



The Geological Storage of CO₂: **AND WHAT DO YOU THINK?**





Acknowledgments

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A detailed report of the research findings is available in the final ECO₂ report D6.3 "Identified public perception factors".

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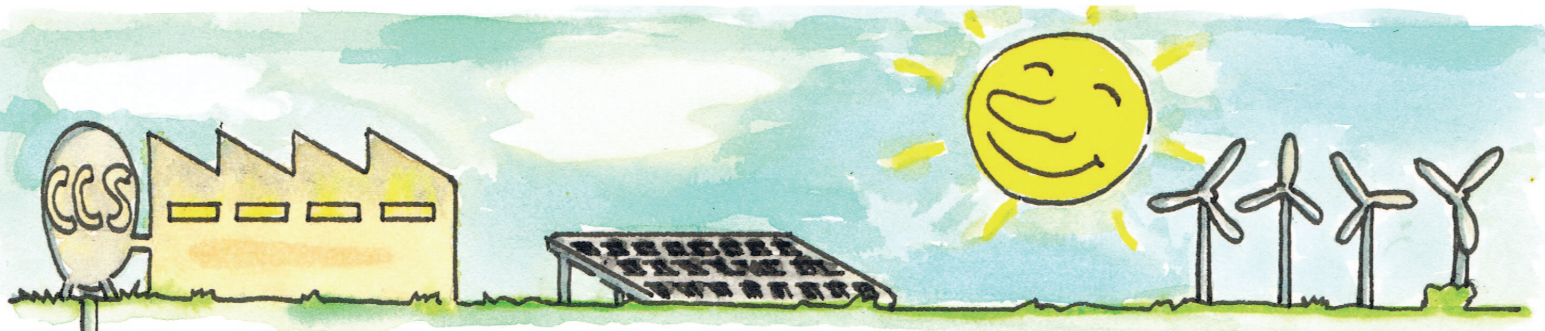
Studying the public perception of the geological storage of CO₂

An opportunity to make a connection between the daily issues which affect us directly, like health, work and money, and those that sometimes appear to be more distant, such as climate, energy and the environment.



We find ourselves within a complex situation where a seemingly small action, like turning on a light switch, can move great systems to bring energy to our disposal.

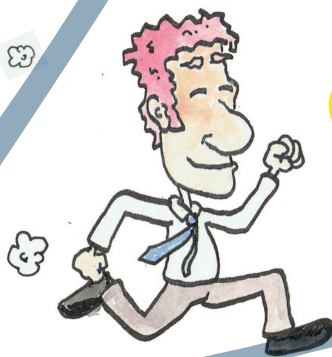
People are puzzled but also interested in this complexity, of which CCS is one element together with many others.



Where we started from

Carbon dioxide Capture and Storage (CCS) is a new important opportunity for reducing CO₂ emissions, however it is a technology which requires large investments and which has been developed mostly by researchers for the storage part and by industry for the capture part, with limited participation of civil society. After about 20 years of research and 15 years from the start of the first European storage experience (the Sleipner plant in the North Sea), researchers from the University of Rome "La Sapienza" and the University of Edinburgh have undertaken a new study, within the ECO₂ project, on the public perception of the geological storage of CO₂.

Previous research shows that the public is mostly unaware of the technology and its possible role for tackling climate change. With interviews and focus groups, new data have been produced within this project to better understand the challenges that the public meets when learning about the geological storage of CO₂ and the role that European-level authorities have given it, with regard to the future of the energy system, for achieving a low carbon society. Why is this? What is really underpinning the status of public perception of CCS in Europe and of the geological storage part in particular?



If CCS is to be deployed widely in a relatively short timeframe, is there potential for popular consensus regarding its implementation in Europe?

What we did

Social researchers participating in the ECO₂ project interacted with people through interviews as well as group meetings where it was possible for the participants to express themselves freely and for the researchers to explore the range of thoughts and feelings on the subject.

World views, emotions as well as rational reasonings about the proposed technology have been shared by the people participating. This brochure aims to illustrate, to a wide public, the interesting outcomes of such an exchange and to stimulate all stakeholders to pick up the questions and demands coming from civil society. Answering such issues is key to clarifying the role of CCS for our society and deciding whether it makes sense for society as a whole to go ahead with its implementation.

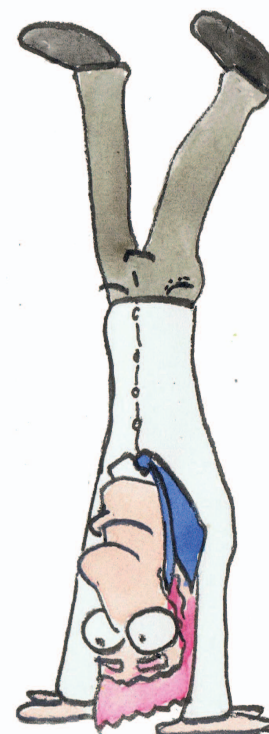
The methods used in ECO₂ to research the public perception of the geological storage of CO₂

Two research teams have collaborated to produce the results presented in this report, one from Italy and one from the United Kingdom. Their common goal was to explore the complexities of public perception of CCS that have emerged from previous studies, which indicated that in addition to considering the technology in itself, people were inclined to question all the different aspects related to it, from practical implementation to the values underpinning its selection.

Researchers carried out work to try to understand what was at the root of already well-known positions on the topic. How are common opinions on CCS being formed? Research settings were designed that would give people time to become familiar with the topic, look into its complexity and explore how they felt in relation to it.

