

Summary of the interviews with Icelandic stakeholders concerning **DACCS & CCTS**

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Project

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1 Introduction

This document summarizes the findings from interviews with Icelandic stakeholders conducted by Risiko-Dialog for the research project Carbon Dioxide Removal Options: Policies and Ethics (CDR-PoEt), as part of their deliverable for the case study on “Direct Air Carbon Capture and Storage” (DACCS) in work package 5 lead by Perspectives Climate Research.

2 Data and Methods

From June 2022 to April 2023, we conducted semi-structured interviews with persons from 10 different Icelandic organizations. Interviewees included administration (N=4), environmental NGOs and activists (N=4), industry and business (N=4) and academia (N=2).

Certain interviewees were at the time of the interview members or vice-members of the Icelandic Climate Council (Loftslagsráð¹). The Icelandic Climate Council is an independent body whose role is to hold authorities accountable and provide advice on policy objectives and specific measures related to climate change. Their members are proposed by a variety of organizations, representing the business community, academia, municipalities, the labor movement, and environmental NGOs.

Neither did we interview any representatives from politics or currently active members of the government level, nor local citizens.

The interview questions were adapted once between 2022 and 2023. Both versions are attached in the appendix below.

The interviews were protocolled and analyzed in a qualitative matter, with a focus on recurring statements, with regard to framing and mental models of the Carbon Dioxide Removal (CDR) methods discussed, concerns, and perspectives on a potential scale-up of Direct Air Carbon Capture and Storage (DACCS) and the storage of imported CO₂ from point sources in Europe (fossil or biogenic Carbon Capture, Transport and Storage, CCTS).

3 Results and Discussion

Stakeholder perspectives are summarized for the following subthemes:

1. Climate mitigation in Iceland
2. Direct Air Carbon Capture and Storage (DACCS)
3. Landscape and energy – two interconnected acceptance factors
4. Cross-border CO₂ import for storage in Iceland (Carbon Capture, Transport and Storage, CCTS)
5. Cross-cutting themes
6. Learnings from Iceland for other countries

¹ <https://www.loftslagsrad.is/english/members/>

3.1 Climate change mitigation in Iceland

The following statement from the Icelandic government has been echoed by many interviewees:

"Iceland aims to achieve carbon neutrality before 2040 and to cut greenhouse gas emissions by 40% by 2030 under the Paris Agreement. [...]"

Iceland's emissions profile is in many ways unusual. Almost all heating and electricity generation is provided for by renewables – hydro and geothermal energy. Iceland has great potential for carbon uptake from the atmosphere by afforestation and revegetation, and to curb emissions from soils by reclaiming drained wetlands. The biggest sources of emissions (outside land use) are industrial processes, road transport, agriculture, fisheries and waste management."²

Among these emission sources, the decarbonization of road traffic (especially for tourism) and the fishery sector were mentioned as pressing issues requiring electrification and thus potentially an increase in renewable energy production. This was sometimes mentioned as a potential trade-off with the energy demand of large-scale DAC (see below).

As for industrial processes, the aluminum smelters were frequently mentioned as major point sources of CO₂ for both their high energy demand and as a sector requiring stronger regulation regarding emissions (e.g., making CCS mandatory).

Carbon capture features twice among the 48 proposed actions in the government's Climate Action Plan³ from 2020:

- Carbon capture from geothermal energy plants is an action already partly implemented.
- Carbon capture from heavy industry is mentioned as a possible action to reduce emissions in connection with EU-ETS.

The fact that DACCS is not mentioned in the plan nor featured on the government website on climate change mirrors the statement by interviewees that the government has not yet developed a definite position on the role of this method in Iceland (as of July 2023).

3.2 Direct Air Carbon Capture and Storage (DACCS)

Both the existing pilot project ORCA and a potential scale-up of DACCS in Iceland were discussed in the interviews.

