stakeholders rather agreed that the people running the workshop were not promoting a specific view of issues concerning CCUS (3-5 on a scale 1-5, avg 4.4). All attendees except one person would like to take part in the next workshop (avg 4.1) and liked the workshops (average 4.6, ratings from 3 to 5). The person who is not interested in participating the next meeting rated the current meeting as 3. People completing the questionnaire had no comments other than stating that the workshops were conducted very professionally, the topics were interesting and the selection of participants was accurate. One of the stakeholders suggested expanding issues related to other elements of the CCUS chain, not only CO_2 storage.

A.1.5.2. Report of RSC 2

A.1.5.2.1. Meeting Overview

The 2nd Regional Stakeholders Committee (RSC) meeting of the Pilot STRATEGY project was held on 14 January 2026 in Katowice, Poland, at the headquarters of CCTW GIG-PIB. The meeting was conducted in a face-to-face format and focused on the potential deployment of Carbon Capture and Storage (CCS) technology in Poland, with particular attention to regulatory, economic, geological, and social aspects.

A.1.5.2.2. Participants and Stakeholder Representation

Sixteen representatives from industry, public administration, and the scientific community were invited to participate in the meeting. Seven stakeholders initially confirmed their participation; despite repeated follow-up via e-mail and telephone, the other invited guests did not respond to the invitation in any way.

Notably, representatives of public authorities from regions potentially affected by future CO_2 sequestration in Poland, who would be expected to have a direct interest in the topic, did not take part in the meeting and did not demonstrate engagement with the initiative. This limited interest

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raises concerns regarding the general perception of CCS in Poland and suggests that the technology is not yet widely regarded as a realistic or imminent option for implementation.

Due to unforeseen circumstances (illness and conflicting professional obligations), three registered stakeholders were unable to attend. Ultimately, four external stakeholders (three participating for the first time) and six representatives of the GIG-PIB project team attended the meeting. Gender balance was maintained, with equal representation of women and men. Stakeholders represented industry, public administration, and research institutions.

A.1.5.2.3. Agenda and Meeting Structure

Following the completion of consent forms by new participants, the meeting commenced with a round of participant introductions, including institutional affiliation, individual perspectives on CCS, and motivations for engagement.

The project coordinator subsequently presented an update on the Pilot STRATEGY project. Three thematic presentations were then delivered in line with the approved agenda, addressing:

- the local potential for CO_2 storage in Poland,
- economic aspects of CCS implementation, and
- the current legal and regulatory framework for CC(U)S in Poland.

All presentations prompted active discussion and exchange of views among participants.

A.1.5.2.4. Key Discussion Points

A.1.5.2.4.1. Social Acceptance and Survey Methodology

Participants raised concerns regarding the methodology applied in social acceptance surveys, particularly with respect to small sample sizes, limited reproducibility of results across countries (e.g. France), and questions related to the representativeness of surveyed groups and the interpretation of findings.

It was further emphasised that recent survey results may indicate a less favourable public attitude towards CCS compared to previous years. This trend was linked to changes in political discourse in Europe and globally, including the growing influence of populist and far-right narratives that are often critical of climate policies, industrial decarbonisation technologies, and expert-driven solutions. Such narratives may contribute to increased scepticism and reduced public trust in CCS, thereby affecting the stability and comparability of social acceptance survey results over time.

A.1.5.2.4.2. Regulatory and Legal Framework

Participants agreed that, to date, Poland has maintained one of the most restrictive regulatory environments for CCS development. Even pilot-scale projects have required concessions and compliance with extensive environmental and energy legislation, significantly impeding implementation.

The prolonged process of amending national regulations has resulted in insufficient geological research of potential CO_2 storage sites, limiting both scientific assessment and prospects for industrial deployment. Participants noted that this situation may change if new legislation allowing onshore CO_2

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storage, currently in the final phase of expert consultation, enters into force. However, to date, CCS-related activities in Poland have largely remained at the level of declarations, with limited tangible regulatory progress.

It was also noted that a lack of CCS pilot projects is not unique to Poland but is observed in several other countries.

A.1.5.2.4.3. Economic and Technical Considerations

Discussions highlighted that the economic feasibility of CCS investments, both pilot and commercial scale, remains highly dependent on sustained high EU ETS CO_2 prices. Without such economic incentives, CCS deployment is unlikely to be competitive.

Participants also stressed the need for thorough geological characterisation and site-specific risk assessments prior to any implementation, recognizing that each potential storage location presents unique technical and environmental conditions.

A.1.5.2.4.4. Workshop Session and Risk Analysis

After a short break, the meeting continued with an interactive workshop session focused on discussion, exchange of perspectives, and a preliminary joint risk analysis related to CCS in Poland. The Slido.com platform was used to facilitate real-time interaction and anonymous input from all participants.

Participants were asked to respond to three questions:

1. How would you rate your knowledge of CCS?
2. What emotions do you most associate with CCS?
3. Which safety issue is most important to you in the context of a CCS pilot project in Poland?

A.1.5.2.5. Workshop Results

A.1.5.2.5.1. Self-Assessed Knowledge of CCS

Despite participants being professionally involved in CCS-related topics, self-assessed knowledge levels varied. On a five-point scale (1-5), 38% of participants rated their knowledge as very high (5), 25% as high (4), and 38% as moderate (3).

A.1.5.2.5.2. Emotions and Perceptions Related to CCS

Participants associated CCS with both positive and negative emotions. Positive associations included *interest in future deployment, trust in scientific expertise,* and *recognition of CCS as a technological challenge*. Negative associations included *lack of knowledge, uncertainty, unclear future prospects, scepticism, insufficient information*, and even perceptions of *greenwashing*. These responses indicate an ambiguous and uncertain position of CCS among global CO_2 mitigation solutions.

A.1.5.2.5.3. Key Safety Concerns

Opinions on safety issues were similarly divided. The most frequently identified safety concern was the risk of CO_2 migration (33%), followed by insufficient geological characterisation and unclear

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allocation of responsibility (22% each). Individual participants also pointed to risks related to rock-brine-CO_2 interactions and to social factors, although the latter were considered potentially underestimated.

Participants agreed that a dedicated risk assessment is required for each potential CO_2 storage location.

A.1.5.2.6. Key Take-Home Messages

1. Economic viability of CCS investments (both pilot and commercial scale) is feasible only under conditions of sustained high EU ETS CO_2 prices.
2. A site-specific risk assessment is required for every potential CO_2 storage location.
3. CCS is not a "media-friendly" technology and lacks clear, immediate arguments that could easily foster positive public perception and local acceptance.
4. Delays in updating national regulations continue to hinder both scientific research and commercial assessment of potential CO_2 storage sites.

A.1.5.2.7. Workshop Evaluation

All four external stakeholders completed the post-meeting evaluation questionnaire. Participants rated the workshops as highly interesting (average score: 5.0/5.0) and agreed that the format enabled open expression of opinions (average: 5.0). Stakeholders largely agreed that facilitators did not promote a specific viewpoint on CCUS-related issues (3x5.0, 1x3.0, average: 4.5/5.0). Overall satisfaction with the workshops was very high (average: 5.0/5.0).

Participants emphasised the strategic importance of CCS for the Polish industrial sector and expressed regret regarding the absence of representatives from potential CCS locations and key policy decision-makers.

A.1.5.2.8. Conclusions

The 2nd RSC meeting successfully delivered substantive technical, regulatory, and social insights into the potential deployment of CCS in Poland. While participant engagement and discussion quality were high, the low attendance, particularly among public authorities and decision-makers, highlights a persistent challenge for CCS development: limited institutional ownership and weak societal anchoring of the technology.

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