This created a favourable space to reflect and see where uncertainty lies and what issues need to be addressed to make progress with exchange on CCS at the societal level. This was a creative approach, both in preparing ad hoc protocols (merging different methodologies ranging from psychoanalysis to ethnography) and in the process development.

Step by step decisions were made on how to progress interaction with the public, based on input received from the participants. Having recognised the need for exploration and reflection, the methods were designed to help understand impressions and judgements which, if unexplored, could easily block progress in societal dialogue on the technology.



'Life-world' perspectives



Observation

People start thinking and learning about CCS from many different points.



Comment

Establishing the current position of people in their world (the 'life-world' position), and building the discussion/knowledge sharing process in a direction which is respectful of that position, allows participants to feel engaged in an issue. A significant level of control by the participants in shaping the process helps researchers to understand how people feel in relation to other elements of the context to which CCS belongs, for instance energy production methods (such as renewable energy technology and nuclear energy generation).



Suggestion

Engagement activities can become much more interesting for the participants when they start from people's life-world positions. Effective approaches may include Citizen Panel processes, focus groups and free association interviews.

Free association interview

It differs from more traditional interview schemes because, apart from the initial question, it does not prompt the interviewee's expression in any way.

There is complete freedom for the interviewee to illustrate his/her own thinking and to explore in-depth reasons for their opinions.

This not only allows for new insights during interviews, but also produces rich material that can be studied at different levels, to understand emotional, cultural and cognitive aspects.



Who are the people that contributed to the research?

People from a variety of backgrounds have participated in the research. Individuals that were interviewed already had some knowledge about the geological storage of CO₂ and in the UK some of them were working in related sectors. Participants to the group meetings were mostly unaware of the technology prior to being involved in the ECO₂ research activities.

Long term group meetings

They create a time and space for social exchange and deliberation on the proposed technical topic and how it is, or can be, a part of people's life-world. Group meetings can be organised in many ways. The groups organised within the ECO2 project were characterised by long term involvement, to allow sufficiently in-depth exchange and sharing of the discussion process, based on input from the participants.

// *I find an exchange of this type to be useful and informative. It allows for a comparison with the community, it can help grow an understanding and knowledge on a certain issue. It gives the possibility to develop an analytical ability that would be useful when someone asks you to vote in a referendum or to demonstrate in the streets against a certain type of technology...* //

(Francesca, Italy)



The following introduces some of our key research findings and the solutions or recommendations that we have considered.



Topic

Most people don't know what CO₂ geological storage is.



Issues

When people learn about the existence of CCS, there is curiosity and interest for existing CCS projects all over the world. Items like learning about the technology through existing experience, knowing how other people dealt with it and its implementation, whether it worked, who is interested and/or investing in it, and what is the status of the technical development, are some of the curiosities that existing projects could satisfy...



Suggestion

It would be beneficial for CCS communication if the experience from pilot or demo projects was widely known.



Knowledge and awareness of the issues related to CO₂ emissions should not be taken for granted: the topic is often in the news but little known. Through social situations, like for instance the group meetings organised in the ECO₂ project, people can more easily develop an interest, which could also help them more easily relate to possible solutions, including CCS.

Why is the technology so unknown?



Topic

People are surprised at the low level of communication to the public about the technology.



Issues

Why is the technology so little known, why is it not discussed in the public domain? Why is it not covered by the media more? If the role that it can play is so relevant, it is surprising there is no outreach. If CCS is to be deployed, public information campaigns are necessary, as is the introduction of concepts related to the need for CCS to the younger generations in schools. Having been involved in the research, people themselves develop motivation to discuss the topic with family, colleagues and friends. People need to be aware of the technology if CCS is to make a difference.



Question

Which stakeholders are interested in communicating with the public about CCS?



You can see it on You Tube - CCS a Bridging Technology for the Energy of the Future

“CCS a Bridging Technology for the Energy of the Future”

Based on the insights gained during the exchange with the citizens who participated in the ECO₂ research, we have developed a short film to introduce the concept of the geological storage of CO₂. It tells the story of two young people who realise that even simple acts we do every day require energy. Like many others in the world, they would like to find ways to produce energy for all without polluting the environment.

From climate change to daily life

People understandably struggle to imagine how the storage of CO₂ could have an impact on their own life, how the general problem that has led to the development of CCS and CCS itself relate to their daily activities. How do the local and the general context interact?



"I don't know if I can speak for everyone but to be honest, it seems difficult to explain to the man on the street what this technology really is, what's it for and where will it bring us. Whereas with the windmills you see the blades turning and think that that's where the electricity comes from, and with the sun it heats the panel, to store gas underground what's the point of that, why do it and where will it bring us?"

(Giovanna, Italy)

