REPORT

The Nordics as Europe’s Carbon Removal Hub

A Blueprint for Nordic Action

IM_

Nordic Carbon Removal Association

June 2025

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Foreword

Carbon removal sits at the crossroads of necessity and opportunity. In climate policy today, emission reductions rightly take centre stage, but to genuinely align with science-based climate targets, reducing emissions alone will not suffice. Carbon removal has become an essential pillar of any credible climate strategy. Yet, to date, efforts remain fragmented, deployment modest, and markets immature. It is in this moment that the Nordic countries have a unique opportunity to lead.

This report represents a significant milestone in translating ambition into reality. It synthesises extensive analysis and research, the best available data, and the insights of pioneering Nordic stakeholders across government, industry, finance, and academia. Admittedly, given the early stage of carbon removal markets, no forecast can fully capture the complexities of what lies ahead. However, the economic and strategic analysis presented in this report provides a robust starting point, guiding our shared path forward.

The Nordics are particularly well positioned, not only because of our abundant renewable energy, significant geological storage potential, and technological leadership in carbon capture and storage. Our robust innovation ecosystems, forward-thinking businesses, and supportive financial institutions add significantly to this, along with governments courageous enough to champion climate action in increasingly turbulent times. This collective strength is rare, valuable, and demands our attention and ambition.

Recognising our potential should not equate to complacency or unrealistic optimism. The barriers highlighted in this report, from regulatory complexity and fragmented infrastructure to immature market dynamics, demand careful strategic consideration and coordinated policy responses. No single actor or initiative can overcome these alone. Collaboration, both within and across borders, will be decisive in determining whether we realise the Nordic region's considerable potential.

The purpose of this report, then, is multifaceted. It aims to deepen the strategic conversation around carbon removal in the Nordics, guide and inform policy and investment decisions, and above all serve as a catalyst for collective action. Crucially, while our focus is specifically on carbon removal, we must ensure it is clearly embedded within the broader framework of carbon management strategies, addressing residual emissions from hard-to-abate sectors, leveraging shared infrastructure such as CO_2 transportation and storage, and actively integrating sectors such as agriculture, forestry, and waste management into the carbon removal landscape.

This report is a call to move beyond ambition to execution, grounded firmly in realism and propelled forward by our shared understanding of what is possible – and urgently needed.

The path ahead will be challenging, but it is clear. If we embrace the opportunity at hand, the Nordics will not merely participate in the global carbon dioxide removal conversation. We will help define it.

Alexander Mäkelä

Co-founder of the Nordic Carbon Removal Association
Chief Policy Officer at Carbon Gap

June 2025

Contributions

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Carbon Gap

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Klimate Nasdaq south pole NextGen

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Executive Summary

The global climate deficit is growing fast, and action is urgently needed if we are to avoid the worst effects of climate change. Over the past years, it has become abundantly clear that large-scale deployment of carbon dioxide removal (CDR) is an inevitable component of the climate mitigation activities needed. Not a substitute for deep greenhouse gas emission reductions, but a critical complement. For every year that global emissions continue to overshoot the required climate trajectory, the need for CDR increases.

Scaling up CDR to the necessary level is a massive challenge. Today, global carbon removals account for about 2 $GtCO_2$ a year, and virtually all of this is from afforestation and reforestation along with some soil carbon sequestration.[1] IPCC models compatible with the Paris Agreement require about 7–9 $GtCO_2$ annually by 2050, and significantly larger volumes still for global net negative emissions throughout the second half of the 21st century.[2] Reaching the necessary scale in time is daunting. It will require the creation of entire commercial value chains almost from scratch and scaling up at an unprecedented pace to reach climate-meaningful removal volumes by 2050 and beyond.

While the task involves substantial challenges, it also holds great potential – particularly in the Nordic region. A well-designed ecosystem for permanent CDR that relies on regional strengths can transition the Nordic economy towards climate-positive industries, adding a new source of economic growth, exports, technological innovation, and high-quality jobs.

In this study, we find that the Nordic region has all the necessary components to scale up a viable and cost-efficient CDR ecosystem, but stringing it together requires greater collaboration and strategic engagement both within and between national borders.

Successfully scaling up this ecosystem would unlock a substantial economic opportunity. We find that such an ecosystem could support up to 148,000 jobs across different sectors in the Nordic countries alone and contribute up to EUR 17 billion to GDP across Iceland, Norway, Sweden, Finland, and Denmark. Part of this potential comes from producing more CDR than needed for domestic climate mitigation and exporting to other EU countries. Adding to this potential is the value that will be generated from exporting technology, products and/or services used to deliver CDR projects in other countries.[3]

The Nordic region is well suited to host a large-scale CDR ecosystem. Compared to many other regions, particularly the rest of Europe, the Nordics combine access to geological storage of CO_2, availability of reliable, low-cost carbon-free electricity, well-developed district heating networks, and a large intrinsic potential for creating carbon removals. The sources of carbon removal are vast, including substantial biogenic point source emissions, available biomass residues for biochar, vast deposits of minerals for enhanced rock weathering, and good conditions for ocean-based removals such as direct ocean capture or alkalinity enhancement, as well as direct air capture. Taken together, these advantages – robust infrastructure, abundant natural resources, favourable geography, and renewable energy availability – create an outstanding environment for high-quality carbon removals, positioning the Nordics to become Europe's leading carbon removal hub.

While in its infancy, the first elements of a flourishing CDR ecosystem in the Nordics are already present. Across all mapped methods (except Direct Ocean Capture), Nordic capabilities are perceived as higher than for international competitors in almost all parts in the value chain, especially for BECCS and biochar.

[1] Implementa Consulting Group based on CDR.FYI
[2] Smith et al.
[3] We have not quantified this value, but this is likely sizeable.

In part, this is due to a strong early engagement in the Nordic countries, where visionary policymakers have defined ambitious climate targets and – in some countries – set aside substantial public funds for CDR development, particularly BECCS and biochar.[4]

Strong international recognition of Nordic ambitions and actions has made the Nordics a region of exceptional interest for the CDR industry. The fact that more than 39% of the top 25 global CDR sellers by volume originate from the Nordics is a testament to this.[5]

To achieve the necessary scale-up of CDR, several key barriers must be addressed.

We propose nine targeted actions for policymakers to overcome these challenges and position the Nordics as Europe's leading carbon removal hub. These actions include, among others, establishing a clear role and ambition for CDR in the region, harnessing the voluntary carbon market to support scale-up, supporting the initial build-out of CDR value chains, and promoting a coordinated Nordic strategy for transport infrastructure. Successfully implementing these measures would unlock significant economic opportunities for the Nordic countries and contribute meaningfully to one of the most critical efforts in combating climate change.

[4] Sweden and in particular Denmark having offered public subsidies in the amount of EUR 3,3 bn (Swedish BECCS reverse auction) and EUR 3,62 bn (Danish CCS reverse auction), over the next 15-20 years to support primarily BECCS.
[5] Implement Consulting Group based on CDR.FYI

Denmark

Carbon Dioxide Removals Profile

Within a Nordic CDR ecosystem, Denmark can be one of the leading providers for BECCS, On & Offshore Storage, Biochar, ERW and potentially Direct Ocean Capture

BECCS · Biochar · ERW · On & Offshore Storage · DOC

- Denmark is well suited to create a full BECCS ecosystem utilising its significant biogenic CO_2 emissions and its geographic potential for on & offshore CO_2 storage.
- Denmark's advanced agriculture and access to Greenlandic rock flour support ERW scaling, while access to residual biomass allows for biochar industry expansion.
- Potential synergies from co-location of offshore storage, offshore wind power and DOC.

The scaling of a Danish CDR ecosystem could bring substantial economic benefits.

12–25 $MtCO_2$ per year by 2050[1]

CDR Potential

Our findings show that Denmark can remove up to 25 $MtCO_2$ per year by 2050 in a scenario which expects the scaling of BECCS, Biochar and ERW to their full potential. Additionally, DACCS and DOC are included on a smaller scale.

12–23 Thousand jobs annually

Job Potential

Scaling the Danish CDR ecosystem can support up to 23,000 jobs annually by 2050. More than half of the jobs will be within:

- Knowledge & innovation services (~22%)
- Industrial equipment & machinery produc tion (~15%)
- Rail, road & pipeline transport (~9%)
- Wholesale & retail trade (~9%)

1.5–3.1 Billion EUR annually

GDP Potential

The Nordic CDR industry can contribute to Danish GDP by up to EUR 3.1 billion annually by 2050. This is especially driven by the Danish strength position within storage of CO_2, which will be used by the other Nordic countries, mainly by Sweden and Finland.

Note: 1) The estimates on the total Carbon Dioxide Removal (CDR) potential come with high uncertainties. For a comprehensive understanding of the methodology and assumptions behind these estimates, please refer to the full report and its appendix.

Sweden

Carbon Dioxide Removals Profile

Within a Nordic CDR ecosystem, Sweden can be one of the leading providers for BECCS and Biochar

BECCS · Biochar

- Significant potential for BECCS from Pulp & Paper, Heat and Power and biogas production sectors.
- Large additional biomass availability enables the scaling of biochar production.
- Access to farmland supports expansion of biochar and could furthermore make Sweden an attractive location for ERW if transport costs for silicate rocks are low

The scaling of a Swedish CDR ecosystem could bring substantial economic benefits.

33–47 $MtCO_2$ per year by 2050[1]

CDR Potential

Our findings show that Sweden can remove up to 47 MtCO2 per year by 2050 due to its substantial potential for BECCS and Biochar based on large amounts of biogenic CO_2 and residual biomass. Additionally, maximum scaling of ERW on Swedish fields is assumed.

25–36 Thousand jobs annually

Job Potential

Scaling the Swedish CDR ecosystem can support up to 36,000 jobs annually by 20250. More than half of the jobs will be within:

- Knowledge & innovation services (~23%)
- Building & infrastructure construction (~20%)
- Industrial equipment & machinery production (~13%)

2.4–3.4 Billion EUR annually

GDP Potential

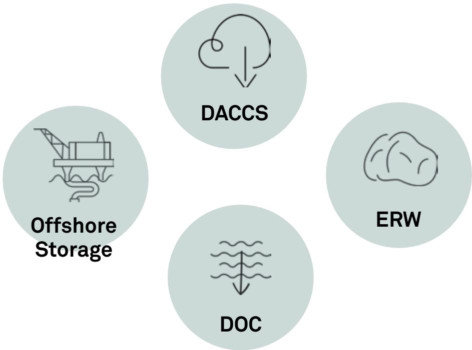
The Nordic CDR industry can contribute to Swedish GDP by up to EUR 3.4 billion annually by 2050. This is especially driven by the Swedish strength position within BECCS.

Note: 1) The estimates on the total Carbon Dioxide Removal (CDR) potential come with high uncertainties. For a comprehensive understanding of the methodology and assumptions behind these estimates, please refer to the full report and its appendix.

Norway

Carbon Dioxide Removals Profile

Within a Nordic CDR ecosystem, Norway can be one of the leading providers of Direct Air Carbon Capture and Storage, Offshore Storage, Direct Ocean Capture and Enhanced Rock Weathering



- Large offshore CO2 storage potential combined with low electricity prices makes Norway an attractive location for DACCS and DOC.
- Norway could potentially export olivine for ERW purposes to countries with dispersal possibilities.
- Norway also has potential for scaling BECCS and Biochar, although their potentials are comparatively lower.

The scaling of a Norwegian CDR ecosystem could bring substantial economic benefits.

15–46 $MtCO_2$ per year by 2050[1]

CDR Potential

Norway can provide up to 46 $MtCO_2$ removals per year by 2050 in a scenario that assumes that Norway provides 40% of the European DACCS demand while simultaneously scaling DOC, BECCS, Biochar and ERW to a smaller extend.

26–54 Thousand jobs annually

Job Potential

Scaling the Norwegian CDR ecosystem can support up to 54,000 jobs annually by 2050. More than half of the jobs will be within:

- Industrial equipment & machinery production (~23%)
- Knowledge & innovation services (~12%)
- Electricity generation & supply (~9%)
- Wholesale & retail trade (~9%)

3.2–7.2 Billion EUR annually

GDP Potential

By 2050, the Nordic CDR industry could enhance Norway's GDP by as much as EUR 7.2 billion annually. This growth is largely driven by Norway's strength position in the transportation and storage of CO2, which could be leveraged by other Nordic countries, primarily Finland and Sweden. Additionally, its attractive location for DACCS presents considerable removal capabilities via this method.

Note: 1) The estimates on the total Carbon Dioxide Removal (CDR) potential come with high uncertainties. For a comprehensive understanding of the methodology and assumptions behind these estimates, please refer to the full report and its appendix.

Finland

Carbon Dioxide Removals Profile

Within a Nordic CDR ecosystem, Finland can be one of the leading providers of Bioenergy with Carbon Capture and Storage and Biochar

- Finland has a significant potential for scaling BECCS from biogenic emissions in the Pulp & Paper, Heat and Power and biogas production sectors.
- Finland additionally has large residual biomass availability which enables the scaling of biochar production.

The scaling of a Finnish CDR ecosystem could bring substantial economic benefits.

20–32 $MtCO_2$ per year by 2050[1]

CDR Potential

Our findings show that Finland can remove up to 32 $MtCO_2$ per year by 2050. This scenario assumes the full utilisation of Finland's existing biogenic point sources, the use of all additional available biomass for the production of biochar and an application of ERW on 50% of Finnish farmland.

17–26 Thousand jobs annually

Job Potential

Scaling the Finnish CDR ecosystem can support up to 26,000 jobs annually by 2050. More than half of the jobs will be within:

- Knowledge & innovation services (~27%)
- Building & infrastructure construction (~14%)
- Industrial equipment & machinery production (~12%)

1.5–2.2 Billion EUR annually

GDP Potential

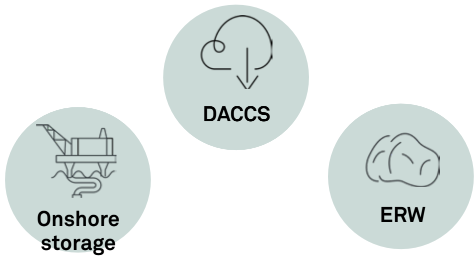
The Nordic CDR industry can contribute to Finnish GDP by up to EUR 2.2 billion annually by 2050. This is mainly driven by Finland's large potential for BECCS.