All interviewees had at least heard ORCA before the interviews and generally perceived the pilot project neutral to positive. The overall landscape of opinions on DACCS is more differentiated. Most interviewees agreed that DACCS can contribute to climate mitigation, as long as it is not used as a substitute for emission reduction (mitigation deterrence). While most interviewees also mentioned risks and concerns, they also all highlight the fact that the technology is still in its pioneer phase with lots of learning processes and potential increase in efficiency ahead. Some interviewees didn't consider DAC as a mature technology with relevant CDR potential (yet), but still welcomed the pilot as innovation in progress – maybe on the path to develop more energy and cost-efficient CDR methods for the future.

² <https://www.government.is/topics/environment-climate-and-nature-protection/climate-change/>, last accessed 4 Jul 2023.

³ <https://www.government.is/library/01-Ministries/Ministry-for-The-Environment/201004%20Umhverfisraduneytid%20Adgerdaaetlun%20EN%20V2.pdf>, last accessed 4 Jul 2023.

The energy demand and landscape footprint as two critical factors for the feasibility and desirability of DACCS were mentioned by almost all stakeholders (see Subsection 3 below).

High financial **costs** of DACCS were mentioned as inhibiting factor but not as a major concern as stakeholders expect demand for CDR to rise. Yet, further increase in energy and cost efficiency are seen as integral part of a potential scale-up pathway.

Regarding **local acceptance**, the risk of NIMBY (“not in my backyard”)-related opposition to concrete sites was mentioned, but rather abstractly with reference to aesthetics/landscape protection and induced seismicity. The question of (lacking) benefits for the local population was also raised as a potential acceptance factor: There are not many local jobs attached to a DACCS site. Regarding induced seismicity, there were no strong concerns among those interviewed. Especially, it was mentioned that this should not be a major issue if DACCS plants are located at geothermal power plants where drilling and underground monitoring has already been taking place. However, some interviewees cautioned that seismic activities around carbon storage sites or exploration of new DAC and storage sites always come at the risk of NIMBY.

3.3 Landscape and energy – two interconnected acceptance factors

“Icelandic people do not give up land easily.”

This quote from one interview refers to Iceland’s long history of societal discussions and conflicts around energy production infrastructure (especially hydropower plants) and energy consuming industries (especially the aluminum smelters). Convincing people to give up land either for both energy and CO₂-related infrastructure of any kind could be one of the biggest challenges around gaining and keeping public support, according to most interview partners.

Concerning a potential scale-up of DACCS in Iceland, all interview partners agree that special attention will have to go into a **landscape** friendly design and location of further plants. The “look”, the integration into the local landscapes and the locations of further DACCS plants are expected to be key acceptance factors. The location of the ORCA pilot plant was broadly considered to be well chosen, since it is pretty much out of view and at an already developed industrial area with a pre-existing geothermal power plant. Interviewees disagreed on whether they liked the particular design of the ORCA DAC-plant or not.

To the same effect, all interview partners identified the high **demand for renewable energy** of DAC as a key systemic challenge. The energy demand should always be considered when discussing further steps, especially in combination with current and past national climate strategy decisions and the upcoming energy transition (e.g., electrification of mobility, especially cars and fishing vessels). Several stakeholders mentioned that a scale-up of DACCS on Iceland should be embedded in the Icelandic (and EU) climate strategy. Concerns related foremost to the high energy demand of DAC in the context of the energy transition (at national level) and the discussion around the expansion of power plants (hydro, geothermal energy) and their impact on landscape and water body protection. The construction of new energy infrastructure is expected to meet opposition.

The NGO and administrative representatives emphasized the issue of trade-offs and competition regarding the demand for renewable energy in the context of climate change mitigation, specifically for DAC. One stakeholder emphasized that the “climate crisis is an energy crisis”. From this perspective, solutions to the climate crisis requiring a lot of energy are

counter intuitive. As long as the electrification of the mobility sector and accompanying transitions in the energy systems has not been achieved in Iceland, any scale-up of energy intensive industry (incl. DAC) might be hard to achieve.