Tangibility and agency

Topic

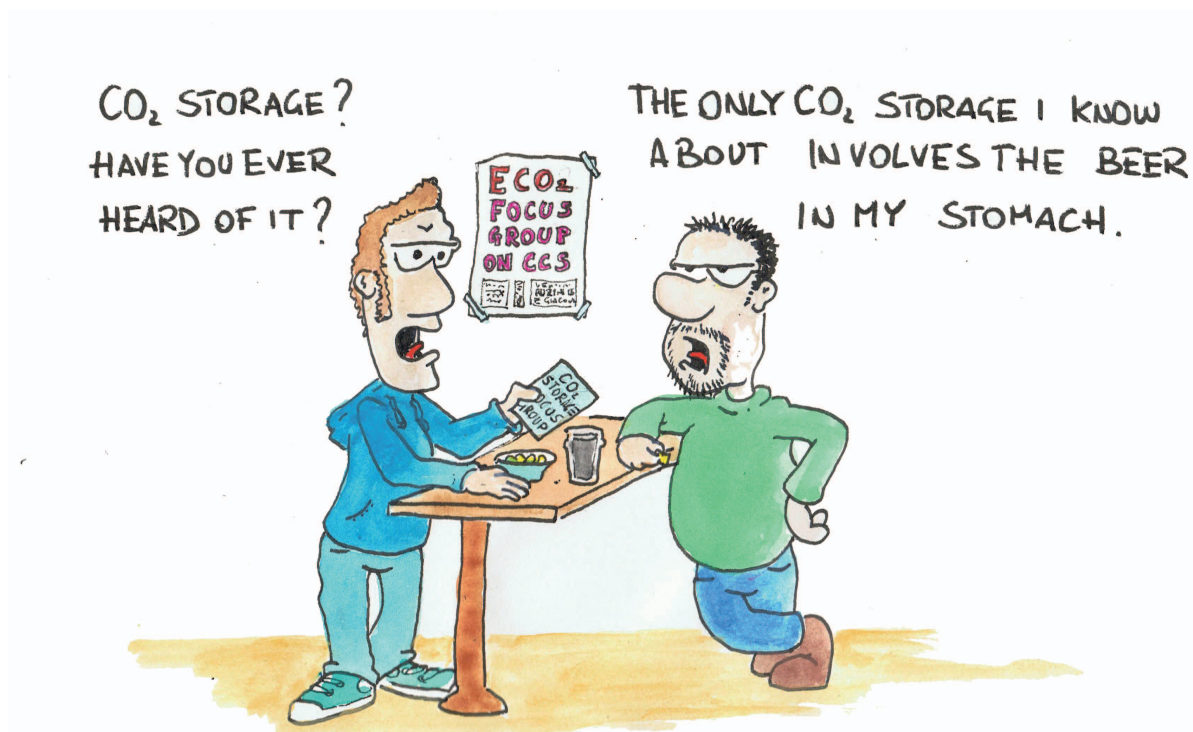
It is difficult for people to engage with something which is intangible, or which they feel does not affect them directly and they do not affect themselves.

Issues

While renewable energy technologies such as wind turbines and solar panels are familiar to people, and can even be installed and managed by individuals or communities, CCS technology is large in scale (space and time), highly technical and the geological storage, happening underground, can be perceived of as being obscure. This makes it difficult for people to visualise how it will affect them, how they can affect CCS, and what role it can play in climate and energy issues. People have other issues to deal with, which are much more immediate and which affect them directly (e.g. income, work, health); it is difficult to prioritise something which in comparison appears to be quite remote.

Suggestion

People need to have a clearer stake to engage with CCS: how is it going to improve their life? How can they influence decisions about it? Stakeholders need to help people understand how CCS fits into their lives.



From the big picture to everyday life

Connecting the topic with something that one feels is near, something that one can act upon, makes it more interesting and relevant and thus it is easier to make the effort to get to know about it.

Being able to “see” it coming true



Topic

How is it going to roll out?



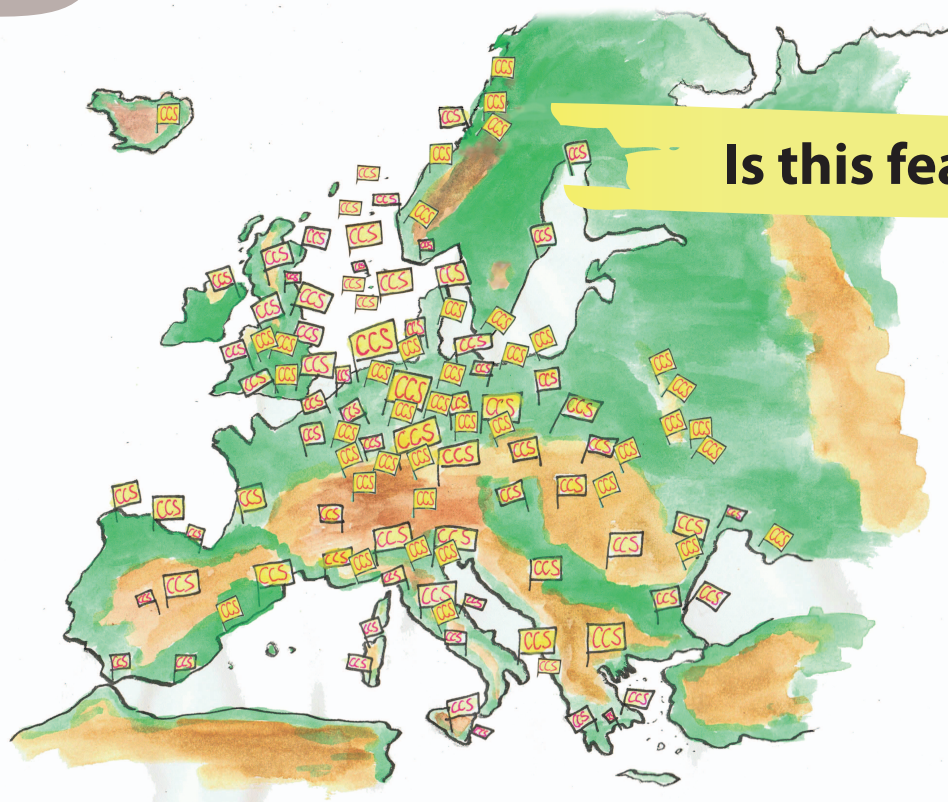
Issues

People find it challenging to imagine how a diffuse application of CCS could come about. At the moment only a few sites are in operation in the world. How are we going to fill the gap, to capture, transport and store the CO₂ coming out from thousands of power plants and industries? Who is really moving in that direction and how? How long can it take? Are transport networks for CO₂ available? Can we count on world cooperation, assuming that the whole operation makes sense only if implemented worldwide?



