

# Our climate, our underground

## Citation for published version (APA):

van Oost, B. (2016). *Our climate, our underground: understanding the slow implementation of carbon capture and storage*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20161220bo>

## Document status and date:

Published: 01/01/2016

## DOI:

[10.26481/dis.20161220bo](https://doi.org/10.26481/dis.20161220bo)

## Document Version:

Publisher's PDF, also known as Version of record

## Please check the document version of this publication:

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# Valorisation addendum

## **Societal relevance**

Mitigating climate change is a major societal challenge. It is considered crucial to switch to a sustainable, low-carbon energy system. Many options are being pursued, like building wind mills, installing solar panels, developing smart grids for decentralized electricity production, increasing the use of alternative energy sources like biogas, shale gas or tidal waves, increasing energy efficiency in the build environment, reducing the carbon footprint of individual consumers, or developing an alternative infrastructure in which hydrogen is the primary energy carrier. However laudable such efforts are, it is also expected that fossil fuels will continue to be the primary energy source for decades to come. Capturing and sequestering the CO<sub>2</sub> emissions from fossil-based power plants or heavy industry therefore plays an important role in the climate strategy of almost all developed economies.

This dissertation is of societal relevance, because it helps to understand some of the tensions, challenges and ironies involved in implementing CCS. This understanding is gained by not choosing sides. I do not answer the question whether CCS is necessary or not, whether CCS is safe or not, or whether the technologies involved are adequately demonstrated so that new coal plants can be forced to implement CCS. Instead, I show that parties differ in their understanding of the risks, benefits and uncertainties involved in CCS and trace how such differences are dealt with in specific contexts.

My research zooms in on the (contested) role of knowledge in the implementation of CCS. I emphasize that the necessity, safety and feasibility of CCS is constructed and not unambiguously given. There are two reasons for this emphasis. First, I seek acknowledgment that parties can rationally disagree about CCS without one being necessarily more rational or better informed than the other because I am convinced that this helps to increase mutual understanding between parties. This does not imply that all viewpoints are equal or that ‘anything goes’ in the governance of CCS. Debates on CCS are structured by existing rules

and regulations. In turn, particular interpretations of the risks and benefits of CCS tend to be more salient than others, depending on the context. So, second, I insist that the relevance of knowledge is context-dependent, because this allows for reflexive learning amongst those involved in the governance of CCS. It is often suggested that parties should generate more knowledge about CCS and that the dissemination of such knowledge should be improved to prevent deadlock on CCS. I argue that one should simultaneously try to facilitate an inclusive, reflexive and situated debate on the conditions under which such knowledge may legitimize collective action on CCS.

### **Stakeholders**

This dissertation is of relevance to various audiences. Below, I will sketch some relevant insights for specific stakeholder groups.

#### *Relevant insights for policy-makers and regulators*

- (a) To reach a socially robust decision on CCS projects, affected parties will have to agree on the framing of the decision-making process.

What consequences of a CCS project have to be taken into account? In how far should broader issues be considered? What knowledge is needed for decision-making? And what to do if this knowledge is incomplete? To answer such questions in a socially robust manner, it is advisable to develop the decision-making frame in a reflexive and inclusive manner.

This is not easy, as decision-making frames are structured by existing rules and by broader political developments. In the Dutch context I observed for example the following challenge. Policy-makers treated the necessity of CCS as an ambiguous issue (calling for a broad public debate at the national level) and treated the safety of CCS as a complex issue (calling for focused inquiry at the local level). Such problem-structuration made sense from a policy perspective, but it turned out to be counter-productive. First, those confronted with a CCS project could only question the safety of this project, even though they wanted to discuss broader issues instead. Second, the local framing of safety was overruled when the responsible Ministers decided to shift the decision-making power to the national level and decided to follow the institutionalized safety frame instead. This resulted in an intractable risk controversy.

- (b) Be aware that projections of the future role of CCS are not neutral and that there is a governance tension in Dutch energy policies.