Note: 1) The estimates on the total Carbon Dioxide Removal (CDR) potential come with high uncertainties. For a comprehensive understanding of the methodology and assumptions behind these estimates, please refer to the full report and its appendix.

Iceland

Carbon Dioxide Removals Profile

Within a Nordic CDR ecosystem, Iceland can be one of the leading providers of Onshore Storage, Direct Air Carbon Capture and Storage and Enhanced Rock Weathering



- Iceland's basaltic bedrock makes Iceland a suitable location for onshore storage of CO_2 from BECCS, DACCS and DOC.
- Large CO_2 storage potential combined with low electricity prices makes Iceland an attractive location for DACCS.
- Iceland could potentially export basalt for ERW purposes to other countries with dispersal possibilities.

The scaling of an Icelandic CDR ecosystem could bring substantial economic benefits.

4–9 $MtCO_2$ per year by 2050[1]

CDR Potential

Our findings show that Iceland can remove up to 9 $MtCO_2$ per year by 2050. In this scenario, Iceland would scale Direct Air Carbon Capture and Storage up to 6 MtCO2 per year, providing 10% of the EU DACCS demand. Additionally, Iceland would build out smaller volumes of Direct Ocean Capture and utilise biomass from fish farming for the production of small scales of biochar.

4–9 Thousand jobs annually

Job Potential

Scaling the Icelandic CDR ecosystem can support up to 9,000 jobs annually by 2050. More than half of the jobs will be within:

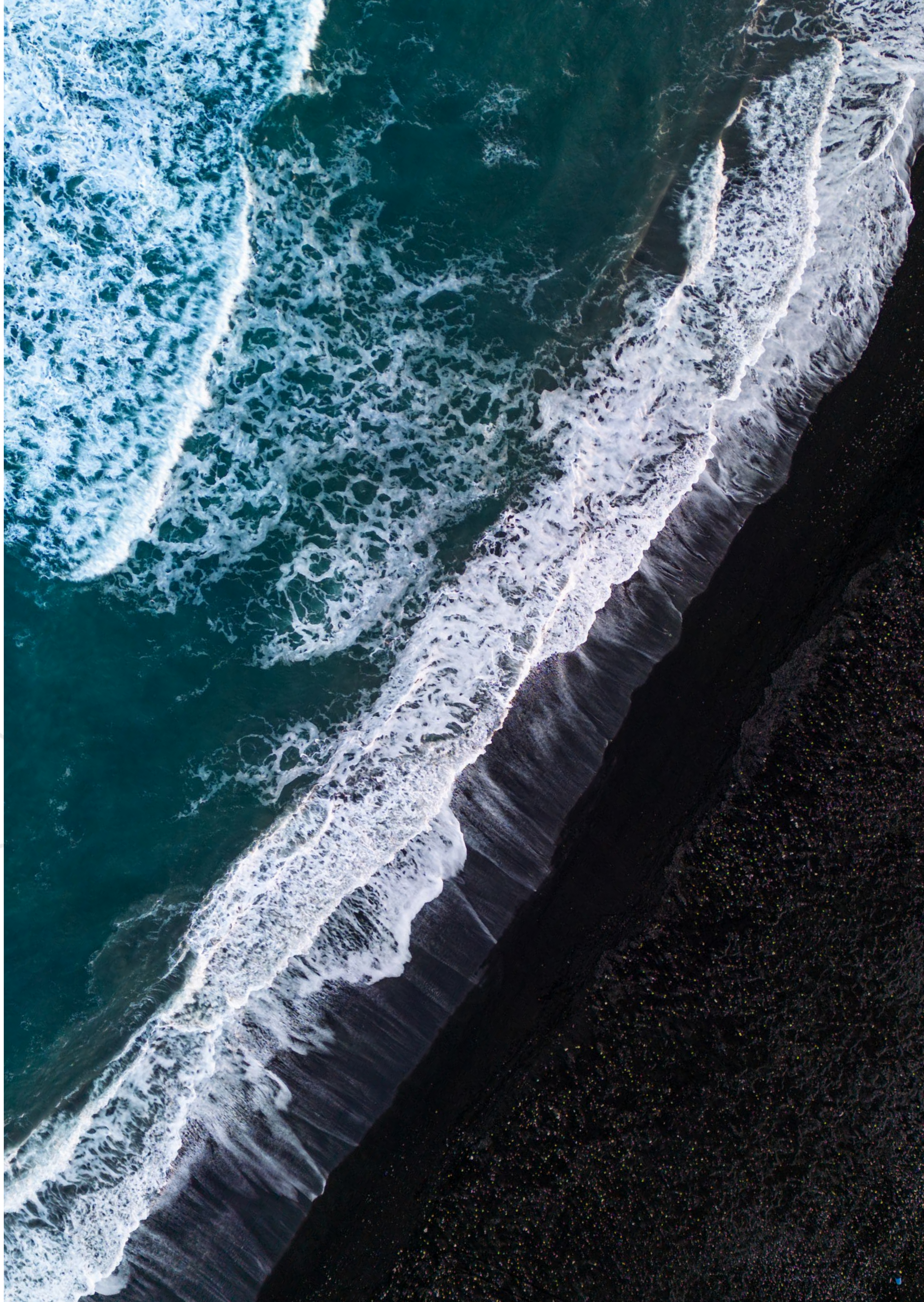
- Building & infrastructure construction (~19%)
- Knowledge & innovation services (~22%)
- Electricity generation & supply (~10%)

0.5–1.2 Billion EUR annually

GDP Potential

The Nordic CDR industry can contribute to Icelandic GDP by up to EUR 1.2 billion annually by 2050. This is mainly driven by Iceland's attractive location for DACCS.

Note: 1) The estimates on the total Carbon Dioxide Removal (CDR) potential come with high uncertainties. For a comprehensive understanding of the methodology and assumptions behind these estimates, please refer to the full report and its appendix.



1 Emission reductions must be complemented by CDR to meet climate ambitions

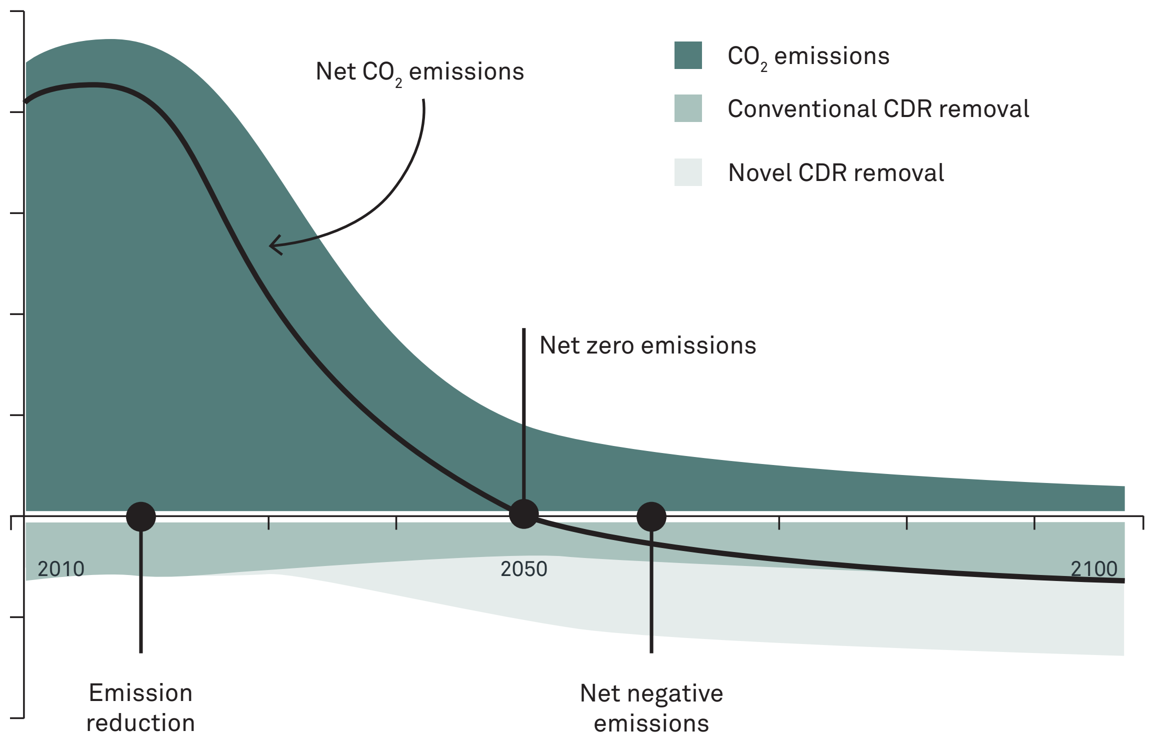
Carbon Dioxide Removal (CDR) has emerged as a crucial element of global climate strategies. While reducing greenhouse gas emissions remains the top priority, it is no longer enough on its own.

1.1 CDR plays a critical role in all transition pathways from IPCC

CDR is no longer optional in any realistic climate scenario – it has become a climate necessity. To limit global warming to 1.5°C or even 2°C – as outlined in the Paris Agreement – scientific consensus indicates that billions of tonnes of CO_2 already in the atmosphere must be removed.

According to the Intergovernmental Panel on Climate Change (IPCC), all credible pathways to achieving long-term climate sustainability incorporate CDR, with estimates indicating a need to remove 7–9 $GtCO_2$ annually by 2050 (see Figure 1).

Figure 1: Need for CO2 reductions and removals in line with 1.5°C target (Stylized pathway)



Source: Adapted from Babiker et al. (2022) and Smith et al. (2024)

Even with ambitious emissions reductions, many IPCC scenarios anticipate a temporary overshoot of temperature targets, especially 1.5°C. CDR is essential to reverse this overshoot by actively removing CO_2 from the atmosphere, thereby returning temperatures to safer levels. Scenarios with minimal reliance on CDR require extremely rapid decarbonisation, which could entail prohibitive social, political, and economic costs.

Estimates suggest a cumulative removal requirement of 450–1,100 $GtCO_2$ this century to meet global climate targets. To put this in perspective, 500 $GtCO_2$ is more than 12 times current annual global emissions and roughly 200 times the annual emissions from global cement production (~2.5 Gt per year).[6]

The scale far exceeds what can be achieved through incremental actions. Achieving removals at this unprecedented scale will require a transformative ramp-up of technological and nature-based solutions, such as afforestation, Bioenergy with Carbon Capture and Storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS), alongside dedicated efforts to overcome significant technological, economic, and political barriers.

By mid-century, nearly all decarbonisation strategies will rely on CDR to offset emissions that remain challenging or prohibitively expensive to eliminate entirely, and to reduce atmospheric CO_2 concentrations from current dangerous levels (~430+ ppm) toward scientifically recognised safer thresholds (~350 ppm). These residual emissions typically occur in sectors where full decarbonisation is technically difficult, economically prohibitive, or culturally challenging – such as aviation (long-haul flights), heavy industry (cement and steel production), and agriculture, particularly livestock methane, where dietary changes are feasible but culturally difficult to achieve at scale.

Achieving net-zero fundamentally depends on balancing greenhouse gas emissions released into the atmosphere with actively removing an equivalent amount of emissions. Literally, CDR is the 'net' in net-zero. Without credible, durable, and scalable CDR solutions, especially in economies burdened by substantial industrial emissions that cannot feasibly be eliminated by 2050, the net-zero goal risks becoming an empty promise. Scaling up effective CDR pathways is critical to ensuring climate integrity and turning ambitious targets into meaningful outcomes.

[6] Global Cement and Concrete Association (2021). Note that we are here comparing cumulative numbers and annual numbers

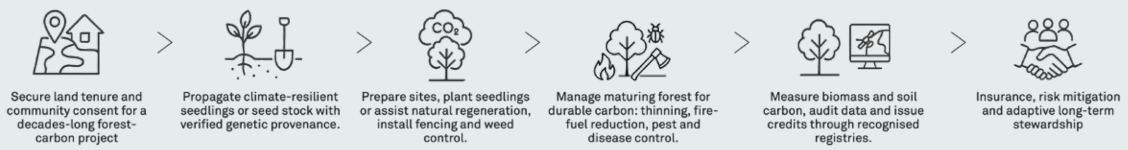
1.2 Emission reductions must be complemented by CDR to meet climate ambitions

CDR can take place through a number of different methods, from nature-based solutions (NBS), such as reforestation, afforestation, and soil carbon sequestration, to technological approaches, including DACCS and BECCS which vary significantly in terms of costs, advantages, drawbacks, and permanence. Crucially, no single method is likely to deliver all the carbon removals required in any credible climate scenario, and diversifying across multiple methods will help balance out the limitations of any single approach.

In the following, we provide a brief overview of many of the most relevant CDR methods, including their individual merits. Going forward in this study, we only consider *permanent carbon removal methods*, recognising that there are strong limitations for large-scale build-out of nature-based methods. We consider the following: DACCS, BECCS, biochar, Enhanced Rock Weathering (ERW) and Direct Ocean Capture (DOC), while also recognising a possibility for Ocean and River Alkalinity Enhancement (OAE and RAE, respectively).

Afforestation, reforestation, and improved forest management[7] involve planting new forests, restoring lost ones, or improving existing managed forests. This currently makes them the largest global contributors to CDR at around 2 $GtCO_2$ per year.[8] The IPCC also estimates, with medium confidence, that the method could have a potential of 3.9 $GtCO_2$ per year, assuming costs of less than approximately EUR 100 per tonne of CO_2 removed. These methods are relatively low-cost, averaging around EUR 35 per tonne of CO_2 removed,[9] with a wide range of EUR 0–100 due to location-specific factors.[10] They offer significant benefits, such as enhanced biodiversity and improved soil and water quality. However, they require strong community buy-in, robust monitoring, reporting and verification (MRV), and large land areas, which can compete with food production and indigenous land rights. The carbon stored is also vulnerable to release from wildfires, pests, and climate change. Moreover, their potential will likely peak by mid-century due to land constraints and carbon storage saturation.

