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Stakeholder perceptions and preferences regarding monitoring CO_2 storage and its contribution to optimizing the societal embeddedness of CO_2 storage projects

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Abstract

Introduction
In this study -part of the ACT II Digimon project- we focus on how a monitoring system can contribute to the societal embeddedness of CO_2 storage projects, based on insights from case studies in four European countries: Germany, Greece, The Netherlands and Norway. The Societal Embeddedness Level Methodology (Geerdink et. al. 2020) is an important building block for setting up the research. It provides a framework for assessing four aspects that are of influence on the level of societal embeddedness of new innovative energy technologies: the impact of CO_2 storage projects on the environment, stakeholder involvement, policy and regulatory aspects and market and financial aspects. We consider the perspectives, concerns and interests of the general population and CCS experts as an important foundation for answering the main research question. The four case studies provide insight in which societal requirements and characteristics concerning CCS monitoring are found relevant by both the general public and CCS experts to enhance the societal embeddedness of CO_2 storage projects.

Methodology
We used a combination of qualitative and quantitative research methods across the four countries. First, we conducted 45 semi-structured interviews with (local) stakeholders and CCS experts in four European countries to gain insight in stakeholder experiences and preferences with regards to CCS and CCS monitoring. Then, we designed an Informed Questionnaire and applied it in online surveys to gain insight in the opinion of the general public at a national level: input of 1000 respondents per country was received. For the Dutch, German and Norwegian case study, we were also able to survey an additional local sample of a minimum of 200 respondents per country. Based on the outcomes of the semi-structured interviews and the Informed Questionnaire surveys, we were able to draw four narratives reflecting the state-of-the-art with regards to CCS and CCS monitoring as well as identify two overarching values how monitoring could play a role in optimizing the societal embeddedness of CO_2 storage projects.

Different national context for CCS development.
The four case studies differ in their current CCS developments, the historical context as well as the regulatory context

in the means of experience in the oil and gas industry, the amount of trust of the general public in CCS activities and to what extend the regulatory framework facilitates CCS initiatives.

Results from case studies

- Generally, monitoring is not on top of mind of the interviewees in all four countries, for two reasons. In two countries it is found a self-evident part of the project which is embedded in the regulatory framework. In the two other countries there are no current CCS developments and therefor the focus is not on monitoring yet.
- Regulations for CCS developments and monitoring of CO_2 storage are based on European regulatory framework and per country tailored on project level.
- The governance for CCS monitoring has not been set up yet.
- Although interviewees are not worried about safety and risks of CCS, a part of the general public states that they are worried about risks of CO_2 storage. Besides concerns about risks, a part of the survey respondents as well as the interviewees states to be concerned about delaying of decarbonization.
- It is found that communication about monitoring results can positively influence worries about risks and safety regarding CO_2 storage. Interviewees as well as survey respondents advocate for trusted third parties to be involved in monitoring and the interpretation and communication of the monitoring results. Finally, it is stated that communication about monitoring results and involving stakeholders in the monitoring process might positively influence the image of CCS projects.
- Monitoring data can also be used to learn about long term effects of CO_2 storage and shared among CCS projects to learn from each other and make a joint effort of accelerating CCS projects.

Conclusion/discussion

While it became apparent in our analysis that some of the concerns (especially those of political nature, like the possible delay of the expansion of renewables or delayed decarbonization) and challenges (like regulatory barriers) can most likely not or only hardly be addressed by a monitoring system, there are two narratives on the potential contribution of monitoring to the societal embeddedness of CO_2 storage. The first narrative concerns the **insurance of safety of operation and communication about safety.** The second is linked to **uncertainties on the long-term storage and to the potential of CO_2 storage for climate change mitigation.**

Although the majority of the results advocate towards transparency and accessibility of monitoring results, it should be considered that data can always be misinterpreted or misused, and reinforce insecurity among the public.

Further research

Overall, this research provides some important insights in the societal requirements and characteristics that are relevant for monitoring CO_2 storage. These insights will be used to support and strengthen the technical design and market implementation of the Digimon monitoring system, an innovative monitoring system for CO_2 storage. In further research we will translate these societal requirements and characteristics into so-called monitoring indicators. The connection between societal and techno-economic findings enhances the societal embeddedness of the Digimon monitoring system, thus contributing to the embeddedness for CO_2 storage projects as a whole.

Keywords: Societal Embeddedness Level; CCS; CO2 storage; monitoring CO2 storage; public perception; public acception; climate goals