However, not all interviewees agreed on the implication of the high energy demand of DAC for a future up-scale. For some, the high energy use of DAC could also be seen as an opportunity if it leads to a further diversification of the energy demand side in Iceland. Currently, there are only few large industrial energy customers in Iceland, most prominently the four large aluminum smelters. It was explicitly mentioned that despite its high energy use, DAC is still more energy- and sustainability-friendly than other industries.

3.4 Cross-border import of CO₂ for storage in Iceland (CCTS)

CCTS is often discussed with reference to local CCS. Local CCS is perceived positively also from the NGO perspective, mostly even more positive than DACCS or CCTS. It is also part of the government's climate action plan (see above). Reasons mentioned are that the existing CCS in Iceland is seen as a pragmatic solution with co-benefits. For example, the CCS installation at a geothermal power plant has increased the local air quality as at the same time, other air pollutants are filtered from the flue gas. One stakeholder explicitly advocated for forcing the Icelandic aluminum industry to do CCS as soon as possible.

The Coda terminal⁴ is a cross-border carbon transport and storage hub in Iceland that is planned to enter commercial operation by 2026. The communication on the project is picking up as we write, and so has the public debate been slowly picking up since 2022.

Still, CCTS is a relative new topic for most stakeholders. In the interviews we found mixed opinions on CCTS across interviewees stakeholder groups (industry, NGO, research). Many interviewees mentioned the rather confusing/paradox idea of importing CO₂ and transporting CO₂ over hundreds to thousands of kilometers before storage. Some interviewees thought that the acceptance of CCTS will mostly be a "technical" question regarding the carbon footprint of transportation and whether it "makes sense" to transport CO₂ over thousands of kilometers instead of exploring storage opportunities closer to the source. In this context, stakeholders mentioned that they would like to see thorough life cycle assessments (LCAs) / environmental assessments to show the net climate impact and any adverse environmental side effects of cross-border CCTS. Interviewees more favorable of CCTS mainly considered the acceptance mainly as a matter of communication and framing (see further below).

Landscape protection was raised as a potentially critical acceptance factor for CCTS infrastructure. CCTS infrastructure is seen as potentially harmful to landscape and nature by some. Other concerns that were mentioned are the discomfort with potential induced seismicity close to Reykjavík and the water usage of the CO₂ storage. However, the hope was mentioned that it will be possible to dissolve the CO₂ in sea water instead of fresh water in the future. These concerns highlight the importance of careful stakeholder and citizen engagement around such projects, as well as a careful site selection, ideally in an excising industrial zone.

One discussion that could become decisive on the framing is on the "waste import narrative". This narrative frames CO₂ as waste and Iceland as potential waste bin for Europe. One framing from the NGO side was that Iceland should not start importing CO₂ from abroad "while we are not able to get rid of our own emissions", i.e., "clean our own house before taking in

⁴ <https://www.carbfix.com/codaterminal>, last accessed 4 Jul 2023.

trash from others". However, stakeholders were unsure how relevant the waste narrative will become compared to other discussions around potential framings for CCTS. Two alternative narratives were mentioned: CCTS as a business opportunity for Iceland; and CCTS as an example of international collaboration for cross-border climate mitigation.

Some stakeholders across sectors argue that instead of importing CO₂, Iceland as a pioneer should rather export the storage technology and its experience to other countries, i.e. closer to the emission sources. The reason given is that the storage knowledge already exists while the transportation to Iceland needs a lot of infrastructure.

3.5 Cross-cutting themes

Political questions regarding a potential scale-up of CDR in Iceland have still been in the open in Icelandic politics at the time of the interviews with CCTS projects on the horizon (CODA terminal).