In the Netherlands, environmental and industrial parties have voluntarily subscribed to stringent CO<sub>2</sub>-emission reduction targets. This agreement is made possible by projections of the future role of CCS in the Netherlands and by visions of regional ‘CO<sub>2</sub> hubs’. It is suggested that the nation as a whole will benefit from installing such a shared CO<sub>2</sub> infrastructure. Importantly, the promise of CCS also helped to legitimize the construction of new coal-fired power plants. This made CCS an even more important part of Dutch energy policies. But to actually implement CCS, energy companies are guided by the price of CO<sub>2</sub> (which is set at the supranational level) and not by their voluntary commitment to national or regional climate objectives.

- (c) Conducting demonstration projects will not automatically move CCS through the remaining stages of ‘technology readiness’, because the meaning of such projects is up for debate.

Policy papers often suggest that CCS has to move through different stages:  
pilot phase → small-scale demos → large-scale demos → commercial readiness.

Most policy-makers and regulators will know that this is a simplification. Innovation scholars have convincingly shown that technology development is rarely a linear process. Still, there is a dominant expectation in policy papers that demonstration projects will act as ‘stepping stones’ towards large-scale implementation of CCS.

My research indicates that this is not automatically the case. Even when CCS demonstration projects are conducted (and are not cancelled or delayed, like many have in recent years), parties may disagree about (i) the lessons learned and (ii) about the representativeness of such projects for other situations.

I cannot prescribe a recipe on how to deal with such disagreement. I do want to stress that demonstrating the working of CCS is not a purely technical or scientific act, but a political one too. In turn, democratic processes are needed to answer the question whether CCS technologies are ‘adequately demonstrated’ so that parties (be it industrial groups or local publics) can be forced to accept their implementation.

*Relevant insights for the general public or those confronted by CCS projects*

- (d) Techno-scientific knowledge on CCS is constructed. However, this does not mean that it is useless or necessarily flawed.

Claims about the necessity, safety and feasibility of CCS play an important role in the implementation of CCS. Throughout this dissertation, I have shown how the meaning and relevance of such claims became contested in various contexts. In doing so, I do not mean to suggest that the case for CCS is flawed.

By showing the complexities involved in the governance of CCS, I hope to counter cynicism and to provide further nuance to cultural stereotypes. Those working on CCS are not necessarily pro-industry or pro-coal, just like those critical of CCS are not necessarily uninformed or climate-deniers. I also hope that my research can contribute to a more 'realistic' understanding of the role of science and technology in our modern culture. Insisting that knowledge is constructed is not a plea for fact-free politics. It is an invitation for continued discussion on how knowledge on climate change and the deep underground can be used to shape our collective energy future, given that such knowledge is unavoidably limited.

### **Activities**

To disseminate my research findings, I have undertaken (and plan to undertake) several activities. A first step has been to conduct interviews and to share my initial analysis with quoted respondents. Their feedback helped to improve my analysis of the selected cases, but it also helped to create awareness about my research. A second activity has been to present my findings on several conferences, including a colloquium on *Responsible Innovation* at Maastricht University and the annual conference of the *European Society for Risk Analysis*, which brought together policy-makers, regulators, social scientists and other professionals working on risk-related issues. Such multi-disciplinary meetings provided usual feedback on my analytical perspective and allowed me to share my findings.

As a third step, I will meet with a representative of the Dutch Ministry of Economic Affairs to share my findings and discuss the policy implications sketched above. After the public defense of my PhD thesis, I also plan to submit an article to the Dutch journal *Nationale Veiligheid en Crisisbeheersing*. This magazine is widely read by civil servants and professionals working in the field of national safety, risk governance and crisis control.

Finally, I have disseminated my research through educational activities. I for example gave a guest-lecture on Engineering & Social Responsibility to students of the University of Hasselt (Belgium) and gave several lectures for the Bachelor of Arts and Culture, the research Master on European Studies and the Master in Public Policy and Human Development at Maastricht University.