Suggestion

People try to imagine the future, how CCS could happen and in this effort they need science and policy to address still unanswered questions and provide solid foundations for present plans, thus motivating collaboration from civil society for the implementation of European roadmaps.



Is this feasible?

Living near a storage site

Participative decision-making processes are an important way of improving the feasibility of CCS projects. When the technology is presented as having already been decided, it is more likely that the Nimby ('not in my back yard') syndrome will appear, people immediately identify with the ones who might “have” to host it.

Understanding the big picture

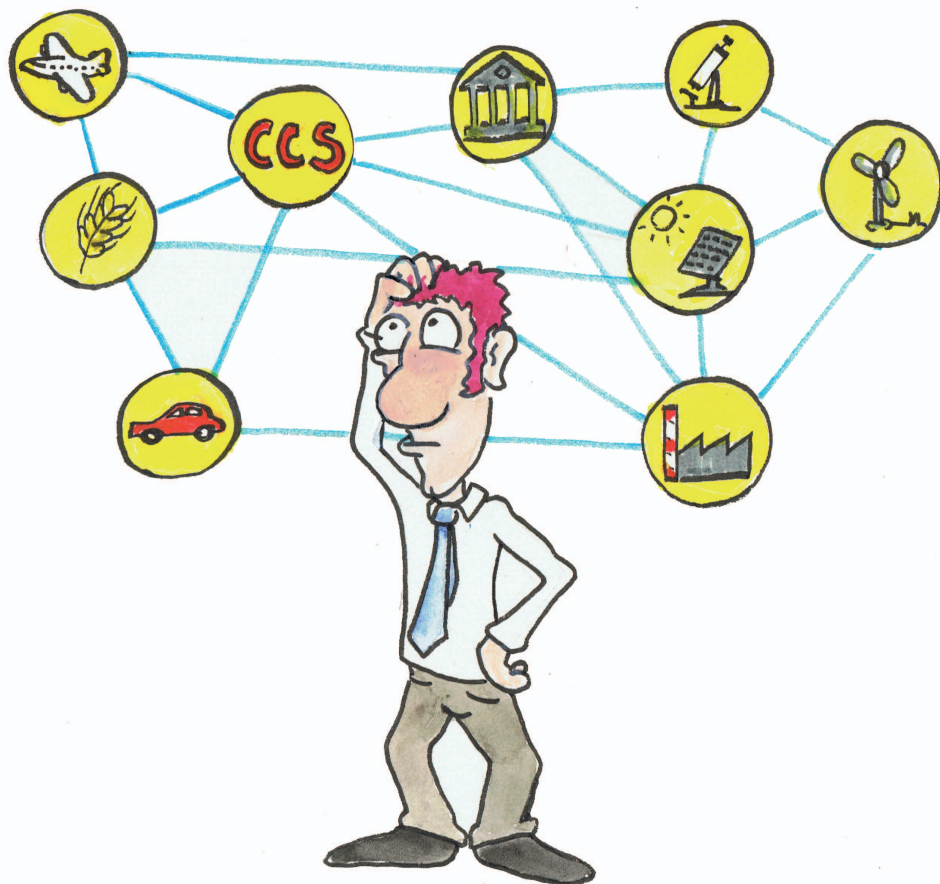
Topic
Why CCS?

Issues

There is a strong need to understand the role of CCS in the big picture, through a more satisfactory input from policy makers and technical stakeholders about the opportunities that CCS offers. While the need for other technological options, such as renewables, is recognised by all, it is unclear whether CCS is really necessary. The technology may be fine, but due to the need for large-scale, widespread application and large investments, does it really make sense to go ahead with its implementation? It is difficult for people to find an answer on their own, particularly with regard to important questions about costs, timelines, the level of world cooperation, and the implications for implementation and safety at the local level. These are questions that single experts themselves find difficult to address, due to the many implications and also the inevitable uncertainties related to the introduction of a large scale technological innovation. A global cooperation is required for understanding the potential of this technology for the future of our society.

Suggestion

Politicians could play an important role in supporting societal collaborative processes, including participation of the lay public, for developing a common understanding of CCS and more clarity on its potential contribution to our future.



CCS and Renewables



Topic

What kind of relationship exists between CCS and renewables?