One of the interviewees mentioned a growing divide within the sustainability and environmentalist sector in Iceland when it comes to a scale-up of DACCS and/or CCTS in Iceland. They worry about a polarization between nature conservationists and advocates of climate mitigation.

From a technical perspective, DACCS and CCTS do not seem mutually exclusive; both methods could be implemented in parallel – even sharing infrastructures and thus minimizing the combined impact on the landscape. Local acceptance issues related to landscape and NIMBY concerns are expected to only "get real" when projects at scale get tangible. An iterative and participative scale-up with more and more ambitious pilot projects was suggested to both mitigate financial and acceptance risks step by step.

There were two other opportunities for Iceland mentioned related to a scale-up of DACCS: getting a guiding role in front of the world, and evolving economic opportunities, i.e. making CO₂ storage a business case.

Some stakeholders argued that other promising CDR methods in Iceland should not be forgotten, including afforestation and the production of biochar from fish manure. Also, innovation with regards to what DAC can look like should not stop at the current design: One interviewee mentioned smart cities with decentralized DAC structures.

In general, the interviews showed how important a **just transition** and **trust** are, when it comes to the actors and organizations involved in the implementation of CDR methods. It can be easier for local companies to gain people's trust; for international companies acting in Iceland, it depends on their origin country's reputation whether they are trusted or not. In the cases discussed in the interviews, no specific concerns were mentioned.

3.6 Carbon accounting & funding mechanisms

When it comes to the accounting and funding of CDR "produced" in Iceland, most stakeholders were open to a variety of solutions. Increasing carbon prices and a carbon tax were mentioned as a potential game changer to finance the scale-up of CDR and incentivize emission reductions. To lower costs, one stakeholder suggested that the government should support CDR projects by guaranteed prices credit purchase.

Some interviewees stated that negative emissions stored in Iceland should always count towards the GHG balance of Iceland, while others think it should be regulated globally and traded on a global market. Two interviewees said that Paris Agreement Article 6 as a potential framework to fund CDR in Iceland has not yet been discussed widely within Iceland. However, most interviewees, outside science and industry, did not have strong opinions regarding carbon accounting and some mentioned, they had never thought about this.

In general, the interviewees agreed that for other countries to be able to account for negative emissions stored in Iceland, international regulations and frameworks should play a major role. This means that any “deals” should be embedded in international frameworks. To avoid green-washing and mitigation deterrence, a group of interviewees suggested that one should assess the emission reduction efforts and environmental impact of countries and companies who want to buy DACCS credits produced in Iceland. However, there was also wide agreement that Iceland should be able to make use of selling DACCS as a neutral service to other countries – if embedded in international laws and agreements. And, on the other hand, this would mean that the Icelandic government could then also “buy” negative emissions produced in Iceland to neutralize their own hard-to-abate emissions.

3.7 Learnings from Iceland for other countries

Interviewees saw potential for other countries to benefit from the pilot projects in Iceland regarding the following aspects:

- Technical expertise and geological storage method by Icelandic researchers and industry (e.g., Carbfix) for geological storage of CO₂.
- Pathway to implement DACCS and CCS independently from the fossil fuel industry.
- Relevance of pro-active stakeholder engagement to mitigate concerns towards geological storage.
- Climate mitigation and nature conservation need to go hand in hand.

At the same time, they cautioned the transferability of lessons from Iceland with reference to the uniqueness of the Icelandic context with regard to:

- Geology
- Renewable energy supply
- Island state with comparably small population size