Figure 2: Value chain for afforestation, reforestation, improved forest management

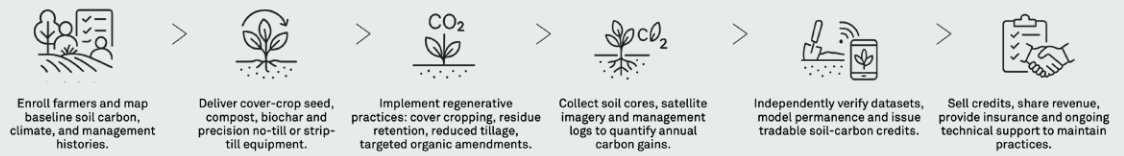


Source: Implement Consulting Group based on Carbon Gap research.

Soil carbon sequestration involves agricultural practices that increase carbon stored in soils. This approach is often low-cost, with a current global median of EUR 45 –and a range between EUR 0 and EUR 90 per tonne of CO_2 removed, and can boost soil health, crop yields, and water retention.[11] While current global sequestration from soil carbon practices is limited and not precisely quantified, estimates suggest a substantial potential of about 1.8 $GtCO_2$ per year by 2050 under widespread adoption of best management practices, assuming costs of less than approximately EUR 100 per tonne of CO_2 removed.[12] However, soils can reach carbon saturation within decades to a century, making it primarily a medium-term solution. Carbon saturation is a point where soils cannot absorb additional carbon, depending on factors such as soil type and management. Additionally, accurately quantifying and verifying these changes across millions of farms remains challenging, though advancements in remote sensing and modelling are improving measurement and verification capabilities.

[7] Includes diverse practices, some of which reduce emissions while others actively remove and store carbon.
[8] Smith et al. (2024)
[9] Intergovernmental Panel on Climate Change, IPCC (2023)
[10, 11] European Scientific Advisory Board on Climate Change (2025) and Boston Consulting Group (2025).
[12] Smith et al. (2024)

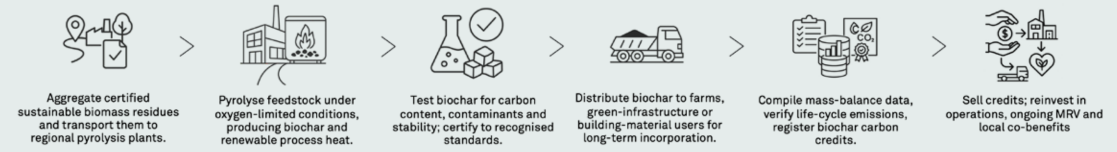
Figure 3: Value chain for soil carbon sequestration



Source: Implement Consulting Group based on Carbon Gap research.

Biochar converts biomass into a charcoal-like substance that is added to the soil, locking up a portion of the biomass carbon. Its permanence varies based on factors such as feedstock type and pyrolysis conditions, but the growing consensus suggests that a significant portion of biochar carbon is highly stable, potentially sequestering carbon for centuries to millennia.[13] Biochar also enhances soil fertility and moisture retention. Global costs vary from EUR 100–200 per tonne of CO_2 removed, depending on feedstock and kiln technology.[14] However, biochar depends on a sustainable biomass supply, sharing resource constraints with BECCS, and its carbon sequestration stability can vary based on production methods.

Figure 4: Value chain for biochar

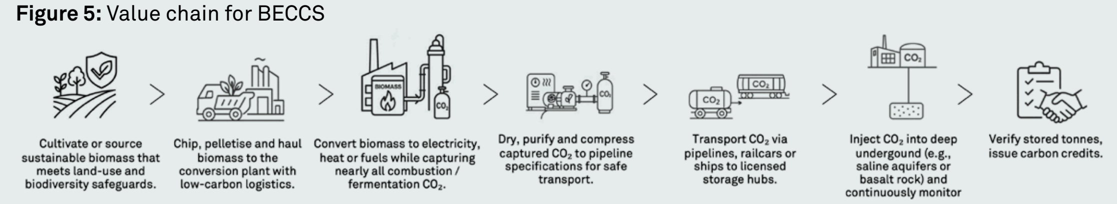


Source: Implement Consulting Group based on Carbon Gap research.

Bioenergy with Carbon Capture and Storage (BECCS) involves converting biomass into energy and capturing and permanently storing the resulting CO_2 emissions. BECCS can generate renewable electricity, heat, and biofuels, making it versatile for decarbonising various sectors. For example, Nordic countries like Denmark and Sweden have significant BECCS potential through biomass-fired CHP plants, biomass gasification, and waste-to-energy systems utilising municipal and agricultural residues. Current global costs for BECCS vary by method and feedstock from EUR 150–300.[15] BECCS leverages existing infrastructure and generates revenues (energy, heat, fuels) that help offset these costs. However, challenges remain, including land requirements, sustainable sourcing of biomass, and the need for robust CO_2 transport and storage infrastructure.

Under standard carbon accounting rules, biogenic CO_2 emissions from biomass combustion are treated as climate-neutral – but only if the biomass is sustainably sourced and regrowth fully offsets the carbon released. When BECCS is applied, the CO_2 is permanently stored underground resulting in net-negative emissions. Even residue biomass, however, would have stored CO_2 if left at the source for a period of time,[16] and this negative impact on the natural carbon sink, including on biodiversity, is important to address from a policy perspective including obtaining net-negative on balance from a systems perspective.

Figure 5: Value chain for BECCS

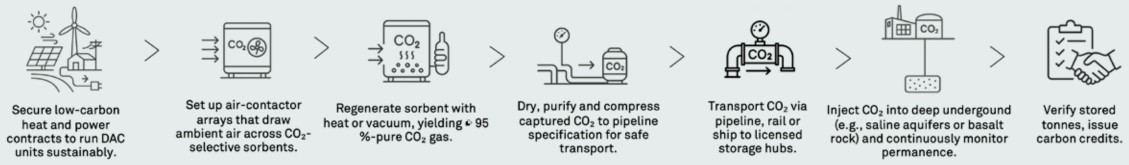


Source: Implement Consulting Group based on Carbon Gap research.

[13] Intergovernmental Panel on Climate Change, IPCC (2022a)
[14, 15] European Scientific Advisory Board on Climate Change (2025)
[16] he average half-life decay rate of biomass used in the Danish district heating sector various from about 3 years (straw) to about 15 years (wood logs), implying that the residue biomass would have stored its carbon content for some years if left at the source (Ea Energianalyse 2024)

Direct Air Carbon Capture and Storage (DACCS) uses chemical or physical processes to capture CO_2 directly from ambient air and permanently stores it underground. Existing DACCS technologies are currently expensive, with global costs typically ranging from EUR 500–1,000 per tonne of CO_2 removed.[17] Its key strength is location flexibility, as DACCS plants can be sited wherever clean energy and suitable CO_2 storage geology are available. DACCS, like BECCS, offers one of the most permanent removal options, producing CO_2 streams that can be reliably stored for millennia. Two main technological approaches exist: liquid-solvent DACCS, which operates at high temperatures (700–900°C), and solid-sorbent DACCS, which uses lower temperatures (60–120°C) and can leverage waste heat sources, potentially making it particularly suitable for the Nordic context. DACCS is energy-intensive, requiring, today, approximately 1.4–4.2 MWh of energy per tonne of CO_2 captured,[18] and significant investment in technology development, renewable energy generation and transmissions capacity to scale. Given its early stage and only first-of-a-kind pilot facilities existing today, significant cost reductions and performance improvements, including energy efficiencies, are expected.

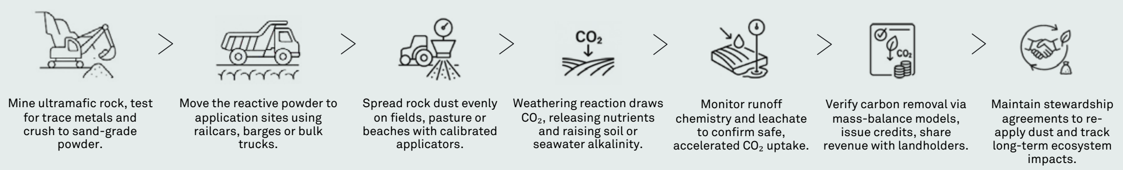
Figure 6: Value chain for DACCS



Source: Implement Consulting Group based on Carbon Gap research.

Enhanced Rock Weathering (ERW) involves spreading finely ground silicate minerals on soils to accelerate CO_2 removal through natural chemical reactions. It offers permanent carbon storage and significant scale potential, with overall costs, including robust MRV, currently estimated with a global range of EUR 250–300 per tonne of CO_2 removed.[19] A substantial portion of these costs arises from MRV activities, reflecting the complexity and intensity of accurately measuring and verifying carbon uptake in soils. Additionally, ERW applied to farmland can reduce the need for fertiliser, and improve soil health and agricultural productivity by replenishing essential nutrients. Typical minerals used for ERW are basalt, olivine and glacial flour, which are all abundantly available in the Nordics. The sourcing of the minerals is relatively low-impact as they are generated as by-products from existing aggregate and mining industries. Glacial rock flour from Greenland is already naturally produced by the grinding action of glaciers on the underlying bedrock, which creates a yearly flux of finely ground particles suspended in glacier meltwater. Its extraction therefore has an even lower environmental impact compared to minerals sourced from traditional mining or aggregate industries, as it does not require energy-intensive mechanical grinding. ERW generally performs better under higher temperatures, making the Nordic region less relevant for ERW disbursement than other regions. Greenlandic rock flour however can be applied in the Nordic region due to its fine grain size and higher reactivity. Scaling ERW to a Gt level would increase demand for Nordic minerals and significantly amplify the logistical, environmental, and sustainability challenges associated with mining, processing, transportation, and application.

Figure 7: Value chain for ERW



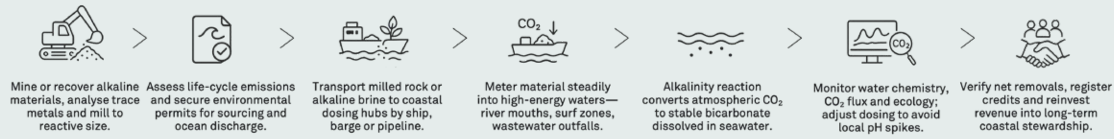
Source: Implement Consulting Group based on Carbon Gap research.

[17] European Scientific Advisory Board on Climate Change (2025)
[18] Al-Juaied & Whitmore (2023)
[19] European Scientific Advisory Board on Climate Change (2025)

Ocean Alkalinity Enhancement (OAE) and River Alkalinity Enhancement (RAE) involve increasing the capacity of oceans or freshwater bodies to absorb CO_2 by adding alkaline substances, such as finely ground minerals. Ocean alkalinity enhancement typically involves directly dispersing alkaline materials, such as olivine or quicklime, into seawater to stimulate chemical reactions that capture CO_2 as dissolved bicarbonate. River alkalinity enhancement, by contrast, involves adding these substances into rivers or estuaries, allowing the enhanced alkalinity to capture CO_2 in freshwater systems before the enriched waters flow into the ocean.

Both approaches offer permanent carbon storage and ecological co-benefits, including counteracting acidification in marine environments and reducing acidity in freshwater systems. However, uncertainties remain regarding their ecological impacts, optimal delivery methods, and effective monitoring techniques. Current global cost estimates are highly uncertain due to the immature deployment, but range from EUR 2–400 per tonne of CO_2 removed,[20] depending on the choice of materials, deployment methods, and rigorous measurement requirements. Small-scale trials and robust scientific studies will be essential for addressing these uncertainties and validating their effectiveness and safety.

Figure 8: Value chain for OAE and RAE

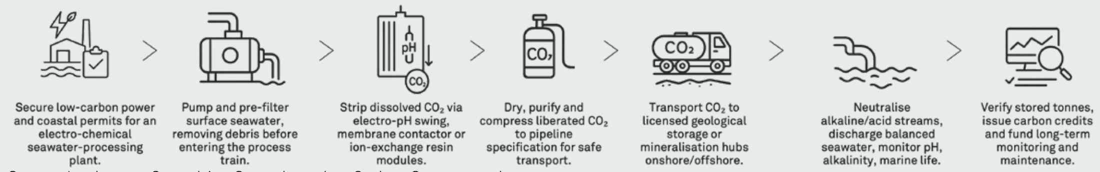


Source: Implement Consulting Group based on Carbon Gap research.

Direct Ocean Capture (DOC) involves extracting dissolved CO_2 directly from seawater using chemical or electrochemical processes. The ocean contains approximately 50 times more CO_2 by volume than the atmosphere, giving DOC significant theoretical potential. Key methods under investigation include electrochemical stripping (pH-swing), membrane-based adsorption, and temperature or pressure swing processes. DOC is energy-intensive, requiring substantial electrical input primarily for seawater processing and CO_2 extraction, reported to use 1.8 MWh per tonne of CO_2 in one sub-type.[21] Its main advantage is using the ocean's vast carbon reservoir and proximity to offshore geological storage, simplifying logistics compared to land-based methods.

The Nordic region is particularly suited for DOC due to abundant offshore renewable energy (wind and hydropower), extensive maritime infrastructure, offshore engineering expertise, and proximity to established offshore CO_2 storage sites. DOC remains at an early pilot stage, with current global costs of approximately EUR 300–1100 per tonne of CO_2 captured.[22] Environmental impacts from large-scale seawater intake and changes in water chemistry require ongoing research. Deployment in Nordic countries is subject to regional marine protection standards, notably the OSPAR Convention, which governs marine environmental activities in the North-East Atlantic, including in Denmark, Iceland, and Norway.

Figure 9: Value chain for DOC



Source: Implement Consulting Group based on Carbon Gap research.

[20] European Scientific Advisory Board on Climate Change (2025)
[21] Captura (2024)
[22] Aleta et al. (2023) and Eisaman et al. (2018).