Issues

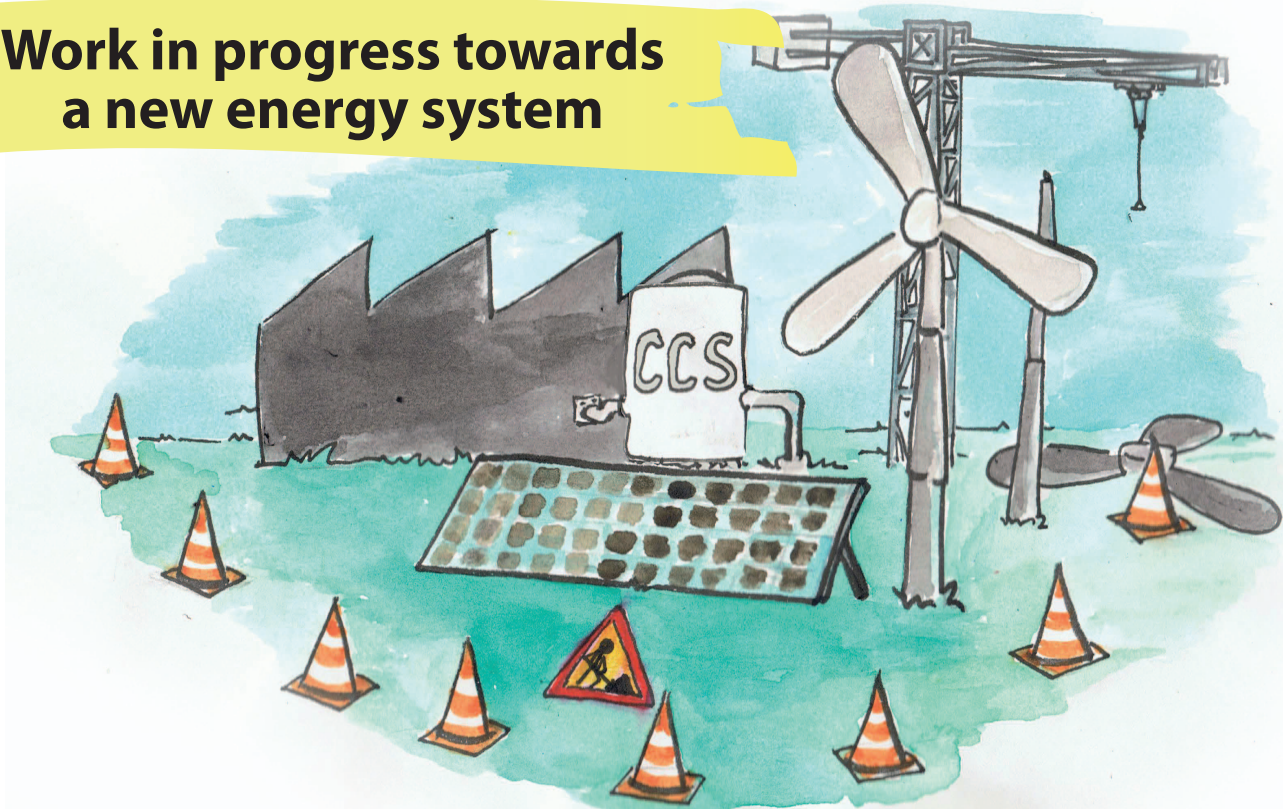
It seems obvious to everyone that investments should focus on renewables. Not only are they low carbon but, for most, they also have a very positive image and promising development for the future. CCS, instead, is “only” a bridging technology, something which should help us reach a new energy system, which does not produce CO₂ emissions anymore. But is CCS really necessary? Could we do things differently? People feel quite strongly about the risk of diverting resources from the ultimate goal of fully low-carbon energy, therefore they need a clear demonstration that investing in CCS will make a real contribution towards this goal.



Suggestion

People would like to have the opportunity to better understand how CCS will contribute to a low carbon society with respect to the development of renewables.

Work in progress towards a new energy system



// The idea is good but the two technologies of CCS and renewables should progress together, in the sense that eliminating the CO₂ is important but also finding other solutions wouldn't be a bad idea. //

(Anna, Italy)

Topic

Difficulties in understanding costs.

Issues

Evaluating the real costs of CCS (for the individual plants and sites as well as for global implementation) is particularly difficult in the present phase, when upscaling is needed to understand how to reduce costs and enable the transition of the technology from the experimental to the commercial stage. This creates a lot of uncertainty among the public and makes it all the more difficult to imagine how an extensive application of CCS could take place, in the absence of a sufficiently clear framework for profit. Many questions arise with regards to the costs for demonstration, costs for diffuse implementation and who is going to support such costs. The reliability of present cost calculations is challenged: more easily accessible information would be needed that demonstrates there is a solid base for the projections of future scenarios. Since costs are so uncertain, how have technical experts and policy makers come to the conclusion that CCS should be an important component of the European roadmap towards a low carbon society? Have the costs of not doing it been considered?

Recommendation

A better understanding of costs would be key to make the discussion about CCS more realistic.



Long term issues

Topic

Looking into the future: long term issues.

Issues

The geological storage of CO₂ stretches well into the future, for hundreds and thousands of years. This is seen as an advantage, since it gives us the possibility to remove CO₂ from the atmosphere for a very long time, but also as a risk, since it is difficult to know what will happen and how future generations will cope with such an heritage. On one side CCS is seen as something that should be urgently implemented to protect future generations from climate change. On the other, there is concern about the fate of the storage sites in the long term future. People are uncertain about our capacity to monitor storage sites and keep them under control over the long term.

Question

How do we bring together the need of long term solutions with our necessarily limited short term perspective...?



// Storage: the idea on its own seems interesting, however what you first need to understand is the technology. Second, even understanding the technology in a way that is sufficiently adequate and comprehensive, doubts remain in the mind of the man on the street that are linked to, to the underlying philosophy, to the philosophy that's behind this storage. //

(Raffaele, Italy)

Control of operations

Topic

How can people trust that storage operations will be conducted in the correct way?

Issues

The technology in itself does not raise particular concern, what is really worrying to people is how it might be implemented, following whose interests, allowing for which speculations? People don't feel they are in control and don't know how to overcome a pervading and widespread lack of trust. It would be necessary to develop appropriate mechanisms for effective control of CCS developments. In this way people could begin to trust operators and the authorities to act coherently in the public interest. At the moment it is also difficult for people to imagine what kind of mechanism could be put in place to ensure reliability. This uncertainty, if not properly addressed, could easily translate in an important showstopper for the technology.

Suggestion

Spaces and opportunities for interaction between citizens, the authorities and operators in charge of the development of CCS projects would be necessary to overcome diffidence by working jointly for finding transparent and reliable control mechanisms.