4 Appendix

4.1 Glossary

CCS: Carbon Capture and Storage

CCTS: Carbon Capture Transport and Storage

CDR: Carbon Dioxide Removal

CDR-PoEt: Carbon Dioxide Removal Options: Policies and Ethics

DAC: Direct Air Capture

DACCS: Direct Air Carbon Capture and Storage

EU: European Union

ETS: Emission Trading System

NIMBY: Not In My Backyard

4.2 Interview Questions 2022

A. The interview partner

1. Name
2. Organization and Function
3. Contact info
 4. Contacted by whom and when

B. Backward looking – DACCS pilot plant Iceland

5. Tell me a little about you, your position. Are you aware of carbon dioxide removal, and particularly DACCS (Brief answer please, we will go into detail on specific points later)?
 - a. optional short input: CDR, DACCS, ORCA
6. On a scale from 1 to 10, how much do you support carbon dioxide removal as an approach to mitigate climate change? Please explain. (How do you feel about it?)
7. On a scale from 1 to 10, how much do you support direct air carbon capture and storage (DACCS) as an approach to mitigate climate change? Please explain. (How do you feel about it?)
 8. Which role do you see for DACCS for climate action compared to other approaches to mitigate climate change? (... e.g., compared to emission reduction, electrification, degrowth, etc.)
 - a. Do you use any analogies or a particular narrative when explaining DACCS to friends or foreigners?
 9. Is the topic DACCS relevant for you and your work?
 - a. In which aspects? Could you rate how relevant the following aspects are for you and your work?
Climate mitigation, Infrastructure, Geological storage of CO₂, Energy demand of direct air capture, Business opportunity, Publicity, International relations
10. How do you feel about having a DACCS project in the region on a scale from 1 (not excited at all) to 10 (enthusiastic)?
 - a. Give a short explanation of why you feel that way?
11. What do you know about the ORCA pilot plant in *Hellisheiði*?
 - a. How would you describe your level of knowledge regarding DACCS?
 - b. Do you see a risk in the pilot plant? What if others would operate it?
 - c. What brought you to the topic?
 - d. [For people involved with Orca/Carbfix/Regulation]:
What was your specific role in relation to the project? Why did you get involved in that role?
OR
[For others in the community: LOCAL COMMUNITY NGO's OTHERS ETC]
How and when did you first hear about the project? How did you get involved? Were you or your organization approached directly?
 - e. How did you experience these engagements?
12. Are you aware of any other energy or large infrastructure projects going on in the area or have been developed recently?
 - a. How do you feel about them?

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- b. How do you think the community feels about them? (e.g., within your organization / professional community / peer group / general public)
13. Did you talk to / engage with *others in your organization* / project partners / external actors / local communities related to ORCA? How did you experience these engagements?
14. What is your impression of how the general public perceives DACCS and the ORCA project?
- a. Who are opinion leaders and influencers?
 - b. Do you remember specific supportive or critical statements / media articles? (Please share exemplary news articles)
15. Which actors (including among public, private, and civil society orgs) will be important and influential in the potential scaling and long-term operation and support of DACCS in your view?

B. Forward looking: Scale-up of DACCS

16. What comes to your mind first when you think about developments and challenges in Iceland, with regard to energy, climate and industry, in the years to come?
17. What is your vision for the region and Iceland in 20 years (2042) with regard to climate and energy? If DACCS is mentioned, ask to expand, otherwise ask why DACCS was not mentioned.
18. Are you aware of any planned DACCS activities beyond the ORCA plant in Iceland?
- a. Which ones?
19. What do you think the DACCS landscape in Iceland could look like in 20 years? Do you like this vision?
- a. Why/why not?
20. Do you believe Iceland could play a particular role in global climate protection?
21. [We talked a lot about DACCS being built more and more on Iceland, larger capacities are needed to remove significant amounts of CO₂ from the atmosphere] Where do you see opposition, trade-offs, obstacles and limits for the scale-up of DACCS on Iceland?
- a. If funding and technical aspects are mentioned: Assuming these are solved, anything else?
22. Which risks do you see for a scale-up of DACCS on Iceland?
- a. For local communities, for the Icelandic population/economy? Globally?
23. Which benefits and opportunities do you see for a scale-up of DACCS on Iceland?
- a. For local communities, for the Icelandic population/economy? Globally?
24. DACCS is very energy intensive. Do you see any trade-offs or conflicts with regard to the Icelandic energy system when DACCS is scaled-up?
- a. For example when it comes to energy consumption?
 - b. the landscape
 - c. geological storage
25. How do you expect other citizens or interest groups to react to a scale-up?
- Fear of negative side effects, especially risk of earthquakes (negative experience with geothermal fluids pumped underground and resulting earthquakes in the past).
- a. Do you see a risk of "NIMBY" ("not in my backyard" – local opposition)?