Mineral products lock CO_2 into crushed concrete, steel and nickel slags, and other alkaline industrial wastes, forming stable carbonates that rival geologic storage for permanence. With more than 3 Gt/year of such residues generated worldwide,[23] the method could remove roughly 0.2–1 $GtCO_2$ annually by mid-century, at first-of-a-kind (FOAK) costs of about EUR 200 per tonne of CO_2 removed.[24] It turns landfill liabilities into low-carbon aggregate, cuts virgin-rock demand, and curbs heavy-metal leaching. Key limits are the finite, dispersed feedstock supply and the need for a clean CO_2 source. Nordic countries could be well placed to scale this durable, circular-economy removal option.

Figure 10: Value chain for mineral products

Source: Implement Consulting Group based on Carbon Gap research.

Several removal methods are nascent in their technological and commercial journey, and cost reductions are likely to be large as the methods develop and scale. However, there is substantial uncertainty regarding how large the potentials could be and how costs will develop. Most likely, there will be a need for a combination of most or all of the above methods, as each CDR method offers distinct advantages.

While many of these methods could be applied successfully in the Nordics – depending on local conditions – the subsequent sections of this report focus explicitly on engineered and hybrid pathways due to their high-quality nature and permanence.

1.3 A global net-zero CDR economy represents a multi-billion-euro opportunity

Achieving global net-zero emissions necessitates unprecedented CDR investments. To meet international climate targets, cumulative global CDR investments of approximately EUR 6–15 trillion are needed by 2050.[25]

Currently, a significant investment gap persists. In 2024, investments in CDR technologies reached only EUR 800 million,[26] far below the estimated EUR 200–500 billion per year needed by 2050 to scale these solutions effectively. Bridging this gap requires that CDR is seen not merely as a cost, but as a strategic investment in climate resilience and economic security. The economic potential should not be underestimated. By 2050, the global CDR market is estimated to expand to between EUR 270 billion and EUR 1.1 trillion annually, according to McKinsey,[27] and between EUR 470 and EUR 940 billion annually according to the Boston Consulting Group,[28] rivalling today's aviation sector and core industrial sectors such as steel.

In the next chapters, we will dive into how the Nordics could tap into this potential, and what the size of the economic benefits could be.

[23] Renforth (2019)
[24] Mühlbauer et al. (2024)
[25] McKinsey & Company (2023)
[26] CDR.fyi (2025)
[27] McKinsey & Company (2023)
[28] Boston Consulting Group (2024)

Figure 11: Overview of select CDR methods

Method	Blue carbon	Peatland & wetland restoration	Afforestation, reforestation, improved forest management	Soil Carbon Sequestration	Biochar	Ocean & riverine alkalinity enhancement	ERW	Bio carbon removal & storage (inc. BECCS)	DACCS	DOC	Mineral Products
Type	Nature-based	Nature-based	Nature-based	Nature-based	Hybrid	Hybrid	Hybrid	Technology-based	Technology-based	Technology-based	Technology-based
Description	Restoring coastal habitats like mangroves, seagrasses to capture CO_2.	Rewetting drained peatlands and wetlands to trap carbon in soil.	Planting and managing forests to store carbon in trees and soils.	Changing farming methods to store more carbon in soil.	Turning biomass into stable charcoal added to soil or built materials.	Adding minerals to oceans and rivers to capture CO_2 chemically.	Spreading crushed rocks on land to naturally absorb CO_2.	Burning plants for energy, then capturing and storing the emitted CO_2.	Pulling CO_2 directly from the air and storing it permanently underground.	Removing CO_2 directly from ocean water and storing it deep underground.	Using minerals and industrial wastes to chemically bind CO_2.
Readiness	Low	High	High	High	Moderate to High	Low	Low to Moderate	Moderate	Moderate	Low	Moderate
Permanence	Decades to centuries	Decades to centuries	Decades to centuries	Decades to centuries	Centuries to millennia	Millennia	Millennia	Millennia	Millennia	Millennia	Millennia
Cost per tonne 2025	~€130	€60-100	€0-100	€0-90	€100-200	€2-400	€250-300	€200-300	€500-1,000	€300-1,100	~€200
Cost per tonne 2050	~€85	~€30	~€45	~€50	~€80	~€210	~€130	~€180	~€270	~€100	~€100
Co-benefits	Supports marine life, fisheries, and protects coastlines from storms.	Boosts biodiversity, reduces flood risks, and improves water quality.	Enhances wildlife habitats, provides timber, and protects watersheds.	Improves farm productivity, soil health, and water storage.	Enhances soil fertility, improves crop yields, and conserves water.	Reduces ocean acidity, benefitting marine ecosystems.	Improves crop yields, restores soils, and reduces fertiliser use.	Produces renewable energy and supports rural economies.	Requires minimal land, is highly scalable, and doesn't compete with farming.	Reduces ocean acidification, helps marine life, and produces useful by-products.	Recycles wastes, stabilises pollutants, and reduces environmental hazards.

Notes: Global estimates. List of CDR methods not exhaustive.
Source: Implement Consulting Group based on European Scientific Advirosy Board on Climate Change (2025), Smith et al. (2024) and Boston Consulting Group (2025).

2 The Nordics have a strong foundation for spearheading the global CDR deployment

Our analysis shows that the Nordics have a very strong foundation for delivering CDR cost efficiently with the relevant foundations and the underlying economics of a solid business case.

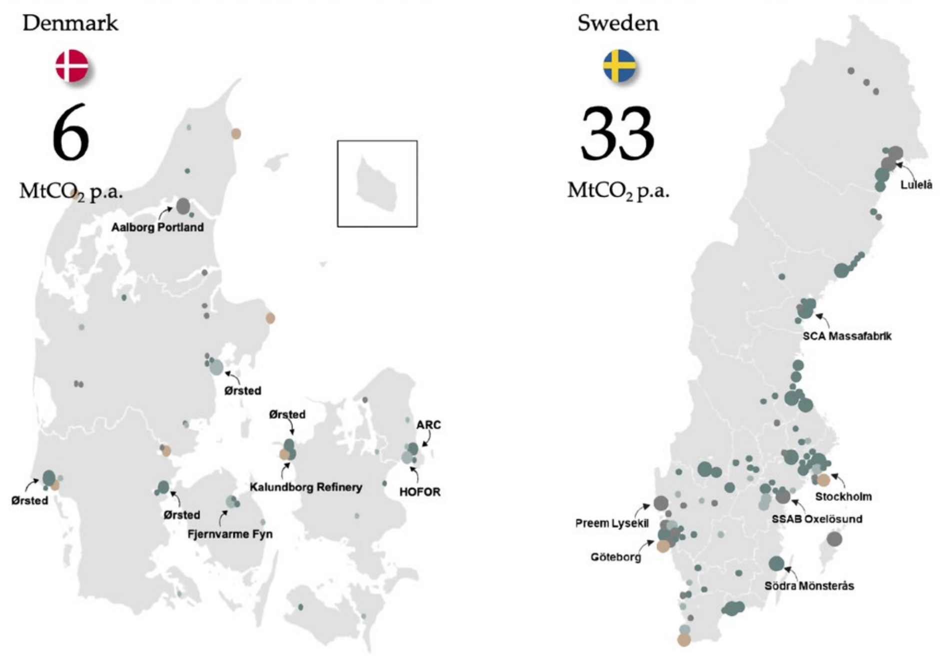
Strong natural endowments such as access to geological storage, a strong regulatory framework and policy ambitions, and an already growing ecosystem of actors in the CDR space provide both relevant capabilities and experience to successfully scale a Nordic CDR ecosystem.

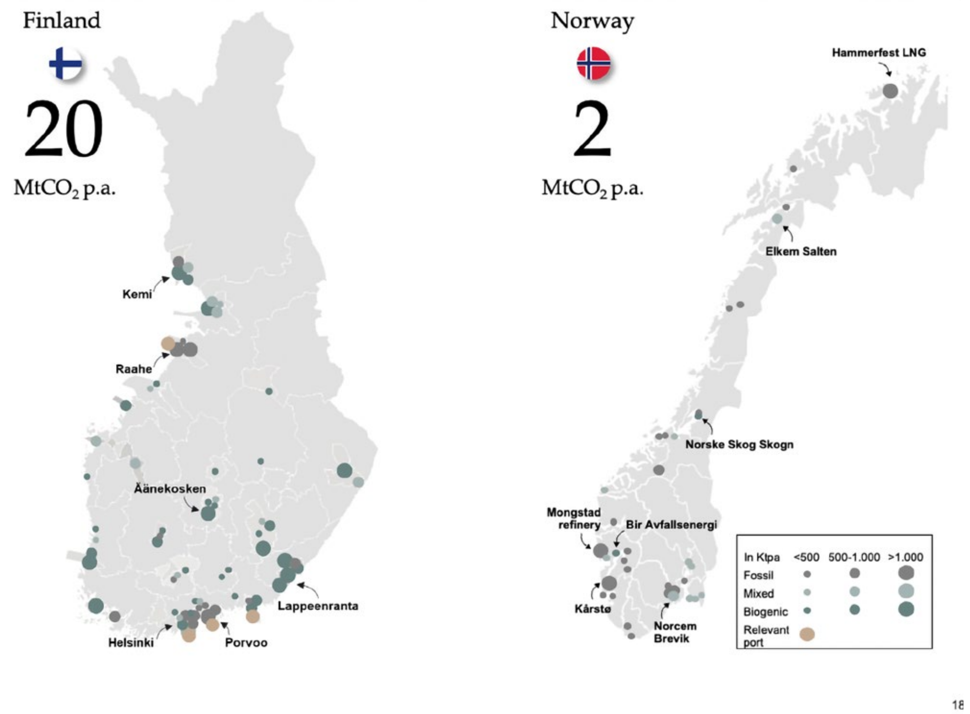
2.1 The Nordics have natural endowments making it well-suited for scaling CDR

Biogenic point sources

The Nordic countries have a significant amount of biogenic CO_2 emissions concentrated at larger point sources, such as pulp and paper, combined heat and power, waste-to-energy, and biogas facilities. Such emission point sources are prime candidates for BECCS. Approximately 90 Mt of biogenic CO_2 are emitted annually in the Nordics from biogenic point sources – however not all is suitable for carbon capture in 2050 due to e.g. reduced reliance on biomass for heating purpose in Denmark.[29] We estimate conservatively that the BECCS potential in the Nordics in 2050 is around 61 Mt per year.[30]

Figure 12: BECCS potential in the Nordics - Biogenic point source emissions

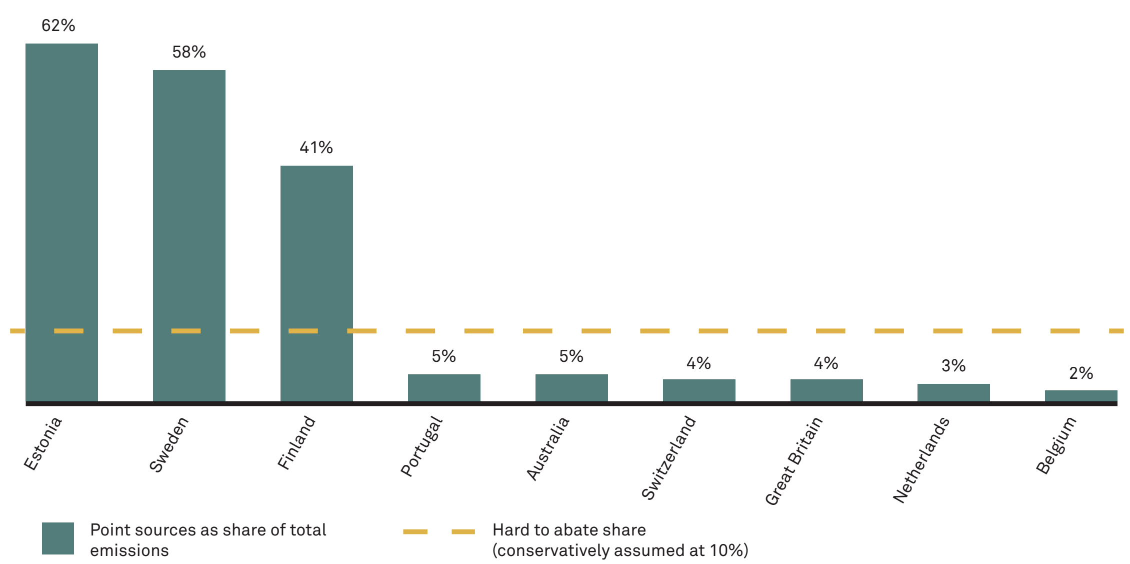




Notes: Iceland is not included in this overview as it does not have biogenic CO2 point sources
Source: Implement Consulting Group based on Danish Energy Agency (2023), Fossilfritt Sverige (2024), Kujanpää et al. (2023) and Everson et al. (2024).

Sweden and Finland are the countries with the highest biogenic emissions in Europe, which allow for the highest potential for BECCS.[31] Importantly, they also have the biggest potential to become exporters of BECCS, as they (together with Estonia) are the only countries that have a larger amount of biogenic emissions than needed to balance the country's hard-to-abate emissions (see Figure 13).[32] This means that Finland and Sweden have a strong potential to exceed their own carbon removal targets through BECCS, thereby contributing significantly to the EU's overall carbon removal targets through exports of carbon removal credits.

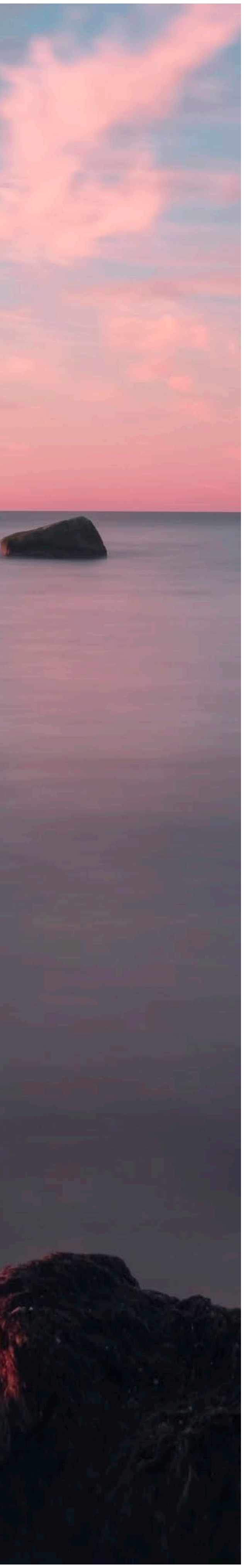
Figure 13: Biogenic emissions from point sources as share of total emissions, 2019



Source: Implement Consulting Group based on Rosa et al. (2021).