// It's a pity that I know so little, because like everyone who knows little, it's all a bit scary. In fact I stopped reading about the impacts on humans. No, because, it all seems like a fairy tale, where's the trick? At this point we are used to thinking this. It's a pity that we know so little! //

(Emilio, Italy)

A temporary solution

Topic

CCS is seen as a temporary solution, it doesn't have the sensation of something which really solves the problem.

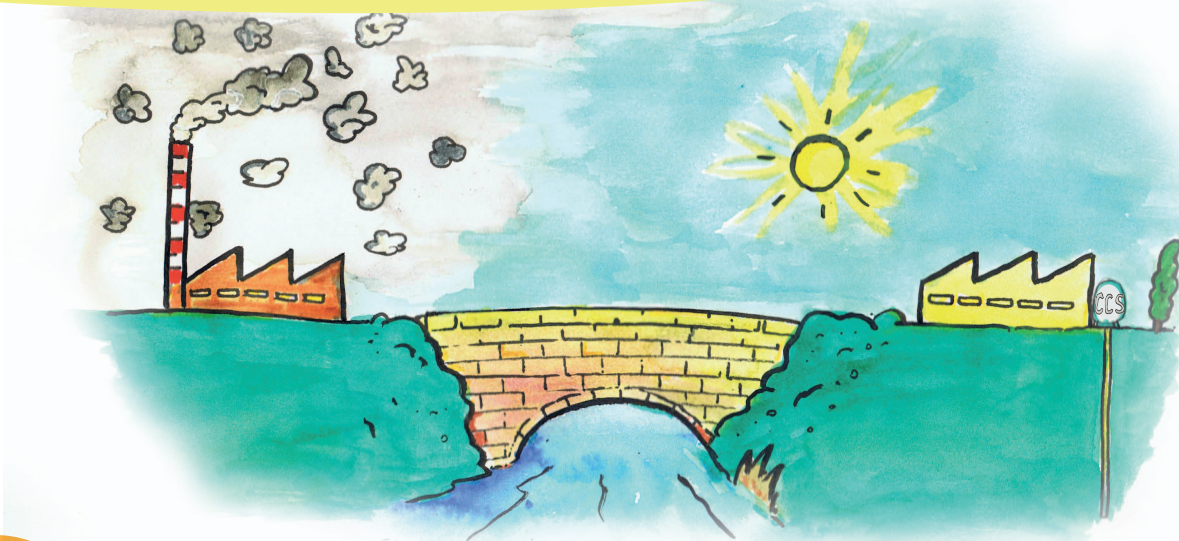
Issues

It might be ok to use CCS as a bridge towards a low carbon society, to avoid or limit the impact of climate change, but it does not satisfy the expectations for a radical change and solution. Some people consider that the CO₂ will eventually escape the reservoir in the distant future, and in any case the power plants or factories emitting huge amounts of CO₂ will eventually have to come to an end anyway. Is it worthwhile to spend large amounts of money for a technology that, on one side, appears to be only a temporary solution and, on the other, runs the risk of making what should be a temporary use of fossil fuels a continuation of "business as usual"? Is it really going to bridge us to a different system or is it only prolonging the life of the present one?

Suggestion

People need to participate in the processes that bring about solutions. Creating spaces and occasions where this can happen could help us understand if, however temporary, CCS can really be considered a solution.

**Is CCS a bridge towards a new energy system
or is it just an idea of how the future could look
like with a less polluting energy system?**



I like the story of the bridge, that it's not a thing that resolves, also because clearly capping, blocking this environmental disaster that we're causing for too long... while we seriously study energy solutions that are less polluting under all points of view... seen in this light as a passageway towards something that we hope can be more long-lasting and above all less impact for all, less polluting, less damaging, less negative, under all points of view.... This is the idea that had the greatest effect on me.

(Barbara, Italy)

Feeling caught in a dilemma

Topic

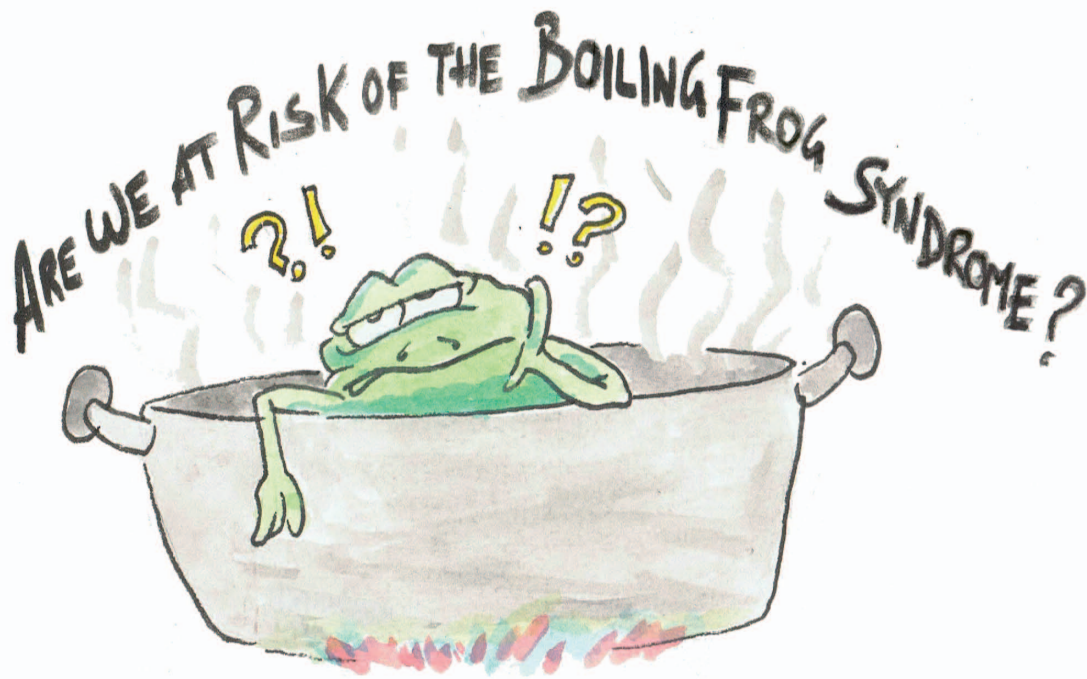
To be or not to be...feeling caught in a dilemma.