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b. Where and why?

26. Some countries or companies are interested in paying for DACCS happening in Iceland to neutralize their emissions. What do you think about this?

a. Would you rather see Iceland with regard to DACCS rather as a climate pioneer producing negative emissions as a country or as a service provider exporting carbon removals?

b. On whose GHG balance should carbon removals from DACCS on Iceland count? (Iceland? Those who pay for it (DACCS as a service)? If both, what should have priority)

27. A transfer question: What advice would you give for DACCS projects in other settings than Iceland?

a. What aspects should be considered / taken into account?

b. For example, in a more densely populated area, close to a city?

c. For example offshore or in coastal areas?

C. Imported liquid CO₂ (for DemoUpCARMA):

DemoUpCARMA is a pilot project led by ETH Zurich (CH). It aims to demonstrate the implementation and scale-up of two CDR pathways leading to negative emissions. One of these pathways is CO₂ capture at a point source in Switzerland, transport and permanent storage in a geological reservoir in Iceland (Carbon Capture, Transport and Storage, CCTS).

28. What have you heard of CCTS projects where captured CO₂ from abroad is transported to Iceland and pumped into the ground for geological storage?

a. Or similar projects?

b. Have you heard of the DemoUpCARMA project before?

29. How do you feel about CCTS projects in Iceland?

a. With CO₂ captured on Iceland?

b. With CO₂ coming from abroad?

c. Would you rather view CCTS as (a) the provision of a public good (emphasizing the responsibility of each nation to act including by storing their own "CO₂-waste") versus (b) the provision of a (more value-neutral) service in return for payment?

d. Why?

30. What is your impression of how other actors in Iceland and the general public perceive CCTS with CO₂ imported to Iceland?

a. Who are opinion leaders and influencers?

b. Do you remember specific supportive or critical statements / media articles? (Please share exemplary news articles)

31. Understanding that at some point capacity for CO₂ storage may be a limiting factor, should some sources of CO₂ have priority? Imported or from DAC? Reasons? Develop please? ... How to prioritize?

D. Follow-up / next steps

32. Do you have another topic or open question you would talk about?

33. Who else should we talk to / interview?

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34. What would you be interested to learn from our engagements and CDR-PoEt?
35. Would you be Interested in participating in a stakeholder workshop on DACCS with other Icelandic stakeholders in autumn, to discuss the consequences and policies for a possible scale-up of DACCS on Iceland?
 - a. Can we contact you for further questions and follow up workshop?
 - b. What would be reasons for you to participate / not be interested to participate?
 - c. Who (else) would you invite? Who would you like to see there?
 - d. Online or in presence in Iceland?

4.3 Interview Questions 2023

A. The interview partner

1. Name
2. Organization and Function

B. Discussion questions

3. What is your state-of-knowledge and perception of current and planned CDR projects in Iceland?
4. Where do you see key acceptance factors for an implementation of direct air CO₂ capture and storage (DACCS) and cross-border import of CO₂ for storage to Iceland?
5. What learnings from Iceland can we derive for implementation of CO₂ storage in other countries?
6. Which policy options for fostering both supply-push and demand-pull for DACCS do you prefer/oppose? Why?
 - Direct funding
 - Tax cuts
 - EU-ETS
 - Paris Agreement Article 6 transactions
 - Others?

C. Follow-up / next steps

7. Do you have another topic or open question you would talk about?
8. What would you be interested to learn from our engagements and CDR-PoEt?