[29] The sectors we include as candidates for BECCS are: Paper and Pulp, Oil refineries, chemical industry, Plastic, glass and concrete, Metals and Energy supply.
[30] Implement Consulting Group based on Danish Energy Agency (2023), Fossilfritt Sverige (2024), Kujanpää et al. (2023) and Everson et al. (2024).

[31] Rosa et al. (2021)
[32] Here indicated as 10% of total emissions.



Residue biomass for biochar production

Producing biochar relies on the availability of residue biomass from a range of sources, depending on the biochar technology applied. Especially wood-based biomass from forestry is useful to produce CDR from biochar, due to its high carbon content. Agricultural residues such as residues from biogas plants are also commonly used despite their lower carbon content, as their high phosphor content creates an additional value for farmers spreading the biochar on their farmland. Marine biomass such as algae can furthermore be utilised.

The Nordics have high volumes of residue biomass available from the agricultural, forestry and marine sectors. Studies find that biomass availability in the Nordics ranges from about 10 Mt in Denmark to about 40 Mt in Norway – with Finland and Sweden in between.[33] Although not all types of biomass can be used for biochar production due to competing needs such as biofuel and heat and power production, the substantial volume of available biomass demonstrates the significant potential for biochar production in the Nordics.

Silicate rock deposits of basalt, olivine and glacier flour for ERW

The Nordic region is rich in minerals necessary for ERW. Norway produces up to half of global olivine supplies, with average annual production around 1 Mt and peaking at 3 Mt during high demand period.[34] Basalt is abundantly available in Iceland, making up 90% of Iceland's bedrock.[35] Greenland is a major source of glacial rock flour, produced by the mechanical grinding of glaciers on the underlying bedrock, which creates a yearly flux of finely ground particles suspended in glacial meltwater. The sediment discharge from Greenland's glaciers is as high as 1 billion tonnes of Greenlandic rock flour a year, additional to existing stocks already accumulated in glacial fjords.[36]

ERW is generally more efficient in warmer climates, positioning the Nordics primarily as suppliers of these minerals. However, Greenlandic rock flour, with its small grain size and high reactivity, can bind CO_2 even in colder climates, making it suitable for spreading on Nordic soil, in particular farmland, where it also holds growth enhancing properties and reduces the need for fertilisers.[37]

Close vicinity to geological storage sites

A critical component in the value chain of BECCS and DACCS is access to nearby geological storage sites, since transportation is a large part of total costs. Accordingly, substantial cost reductions are associated with pipeline transportation rather than truck or maritime transport.

The geological conditions for CO_2 storage are exceptionally good in the Nordics. Studies show that the Nordics are home to between 43–59% of total European technical storage potential in depleted oil and gas reservoirs, saline aquifers and rock formations that bind CO_2, such as basalt or sandstone (see Figure 14). Most of this potential is located in Norway and Iceland (ranging from 60–70 to 280–330 Gt), but Denmark also has an estimated storage potential at around 16–25 Gt. The estimates for Iceland's storage potential vary significantly due to the large availability of suitable basalt rock formations, with some studies showing a storage potential as high as 2,000–6,800 Gt – more than four times the high estimate for Europe as a whole.[38]

[33] CIP Foundation (2024), S2Biom (2016) and Everson et al. (2024).
[34] Carbon Gap (2024)
[35] Snæbjörnsdóttir et al. (2014)
[36] Bendixen et al. (2019)
[37] Gunnarsen et al. (2023)
[38] Snæbjörnsdóttir & Gislason (206) and Anthonsen (2012).

As of now, at least 14 Nordic storage site projects have been announced (see Figure 14). A majority of projects are being developed in the Norwegian and Danish parts of the North Sea (offshore), but onshore storage sites in Denmark have also been announced, as well as mineralisation storage in Iceland.

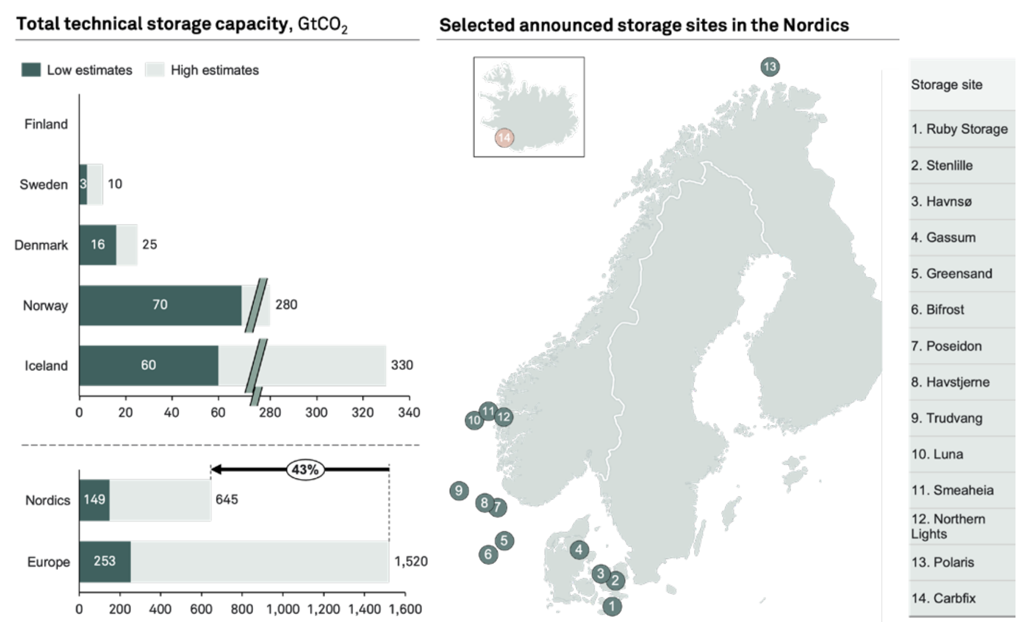
Open-field farmland for biochar and ERW storage

A critical component for the successful scaling of ERW and biochar is the availability of storage locations that can utilise the co-benefits of these technologies. As explained in Chapter 1, biochar can improve e.g. soil structure and water retention, act as a nutrient source, increase biodiversity and promote plant growth in greenhouses, whereas Greenlandic rock flour reduces the need for fertiliser.

Since many of these co-benefits are most clearly reaped by dispersing the product on open-field agricultural land, the availability of such land in the Nordics is important to scaling biochar. Sweden, Denmark and Finland in particular have sizeable agricultural land areas, ranging from 2.3–3.0 million hectares (see Figure 15).[39] This offers Nordic biochar and ERW producers sufficient final storage locations for their products in close vicinity, enabling them to keep transport costs and emissions down and gain the maximum value from produced CDR.

Assuming an application of 20 tonnes of Greenlandic rock flour per hectare of agricultural land, and 250 kg CO_2 removed per tonne of Greenlandic rock flour spread,[40] one hectare of agricultural land could have a carbon removal potential of 5 tonnes. Assuming the application of 3 tonnes of biochar a year per hectare of agricultural land,[41] one hectare of agricultural land has a carbon removal potential of 6 tonnes. Yet, it is important to consider that not all agricultural land is equally suited as a storage location for ERW and biochar due to the characteristics of the soil.[42]

Figure 14: Technical CO_2 storage potential in the Nordics



Source: Implement Consulting Group based on Anthonsen & Christensen (2021) and Clean Air Task Force (2023).
Notes: 1) Stenlille has not been awarded an exploration license 2) Coda Terminal (Carbfix) is included as part of Nordic storage projects, but the project has been shut down due to political and public opposition. Carbfix, the owner of the project, is now seeking alternative sites to retain EU funding and maintain project timeline

[39] Jordbruksverket (2022), Statistics Denmark (2024), Luke (2024), Statistics Norway (2024) and World Bank Group (2021).
[40, 41] Assumptions based on interviews with industry stakeholder.
[42] Relevant characteristics to consider for ERW is the PH value of the soil, as well as the soils moisture level.

Figure 15: Open-field farmland in the Nordics

Million hectares

Agricultural land in the Nordics (million hectares)					
	Denmark	**Finland**	**Iceland**	**Norway**	**Sweden**
Agricultural land	2.6	2.3	0.2	1.1	3.0

Source: Implement Consulting Group based on Jordbruksverket (2022), Statistics Denmark (2024), Luke (2024), Statistics Norway (2024) and World Bank Group (2021).

Access to low-cost, carbon-free electricity

For most CDR methods, electricity is the key driver of operational costs. Consequently, to scale up a CDR industry, access to low-cost carbon-free electricity is a priority.

The Nordic countries are well endowed with both a very high share of low-carbon electricity as well as electricity prices (well) below European averages. All Nordic countries have carbon-free electricity shares of 85–100%, compared to a European Union (EU) average of about 70% (see Figure 16).

Moreover, electricity prices in the Nordics are on average quite low compared to most other parts of the EU. Northern Norway (NO3+NO4), Northern Sweden (SE1+SE2) and Iceland particularly host low electricity prices of around EUR 25–40 /MWh on average, compared to an EU average of more than EUR 100/MWh.[43, 44.]

In addition, electricity transmission is generally perceived as highly stable in the Nordic countries, with high security of supply and very limited outages. Going forward, substantial build-out of the Nordic transmission grid is required. While timely build-out generally appears to be challenged, it is expected that required reinforcements of the grid will be implemented in the Nordics.

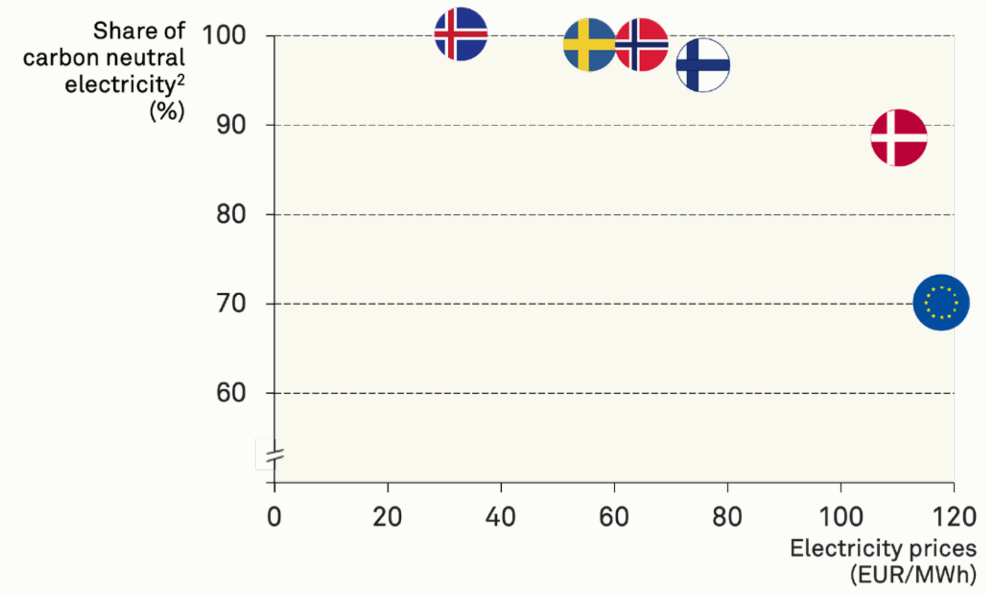
Continued access to carbon-free electricity requires continued build-out of electricity sources. All Nordic countries have ambitious targets for new generation capacity that allow them to meet the needed additional volumes.

Well-developed district heating systems

Most of the technical CDR methods convert large amounts of energy, often resulting in substantial amounts of surplus heat. Denmark, Sweden, Finland, and Iceland have a well-developed district heating system around larger cities,[45] which provides an opportunity to create value out of the surplus heat. This improves the cost-efficiency of the projects in the Nordics compared to projects in other countries. The surplus heat from some pyrolysis processes for biochar production have an even higher temperature, making it a relevant source for industrial process heat, further increasing its value.

[43] Using average spot market prices in the period 2021-2025. Please note that electricity prices in the early 2020's has been sub stantially above "normal" periods for most of the EU including also the Nordics.
[44] NO3+NO4 and SE1+SE2 refers to the specific electricity price areas in Norway and Sweden respectively. Norway is divided into five price areas, where Sweden is divided into four.
[45] The share of district heating in the Nordic countries are the following: Iceland: 90%, Denmark: 65%, Sweden: 50%, Finland:38, Norway: 4%. Based on W. E. District (2021) and Green by Iceland (2025).

Figure 16: Electricity prices and carbon-free electricity shares in the Nordics



Notes: 1) Prices are based on yearly averages in the period January 2021- April 2025. 2) The average of the year 2025 only consist of the four first month.
Source: Implement Consulting Group based on day ahead-prices from Nord Pool, European Day ahead-prices from FfE, and Landsvirkjun (2025).

2.2 The Nordics have a strong regulatory foundation that actively supports the growth of the nascent CDR economy

The scaling of the CDR economy requires a strong political commitment to both decarbonisation in general and carbon removals specifically. At the current maturity of projects, this is important both to secure a stable revenue stream for the first-in-line projects, and to build investor trust in future framework conditions.

The Nordic countries (except Norway) have ambitious net-zero targets that exceed the EU ambition of reaching net-zero by 2050 compared to 1990 emission levels. Finland stands out with the most ambitious target of reaching net-zero as early as 2035, followed by Iceland aiming for net-zero at 2040, Sweden and Denmark aiming at net-zero at 2045 and Norway aiming for close to zero emissions (90–95% reductions) in 2050.

Several Nordic actors emphasise the role of negative emissions in achieving these targets. Sweden, for instance, aims to include 15% emission removals through supplementary measures in its 2045 net-zero goals. Additionally, some Nordic countries have set – or have suggested – net-negative emission targets.