Issues

People on one side feel the pressure, the urgency, emissions are to be reduced, CCS is really urgent and necessary, it is something that should be done immediately, without wasting any more time. On the other side they feel uncertain, perhaps something else could be done, they try to think of other solutions, hoping that CCS may not really be necessary...Feeling under pressure doesn't help, is not the best condition for reasoning, something must be done, but what? There are insufficient opportunities to share about these problems, to elaborate and dialogue at the societal level. The urgency of change and the absence of spaces to reflect together on how to lead change in the desired direction makes people think that perhaps some better solution could be available...thus running the risk of not implementing technologies which could be essential to avoid disasters.

Suggestion

What is really urgent is creating and enhancing opportunities for people to discuss these issues in calm and reflexive settings that allow appropriate consideration of all options and in-depth dialogue between the public, policy makers and industrial operators. This could help to more proficiently address the pressing need of a more environmentally sustainable energy system without being misled by feelings of anxiety.



Do we need to act with urgency or do we keep looking for other solutions?

Forming judgements



Topic

People react to questions about CCS with emotional and/or rational evaluation.



Issues

The psychologist Daniel Kahnemann describes two different systems of thinking: 1) quick, emotional, automatic, and 2) slow, rational, evaluating. Thinking according to these different systems can affect the judgements we make about CCS, depending on which one is dominant at the moment of developing perception. This can be influenced by many factors, such as for instance the way CCS is presented, the situation and the personal preferences towards one system or the other. When people are given the opportunity to shape the learning process and be listened to, this encourages them to make use of both thinking systems.



Suggestion

Stakeholders that use public engagement approaches which allow people to shape the learning process and be listened to, enhance the probability that people will use a thoughtful and reflective approach in their evaluation of the technology.



Different thinking systems at work on CCS

As an example of the way different situations can influence our thinking systems, we have observed that in long one-to-one interviews, some people switched from using system 1, to system 2, during the interview and usually gave their concluding judgement based on both. Participants in these cases gave a quick answer to the question, then during the interview reflected on the question more deeply, and sometimes came to different conclusions by the end.

When asked what they think of CCS and after some deliberation:



"(System 1) That it's a good thing! Because I think there is an end goal, particularly in Scotland and the western world of trying to move to renewables, but that's not going to happen any time soon... and to be able to do that in my opinion, in the relatively short term CCS is the only opportunity because we have the infrastructure and capability, technology and some of the knowledge to be able to do that..... (System 2) It's feasible, but with the main problem is it is, is cost, because it's first and f-, kind of an industry in its infancy, everything at the beginning costs more and that's where that, the, not the problem but the difficulty, the hurdle to overcome is, otherwise industry would be doing it anyway"
(Leslie, UK)

"(System 1) The assumption at the moment, is that the activities would be very similar to those of the oil and gas industry..... (System 2) it's not clear to me whether you would use, whether they would use existing wellheads or whether they'd have to drill new holes, it's not clear to me whether more seismic surveys would be required but that seems very likely, and it's not clear to me what the risks would be of seepage of whatever it is, and I don't even know what would be, what would be buried under marine strata, what the risks might be of seepage of that, presumably it's some sort of carbon product, some carbon locked into something, I don't know whether it's carbon dioxide or whatever it is."
(Malcolm, UK)



Through our work with the free association interviews, we have identified themes, questions and emotional areas relevant to this topic that people feel and consider when formulating their thoughts on the geological storage of CO₂.

A need for leadership

Topic

People need leadership in order for them to feel like CCS is something worth thinking about.

Issues

There was a feeling amongst some members of the public, stakeholders and industrial experts which took part in our study, that more needs to be done by politicians to support and promote CCS. People need to see support from politicians or other community leaders on topics which are distant to them, so that they know whether it is something which is worth consideration. However, politicians choose their campaigns based on public interests and so it is also the case that the public could provide stronger 'leadership' or interest regarding CCS to show politicians that it is something worth implementing. Additionally, if CCS does not have political support, individual developers and industries will not take the risk of implementing it, and thus the public will remain unaware of CCS and of the role it can play.