Importantly, Nordic countries have been among the first to provide large subsidy and support schemes to drive the development of BECCS and storage, in particular. Sweden and Denmark have put in place subsidies for BECCS, with dedicated Carbon Capture and Storage (CCS) strategies and initial funding for biogenic and fossil carbon capture. Denmark also aims to strengthen the biochar market, targeting 2 MtCO_2 removals from biochar by 2035 and pledging DKK 10 billion in subsidies by 2027. Norway has so far focused on supporting the concrete Longship project, which aims at developing transport and infrastructure around the Northern Lights offshore storage site with NOK 20 billion in public support.

Figure 17: Nordic and EU-level emission targets, CDR targets and CDR funding schemes

	Net-zero target	Net-negative targets	CDR Targets	Funding schemes for CDR
Denmark	Net zero **2045**	110% emission reduction by 2050 (Not an adopted target, but in a work-programme from the government.)	**All CDR:** The net negative target of 110% requires DK to reduce at least 7.8 CO_2 / year[2] after 2050 **Biochar:** - 2 Mt CO_2 / year by 2030 **CCS:** CCS subsidy aims at reducing 2.3 Mt CO_2 / year by 2030, no clear removal targets set	**2025-2033:** NECCS fund (DKK 2.5 bn) **2026-2046**: CCUS fund (DKK 16 bn) **2029-2044:** CCS fund (DKK 27 bn) **2025-2045:** Biochar support (DKK 10 bn)
Finland	Net zero **2035**	Net-negative post 2040	**LULUCF:** contribution of ~21 MT in 2035.	None
Iceland	Net zero **2040**	Net-negative post 2050	None	None
Norway	**No net-zero target** (Target a domestic reduction of 90-95% domestic reduction by 2050 instead)	None	None	**2005:** CLIMLIT, CC R&D support scheme with NOK 347 million subsidies **2020:** Longship CCS project, focussing on supporting the whole CCS value chain (~NOK 16.8 bn (2020))
Sweden	Net zero **2045**	Net-negative post **2045**	**All CDR:** by 2045, 85% of emissions must be reduced, 15% of emissions can be removed via supplementary measures[1] **BECCS:** The BECCS support scheme aims to fund up to 2 Mt CO_2 / year by 2030	**2022:** BECCS support scheme (reverse-auction, ~SEK 36 bn total approved, focus on bioenergy CCS).
EU	Net Zero **2050**	Net-negative post 2050	**LULUCF:** -310 Mt CO_2e/year by 2030 **Technological removals:** 5 Mt CO_2 / year by 2030	**Horizon Europe** supports CC R&D **EU Innovation Fund** supports low carbon technologies including CDR

Notes: 1) Supplementary measures include BECCS, Enhanced land carbon sinks and Verified emission reductions abroad, 2) 10% of Denmark's 1990 GHG emissions.
Source: Implement Consulting Group based on Naturvårdsverket (2025), Danish Council on Climate Change (2024), Finnish Ministry of the Environment (2022), Danish Energy Agency (2024), Swedish Energy Agency (2025), Government of Iceland (2021), European Commission (2021) and European Commission (2018).

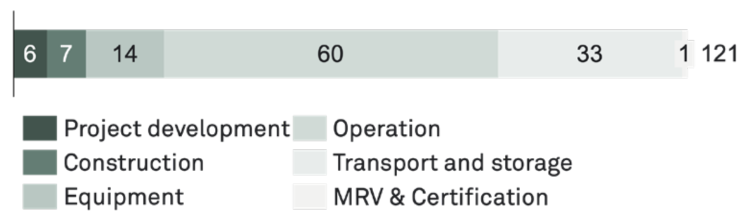
2.3 The Nordics' early engagement has developed a strong ecosystem of actors across different CDR value chains

Despite being a very nascent market, there is already a substantial amount of activity around CDR in the Nordics. The activity is visible across different CDR methods and value chains, suggesting the growth of a synergistic CDR ecosystem in the Nordics. The existing capabilities and the expertise being developed are a valuable starting point for scaling the industry.

As of May 2025, our mapping shows that 121 companies in the Nordics are strongly active in the CDR ecosystem for our chosen technologies.[46] These companies represent actors across the full generic CDR value chain for our chosen methods (see Figure 18), with most companies engaged in the operation of CDR as well as in transportation and storage. There is a smaller presence of Nordic actors involved in the equipment and construction sectors, indicating lower Nordic capabilities in these steps of the value chain, with even fewer actors engaged in project development and MRV & certification.

Figure 18: Companies in the Nordics engaged in the CDR value chain for chosen methods

Number of companies

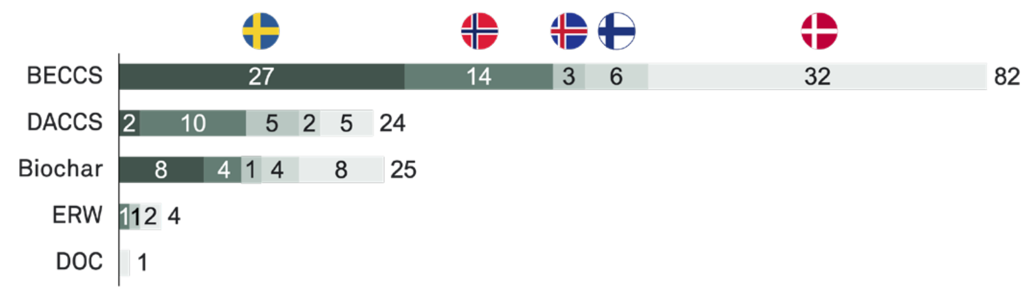


Notes: The chosen methods are BECCS, DACCS, Biochar, ERW and DOC. The mapping is likely not exhaustive
Source: Implement Consulting Group based on Carbon Gap research.

When evaluating Nordic involvement in selected CDR methods, we observe that most Nordic companies are engaged in the BECCS value chain, with 82 companies. Following this, there are 25 companies active in the biochar sector and 24 in DACCS. Additionally, the ERW value chain is emerging, with participation from four Nordic actors. DOC is still in very early development, but notably, one of the very few global players within this space is also present in the Nordics (see Figure 19).

Figure 19: Companies in the Nordics engaged across the value chain of chosen CDR methods

Number of companies

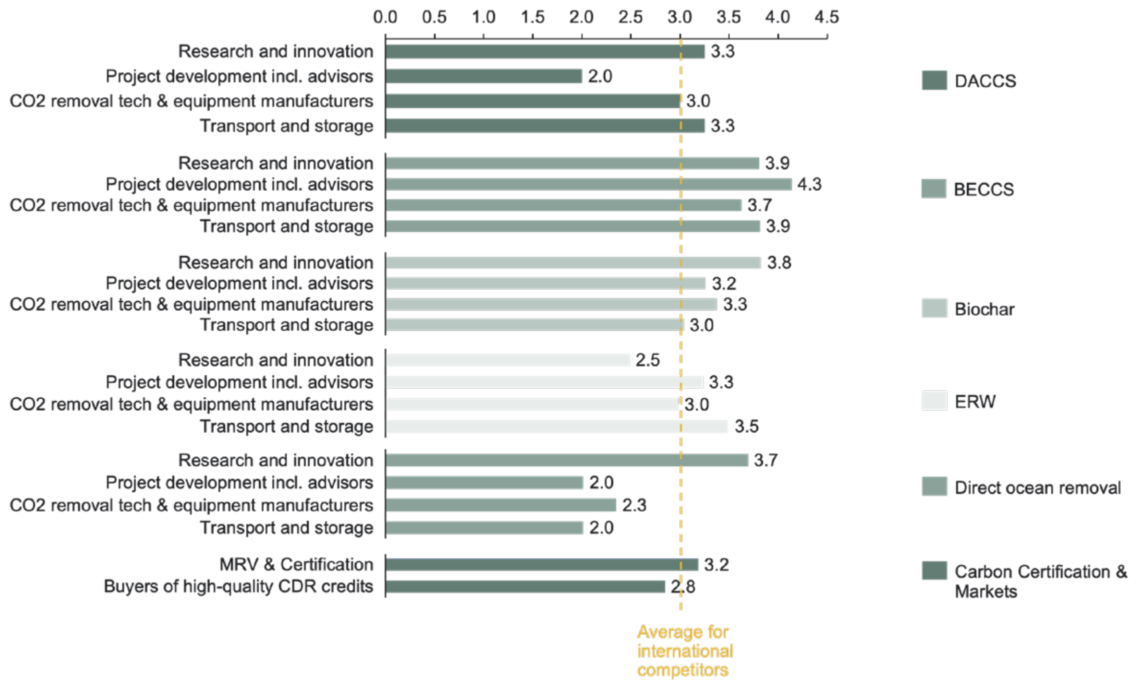


Notes: Including all companies within the value chain of given CDR technology. Companies active within two methods (e.g. storage providers) are counted once per method (e.g. BECCS and DACCS), therefor this figure summaries to more than the total of 121 companies
Source: Implement Consulting Group based on Carbon Gap research.

[46] BECCS, DACCS, Biochar, ERW, DOC. Companies active within other CDR methods are not included in our analysis.

The early Nordic engagement in CDR has resulted in the establishment of valuable capabilities and experience that increase the potential build-out pace and the sustainability of the industry. In a survey we conducted with 80 respondents, we assessed the perceived capabilities of Nordic actors compared to their non-Nordic counterparts. The findings indicate that Nordic actors are viewed as having above-average capabilities, particularly in BECCS, followed by Biochar and ERW (see Figure 20). For DACCS, Nordic actors are perceived to be on par in all steps of the value chain except project development and advisory. For DOC, the Nordics are not rated as favourably, except within research and innovation. Lastly, Nordic actors within MRV & certification are scored slightly above average, while Nordic buyers of carbon removal certificates are scored slightly below.

Figure 20: Perceived strength of Nordic capabilities within the different CDR value chains



Source: Based on an Implement Consulting Group Survey with 78 respondents from the CDR value chain.

Several Nordic projects and companies are truly leaders within the global CDR industries. A selection of Nordic flagship projects and companies (see Figure 21) shows that there are indeed strong capabilities across the different value chains in the Nordics, creating synergies and supporting collective growth. One example is the Climeworks' DACCS projects and the Carbfix storage project in Iceland. Another is Ørsted and Stockholm Exergi's plan to store 430,000 tonnes of captured biogenic CO_2 at the Northern Lights offshore storage site in Norway. Many of these efforts are supported by government subsidies, demonstrating the Nordic governments' commitment to overcoming initial challenges and establishing the first projects of a functioning Nordic CDR ecosystem. This is further exemplified in a series of case studies (see Figure 21)

Figure 21: Overview of selected Nordic flagship projects and/or companies within CDR

BECCS

Ørsted
Asnæs / Avedøre

Ørsted is developing CCS plants at both the Asnæas and Avedøre power stations, aiming to collectively capture 430,0000 tonnes of CO2 annually from 2026. The project was awarded a 20-year subsidy by the Danish Energy Agency.

BECCS

Hafslund Celsio
Klemetsrud

Hafslund is developing a CCS plant at their Klemetsrud waste to energy facility in Oslo, aiming to capture 350,000 tonnes of CO_2 annually from 2029. The project was supported by the Norwegian government via the Longship initiative.

BECCS

Stockholm Exergi
Värta

Stockholm Exergi is developing a CCS plant at their biomass CHP plant, aiming to capture 800,000 tonnes of carbon annually from 2028. Stockholm Exergi has secured funding from both the Swedish Energy Agency and the EU Innovation Fund.

DACCS

Climeworks
Orca / Mammoth

Climeworks operates two DAC facilities, including the Orca plant and the largest Mammoth facility. Orca has been operational since 2021, capturing 4,000 tonnes of CO_2 per year. Mammoth began operations in 2024, designed to capture up to 36,000 tonnes of CO_2 per year.

DACCS

Removr
Polar

Removr is a Norwegian company developing DAC facilities. Their first commercial scale facility in Hellisheidi, Iceland is planned to be operational in between 2028-2030 and capture up to 50,000 tonnes of CO_2 per year

Biochar

Stiesdal
SkyClean

Stiesdal's SkyClean technology utilises a pyrolysis process developed at the Danish Technological University to produce biochar from a wide range of biomass. Stiesdal plans to establish a 20 MW demo plant.

Geological Storage

Northern Lights

Northern Lights (owned by Equinor, Shell, Total and Nordsøfonden) is developing CO_2 transport and storage infrastructure in Norway. It's storage site has been operational since 2024 with a storage capacity of 1.5 million tonnes CO2 per year and aims to scale up to store 5 million tonnes.

Geological Storage

Greensand

The Greensand project (owned by Ineos, Harbour Energy and Nordsøfonden) aims to establish a CO_2 storage site in Denmark with an initial capacity of 400,000 tpa CO_2 from late 2025/early 2026. The project has the potential to scale up to 8 million tonnes.

Geological Storage

Carbfix

The Icelandic Company Carbfix is building storage sites which utilize natural processes where CO_2 is dissolved in water and reacts with rock formations, such as basalt, to form stable minerals. Storage activities are planned to start from 2025 onwards.

ERW

Rock Flour Company

The Rock Flour Company is an Greenlandic company which aims to utilise abundantly available Greenlandic Rock Flour for ERW purposes. Greenlandic Rock Flour has the advantage of enabling ERW in colder climates and can be used in northern Europe.

Source: Implement Consulting Group based on company websites and interviews.

DEEP DIVE | Companies in the Nordics advancing credible and transparent MRV systems and Carbon Market services

A cornerstone in developing a Nordic CDR ecosystem is establishing a robust offtake market built on credible, transparent MRV services and certified carbon credits issued through robust and international crediting platforms —complemented by trustworthy, value-added offerings for potential offtakers. In the Nordics, several leading companies are engaged in creating such market infrastructure and services.

From globally leading standards and methodologies through project verification and certification to tailor making offerings to possible buyers of removal certificates, the Nordic region fosters strong capabilities contributing to signaling demand for future CDR projects, de-risking financing, and accelerating project development.

1

Activating the Nordic BECCS market: Inherit, Nordea and Puro.earth

Inherit, a Norwegian carbon removal developer, is establishing one of the first operational biogas-based BECCS plants in Denmark. Nasdaq-backed Puro.earth, a world leading standard, registry and platform focused solely on durable carbon removal, will certify Inherit's high-integrity carbon removal credits. Nordea, the leading Nordic bank, has committed to purchasing 68,000 tonnes of these credits over five years, signalling strong market demand and helping to de-risk financing and accelerate project development. This collaboration highlights the feasibility and investment potential of BECCS in the region and sets a precedent for how to bring a project to market.

2

Supporting the Nordic CDR market with expert knowledge: South Pole

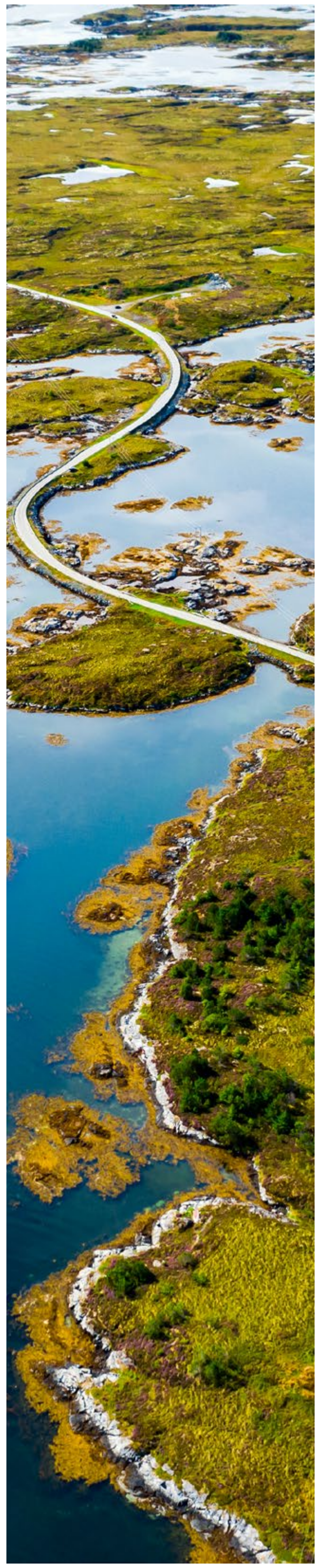
The carbon project and climate consultancy South Pole, with its extensive global experience and strong presence in the Nordics, has been instrumental in supporting early CDR market development. Through initiatives like NextGen and Airfix, South Pole has linked regional Nordic efforts to global frameworks, promoting robust accounting and compliance market alignment. Their work with Nordic stakeholders on certification, procurement, and finance solutions exemplifies their role in fostering high-integrity carbon removal projects and shaping a credible, equitable market.

3

Connecting High-quality Carbon Removal Projects with Strategic Buyers: Klimate

Klimate, based in Copenhagen, connects high-quality carbon removal projects with strategic buyers, leveraging a digital platform for transparent oversight and measurable impact. By offering access to strictly vetted projects and a portfolio approach to CDR, Klimate helps companies minimise risk and maximise impact. Their efforts in connecting project developers with forward-thinking buyers have supported the development of CDRs, bringing crucial offtake certainty to developing projects.

DEEP DIVE | Nordic Collaboration: Marking the beginning of the engineered carbon removal era



The Nordics played a defining role in creating the first credible market mechanisms for engineered carbon removal. Through early collaboration and innovation, the region helped establish the foundation for high-integrity carbon removal credits—driving the emergence of a market that is now gaining global traction.

Pioneering Projects & Technology Breakthroughs

In 2019, the voluntary carbon market lacked a credible, scalable mechanism for durable, engineered carbon removals. Most carbon credits focused on avoidance or reduction - removals were the missing piece for neutralising residual emissions in net-zero strategies.

→ Recognising this gap, Puro.earth, a Finnish company, started developing the first standard for engineered removals.

→ Introduced to the founders of Puro, South Pole played a role in shaping the early development of the platform. As one of 22 signatories – together with a number of Nordic front runners - South Pole co-developed the first methodologies, including for biochar, and helped translate the concept into a functioning market.

→ Just 71 days later, the world's first CO_2 Removal Certificate (CORC) auction was held, with South Pole enabling early corporate participation - for Nordic as well as international pioneers in the CDR space, such as Swiss Re.

Business and Market Development

→ Puro.earth CORCs enabled companies to neutralize residual emissions through third-party verified removals, setting a new benchmark for climate action.

→ South Pole facilitated access to the inaugural and subsequent CORC auctions, enabling Nordic and global corporates to participate in the early CDR market.

→ Today, Puro.earth has evolved into the leading standard and registry for durable engineered carbon removal and auctions have been replaced by fully developed external marketplaces and intermediaries.

Collaboration and International Influence

→ Early cooperation between Nordic actors - developers, buyers, intermediaries, and standards bodies - was critical to building the viability of the durable CDR market

→ South Pole continues to be a key market intermediary, integrating Puro.earth CORCs into climate strategies for companies worldwide.

→ The milestone of over one million CORCs issued reflects the long-term market infrastructure seeded by this Nordic-led initiative.

What began as a Nordic-led effort to create the world's first engineered carbon removal market has laid the groundwork for global action. As demand for high-integrity removals grows, continued collaboration between standards, intermediaries, and buyers will be essential to scale durable carbon removal - and realise its full potential in delivering net-zero.

Intermediate transport and logistics infrastructure under development

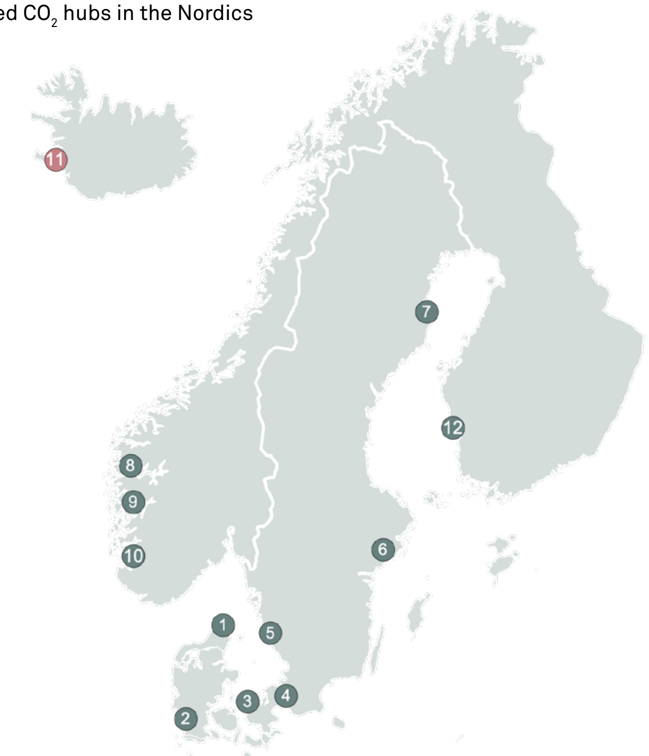
Due to the early Nordic engagement, there is already substantial activity and development within intermediate transport and logistics. The intermediate management of CO_2 is a complex logistical challenge, and requires a substantial multi-user infrastructure, often anchored around CO_2 hubs and exporting terminals.

The Northern Lights terminal in Øygarden is the most advanced project – operational since 2024 and handling 1.5 $MtCO_2$ per year. Ten other CO_2 hubs have been announced in the Nordics, and several more are or have been considered (see Figure 22).

Storage providers in Norway, Denmark and Iceland are currently developing onshore CO_2 receiving terminals connecting to offshore CO_2 storage sites. The first Danish CO_2 receiving and shipping terminals are to be operational within the next year, with the Esbjerg CO_2 terminal, built to receive and handle the CO_2 for the offshore storage site Greensand, aiming to start operations in late 2025 or early 2026 and the Greenport Scandinavia project in Hirtshals expecting to receive its first volumes of CO_2 for storage in the onshore site Gassum around 2026. Carbfix received EU funding in 2022 to build a CO_2 receiving terminal in Iceland. Their Coda Terminal in Straumsvík has recently faced local opposition, and Carbfix is now looking for an alternative location in Iceland.

While we see no storage sites under development in Sweden – due to its limited technical storage potential – we see several CO_2 exporting hubs under development, aimed at exporting CO_2 captured in Sweden to storage sites in Denmark and Norway. The Stockholm Norvik project, developed in collaboration with several large Swedish CCS actors such as Stockholm Exergi, Malärenergi, Söderenergi, Vattenfall, Heidelberg Marterials, Nordkalk and Plagazi, is planned to become the largest CO_2 hub in Sweden, handling up to 9 $MtCO_2$ per year. Moreover, Malmö/Copenhagen is in early-stage development by a similar group of companies including Sysav, Nordion, Uniper, E.ON, and Copenhagen Malmö Port, with the support of Växjö and Öresundskraft.

Figure 22: Announced CO_2 hubs in the Nordics



CO_2 Hub
1. Hirtshals Port
2. Esbjerg Port
3. Kalundborg Port
4. Copenhagen Malmö Port
5. Port of Gothenburg
6. Stockholm Norvik
7. Skellefteå
8. Smeatheia Terminal
9. Northern Lights Terminal
10. Gismarvik CO2 Hub
11. Coda Terminal[1]
12. Port of Pori

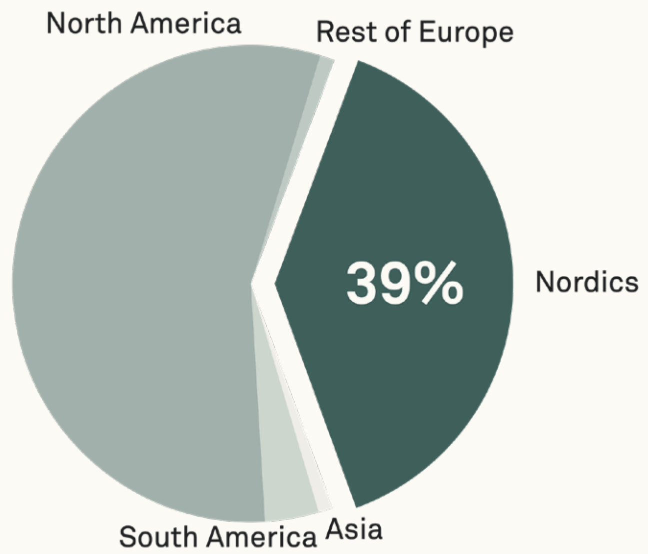
Notes: 1) Coda Terminal (Carbfix) is included as part of Nordic CO_2 hubs, but the project has been put on hold due to public opposition. Carbfix, the owner of the project, is now seeking alternative sites to retain EU funding and maintain project timeline.
Source: Implement Consulting Group based on company websites.

Nordic projects are the largest providers of permanent carbon removal certificates

A clear testament to the early engagement in the Nordics is the very large share of sold Carbon Removal Certificates (CRCs) coming from Nordic projects. As of May 2025, 39% of the top 25 CDR sellers by volume were Nordic actors (see Figure 23).[47] Two Nordic companies in particular stand out, with Stockholm Exergi being the second largest CDR seller by volume, selling a total amount of 5 Mt CDRs to buyers such as Microsoft and Frontier Buyers. The Danish company Ørsted further stands out as the fourth biggest supplier, selling a total amount of 4 million CDRs to Microsoft and Equinor.[48] Other Nordic BECCS sellers include Öresundskraft AB selling to Wihlborgs and Helsingborgshem, and Hafslund Celsio selling CDR credits to the Frontier Buyers coalition.

Figure 23: Nordic sellers' share of top 25 sellers' total CDR volume (2020 - May 2025)

$MtCO_2$ removal



Notes: Including all transactions made before 13/05/2025. 99.5% of transactions involve permanent technical removals.
Source: Implement based on CDR.fyi (2025).

According to industry stakeholders, the fact that the projects were based and developed in the Nordics were well-received by international buyers of credits, associating the Nordics with high quality and low risks due to among others strong sustainability standards and stable framework regulatory conditions in the Nordics.

[47] 99.5% of the measured volumes are permanent technical removals
[48] The transactions are closed, however actual delivery of credits will only take place once the projects are fully operational

2.4 A scaled-up ecosystem would rely on different comparative strengths of the Nordic countries

To scale up the CDR ecosystem in the most cost-efficient manner, it is crucial for the Nordics to collaborate and create cross-Nordic CDR value chains. The Nordic countries possess different CDR strength positions based on their intrinsic characteristics and geographic conditions. Collaboration will allow the Nordics to develop synergies and capitalise on the strengths of neighbours, optimising the overall CDR potential.

Sweden and Finland have significant biogenic CO_2 point sources that present substantial potential for BECCS. Despite this potential, both countries lack sufficient local storage capacity. Finland has prohibited CO_2 storage due to unsuitable geology, while Sweden has identified a relatively low technical potential of 3–10 $GtCO_2$ and lacks active storage projects. Consequently, Sweden and Finland must rely on Norwegian, Danish, and Icelandic storage to realise their full BECCS potential.

Norway on the other hand has a large potential for offshore storage due to suitable geological foundations in the North Sea and existing offshore oil and gas expertise which can be transferred to the development of offshore storage sites. However, Norway does not have large potential for BECCS due to a limited amount of existing biogenic CO_2 point sources. Current Norwegian point sources emit only 1.8 Mt of biogenic CO_2. To achieve economies of scale for its storage sites, Norway would benefit from importing CO_2 from Sweden, Finland, and potentially other countries.

Norway and Iceland both have a strong foundation for DACCS, with low electricity prices,[49] high renewable energy shares and proximity to storage sites. These are the ideal conditions for DACCS. Moreover, both countries also have vast supplies of the silicon minerals used for ERW. Norway supplies nearly half of all global olivine used for industrial purposes and Iceland has abundant basalt supplies. These minerals – once crushed – could be disbursed on farmland in other Nordic countries to improve soil quality, although this is contingent on upcoming EU regulations regarding olivine's heavy metal content. Due to ERW being more effective under warmer climatic conditions, the minerals might need to be transported outside of the Nordics.