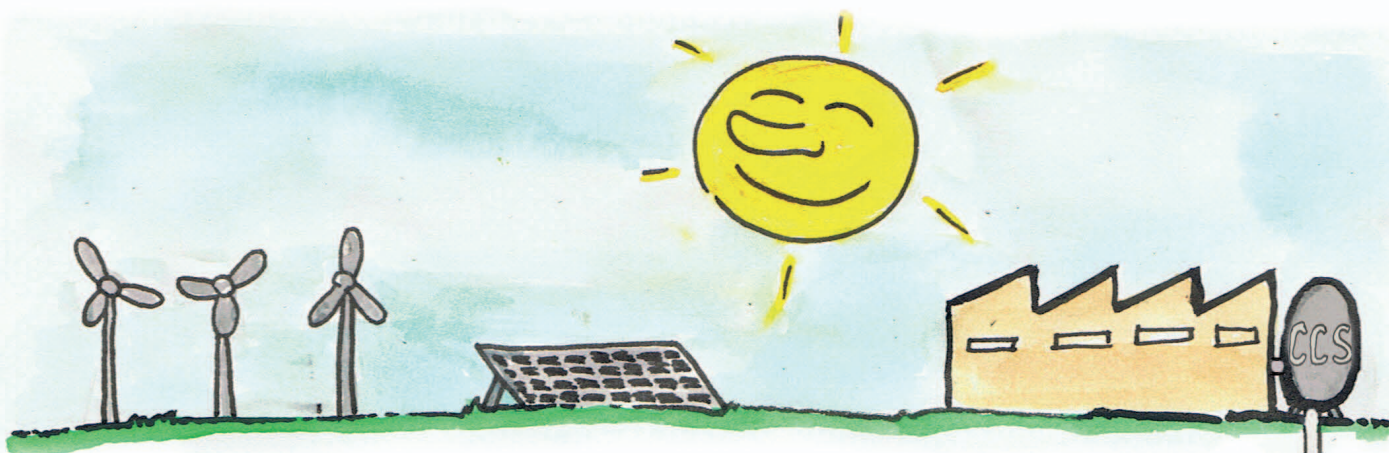
Suggestion

Political parties need to decide upon and communicate their stance on CCS.



// I think the politicians need a lot of leadership from us, so that they have the permission to say. look actually this is a problem, we need to do it, but the problem is it's a bit of chicken and egg thing, we also need the politicians start being a bit braver, so we need to do stuff to make politicians say things they normally can't, but we also need them to be a little bit braver and start saying things. //

(John, UK)



Where are we now?

The people we have met during the four years of the ECO₂ research work have helped us explore the many different facets of CO₂ Geological Storage public perception. When people think about CCS they don't consider technical aspects alone. Relating to their values and life experiences they test the idea of the technology and its many different implications in the short and in the long term. Most of the time they find it challenging to assign CCS a place in the present and future energy scenarios. The role CCS can play is still unclear to the public.

People would like to better understand:

The compatibility of CCS with the development of renewables

The real costs and who is going to pay for them

The implementation timeline (including transport and pipeline networks)

Means of verification of correct operation, site management and closure

Long term demonstration, liability and management

Answering these complex questions requires a high level of collaboration from many sectors of society. The further development and application of societal processes and tools that can support joint engagement of the public, the authorities and technical stakeholders, could probably be key to achieve more clarity about the CCS option, dealing in a proficient way with the uncertainties.

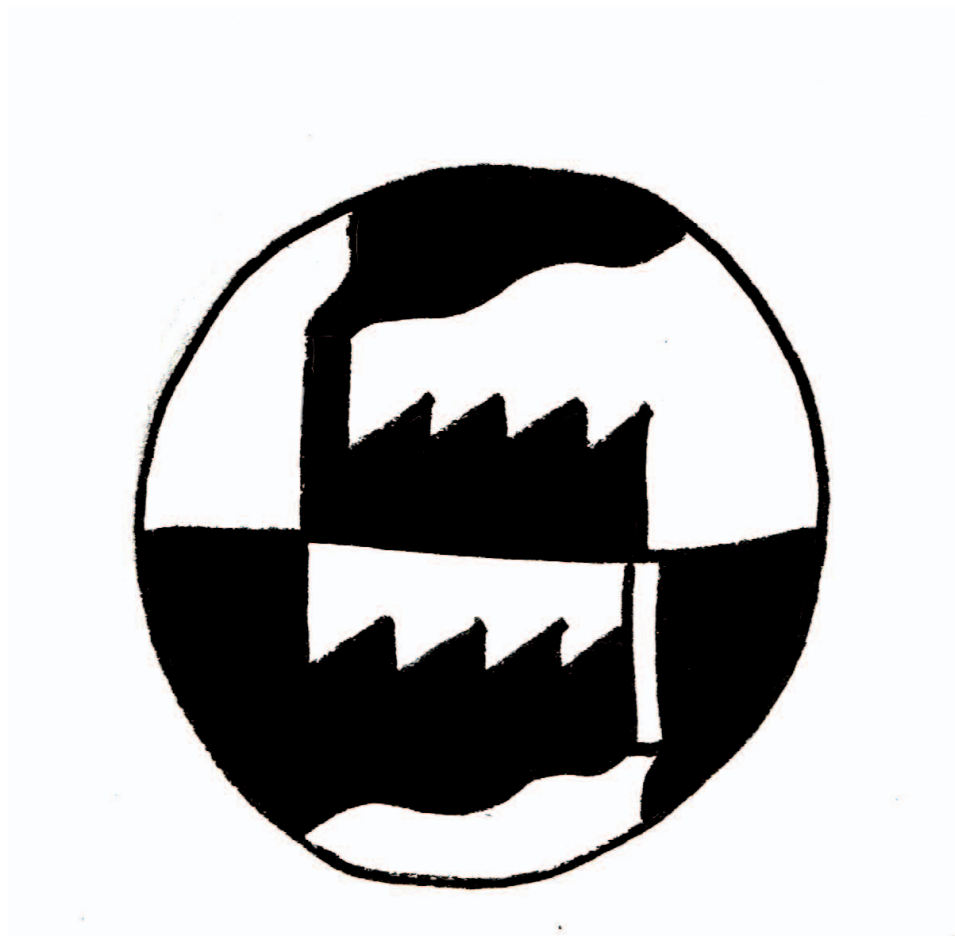
People are interested to know how CCS is going to impact their own backyard and how national and world developments interact with their local reality.



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ECO₂
Sub-seabed CO₂ Storage:
Impact on Marine Ecosystems