Denmark has a more balanced position than the other Nordic countries, as it has the potential for BECCS and biochar, as well having geological storage onshore and offshore, not to mention farmland for 'storing' biochar and ERW. As Danish storage sites become operational, a mix of CO_2 from Nordic and other European countries will be ideal to achieve economies of scale. Denmark has relatively high electricity costs compared to other Nordic countries. However the proximity to storage sites (e.g. onshore) provides an opportunity for DACCS in Denmark in particular if it can take advantage of very low power prices during peak production. Additionally, including also potentials in Greenland, there is abundant glacial rock flour which can be used on Danish farmland for ERW or exported to other countries.

All of the Nordics have long coastlines and access to high seas, which makes the countries relevant for ocean-based removals such as direct ocean capture and ocean alkalinity enhancement. DOC in particular also relies on electricity input, and a possible business model would be to build floating DOC platforms near large offshore wind farms and near offshore storage. This would leverage renewable electricity with low prices during peak production and minimise the cost of transporting the CO_2 to storage sites.

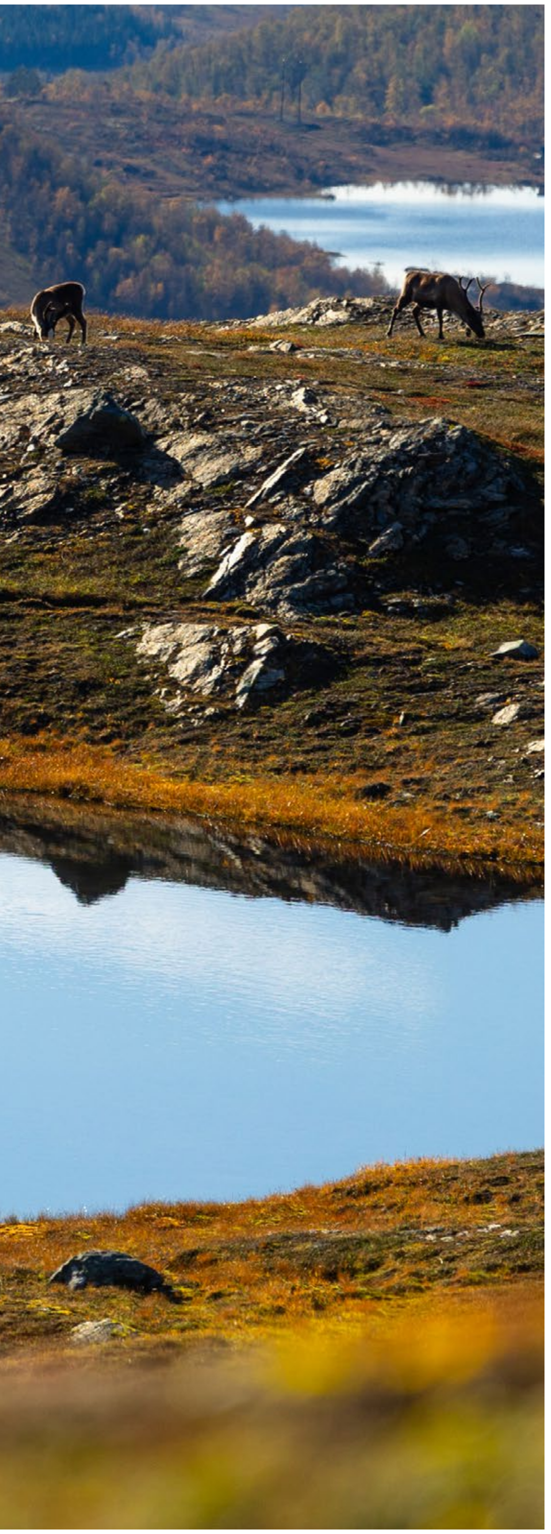
[49] For Norway, especially in its northern regions.

Figure 24: Strength position of different Nordic countries

	Denmark	Finland	Iceland	Norway	Sweden
Strength position	BECCS; On & Offshore Storage; Biochar; ERW; DOC	BECCS; Biochar	Onshore Storage; DACCS; ERW	DACCS; DOC; ERW; Offshore Storage	BECCS; Biochar
Strength rationale	• Significant potential for BECCS and biogenic feedstock and agriculture for Biochar • Onshore and offshore storage sites under development • Abundant occurrence of Greenlandic rockflour • Low offshore wind power prices & proximity to offshore storage makes Denmark attractive for DOC	• Large potential for BECCS from Pulp and Paper industry • Large biomass sources for Biochar production	• Onshore storage potential due to abundant basaltic rock • Low electricity prices and proximity to storage makes Iceland attractive for DACCS • High basalt occurrence offers ERW potential	• Large storage potential and development of existing storage sites • Low electricity prices and proximity to storage makes Norway an attractive location for DACCS & DOC • Large Olivine production for ERW	• Significant potential for BECCS from Pulp & Paper, Heat and Power and biogas production • Large biomass sources for Biochar production
Collaboration potential	• Import biogenic CO_2 for storage from Sweden and Finland • Export biogenic CO_2 to Norway until national storage is scaled • Export ERW to Sweden and Finland, who engage in open field farming	• Export of biogenic CO_2 to Denmark, Norway or Iceland for storage	• Import biogenic CO_2 from Sweden, Denmark and Finland • Export of Basalt to Sweden, Finland and Denmark, who engage in open- field farming	• Import of biogenic CO_2 from Sweden and Finland • Import of biogenic CO_2 from Denmark until Danish storage is scaled up • Export of ERW to Sweden, Denmark and Finland, who engage in open-field farming	• Export of biogenic CO_2 for storage in Norway, Denmark or Iceland

Notes: The figure only shows high CDR strength positions per Nordic country in a common Nordic CDR ecosystem. This does not imply that other CDR technologies should not be developed in each Nordic country.
Source: Implement Consulting Group.

2.5 The Nordics could be a major removal hub for Europe



Given that the Nordics have several intrinsically good prerequisites for developing a large-scale CDR ecosystem, how large could such an ecosystem develop to be?

We estimate that by 2050, the Nordics could bolster a CDR ecosystem of permanent CDR methods removing about 85–160 MtCO_2 per year.[50] This ecosystem would deliver around 35–60% of the current expected need for CDR in Europe. We note that this is not an upper boundary for how large the ecosystem could become, as several CDR methods have almost no technical limit, and additional demand likely could materialise from outside the EU.[51]

According to the recent report by the European Scientific Advisory Board on Climate, the EU would need to rely on permanent carbon removal methods in the amount of 233–256 MtCO_2 annually by 2050 to meet its net-zero climate targets.[52, 53] These removals are needed to offset the remaining very-hard-to-abate emissions, and will be realised with a high likelihood through e.g. inclusion in the EU Emissions Trading System (ETS) scheme and/or other compliance mechanisms. Given the Nordic region's very strong fundamental position in CDR, we consider it possible that 35–60% of this carbon removal need could be delivered by the Nordics.

The CDR methods deployed will most likely be different between the Nordic countries, given each country's different characteristics (see Table 1).

BECCS is likely to become the main CDR method in the scenarios we are considering. By capturing the biogenic CO_2 from combined heat-and-power plants, waste-to-energy plants, paper and pulps mills, and biogas plants we estimate a potential of around 50–64 MtCO_2, taking into account both a partial phasing out of biomass in the Danish heating sector as well as not adding more biomass to the Nordic energy systems. [54]BECCS will in particular play a role in Sweden and Finland.

For biochar, we estimate a total potential of around 15–21 MtCO_2 per year. This is relatively evenly distributed across the Nordic countries (except Iceland, with its very limited biomass availability) due to both relatively similar availability of residual biomass fractions as well as opportunities for dispersal on open-field farmland. This assumes that additional biomass residue will be used for biochar.

[50] Due to the substantial uncertainties on technological and commercial readiness as well as economic incentives and regulatory frameworks, such an assessment will naturally be based on a number of assumptions with large uncertainties.
[51] Direct air capture as an example is only restricted by land availability and electricity supply. With enough of both, the technical potential is massive. Similar for other methods such as direct ocean capture, ERW and ocean alkalinity enhancement
[52] European Scientific Advisory Board on Climate Change, 2025 – Figure 3.
[53] These numbers are a little higher than those published by the European Commission in 2024 which generally are more optimistic about the amount of emission reductions as well as relying more on nature-based removals (LULUCF) than the Advisory Board does.
[54] Several estimates in the literature suggest a higher potential from BECCS. These often assume additional use of biomass for energy purposes, which we have conservatively assumed will not be the case in the Nordics due to higher valued purposes for the biomass.

For DACCS, we estimate a potential of around 14–34 MtCO_2 per year. This is extremely uncertain, and very difficult to predict, as DACCS is mainly restricted by electricity availability.[55] We have based the estimate on a combination of how much is needed to deliver on national targets[56] as well as the assumed need for DACCS in the EU. We estimate that DACCS will play a particular role in Norway and Iceland, where electricity prices are low, and it is possible to locate very close to storage sites (as also witnessed by the current DACCS demonstration facilities already sited in Iceland and Norway).[57] DACCS could also play a role in Denmark in particular if co-located with large electricity generation to take advantage of fluctuating (low) power prices.

We note that there could be a much higher DACCS potential in the Nordics if the costs of the technology come down sufficiently and availability of power is not a limiting factor. An extensive literature review by the European Advisory Board found a potential for DACCS in the EU of 0–400 Mt in 2050, with electricity availability as the main restriction on how large a share of that could be taken by the Nordics.

For Enhanced Rock Weathering, we estimate a potential of around 5–25 Mt per year. ERW potential is almost limitless as silicate minerals are abundant, and dispersal opportunities are plentiful. However, as ERW is generally more effective with higher temperatures than in the Nordics, the economic opportunity for the Nordics is most likely larger by applying Nordic minerals to lands outside the Nordics. ERW could, however, take place in the Nordics – especially using the minerals in Greenlandic glacial flour, which works better in colder environments.

For DOC, we estimate a potential of around 0–15 Mt per year. Due to the low technical maturity of DOC, the potentials stated come with even higher uncertainty than our estimates for DACCS. In our lower scenario, we therefore assume that the technology will not further mature and not contribute to the Nordic CDR potential. Nevertheless, we estimate that Norway could benefit from low electricity prices and offshore storage locations, as well as their collected expertise from developing DACCS, and we therefore include an upper potential of 10 Mt per year, equalling Norway's lower potential for DACCS. We also see potential for the build-out of DOC in Denmark and Iceland, but to a lower extend. As with DACCS, we note that the actual technical potential is much higher than estimated here, as DOC is primarily limited by electricity availability.

[55] And to some extent land use
[56] To deliver on the Danish ambition of 110% net negative, it is estimated by Klimarådet that 8-13 Mt of DACCS is needed per year.
[57] We take note that large-scale increases in electricity generation appear to be challenging in Iceland, at least in the short-medium term.

Table 1: Estimated removal potential per CDR method and Nordic country

$MtCO_2$ per year

	Denmark	Finland	Iceland	Norway	Sweden	Total
BECCS	3-6	15-20	0	2-3	30-35	**50-64**
DACCS	0-3	0	4-6	10-25	0	**14-34**
Biochar	5-6	5-6	0	3-5	2-4	**15-21**
ERW	4-7	0-6	0-1	0-3	1-8	**5-25**
DOC	0-3	0	0-2	0-10	0	**0-15**
						85-160

Notes: All estimates are subject to uncertainties.
Source: Implement Consulting Group based on Interview with Dansk Fjernvarme, Interview with The Rockflour Company, Carbon Gap (2024), Kujanpää et al. (2023), Fossilfritt Sverige (2024), Det Nationale Bioøkonomipanel (2022), Corbo (2020), Gylfadóttir (2024) and European Scientific Advisory Board on Climate Change (2025), Danish Energy Agency (2023).

2.6 Upside scenario for a Nordic CDR ecosystem

The current need for CDR in the EU estimated by the European Scientific Advisory Board on Climate Change is conservative. The Advisory Board only considered how much CDR is needed for the EU to meet its own net-zero target in 2050, but does not consider whether the EU should also play a role in meeting the global requirement for CDR, as estimated by the IPCC to be about 7–9 $GtCO_2$ per year by 2050. Currently, afforestation, reforestation, and improved forest management, along with soil carbon and durable wood products, remove 2 $GtCO_2$ annually, leaving 5–7 $GtCO_2$ of residual emissions to be addressed by 2050. If we assume that the EU instead builds out CDR proportionally to its share of global Gross Domestic Product (GDP) (24%), the EU will need to deploy 1.2–1.7 Gt of CDR per year in 2050, up to seven times higher than the ~250 Mt estimated by the Advisory Board. [58]

As argued throughout the report, we expect the Nordics to play a role as CDR provider for Europe. If the Nordics could capture 25–50% of the remaining EU need for CDR, this could therefore add up to 300–850 $MtCO_2$ removals per year. Since biomass is the most limiting resource, we expect that this potential would not be fulfilled by further volumes of BECCS and biochar, but rather via DACCS, DOC and ERW – and possibly other novel removal methods – that would be deployed to meet the additional need. For DACCS and DOC, additional renewable electricity would become the limiting factor. Countries with the possibility to scale renewable energy will therefore be able to capture the largest share of the global CDR potential.

[58] European Scientific Advisory Board on Climate Change (2025)

3 Unlocking the Nordic CDR opportunity involves substantial economic benefits

The Nordic countries have a significant opportunity to benefit from the development of a large-scale CDR ecosystem. Establishing and operating carbon removal industries will generate jobs, stimulate economic growth, and contribute to regional GDP. By investing early in the necessary technologies and operational capabilities, the Nordics can position themselves as global leaders in industrial innovation – enabling them to export both their solutions and project development expertise. Moreover, CDR technologies offer a cost-effective way to address hard-to-abate emissions, helping countries meet their climate targets more efficiently. The potential for exporting these solutions underscores the broader economic value of building a robust CDR ecosystem in the region. Being leaders in the CDR market has the potential to support economic development in the Nordics through up to EUR 17 billion in GDP contribution and 148,000 quality jobs per year by 2050.

3.1 An economic growth potential of up to EUR 17 billion – or 1% of the Nordic GDP

The CDR industry has the potential to become a significant economic and employment driver in the Nordic region, supporting both GDP and jobs. This opportunity is directly linked to the scale of CDR required to meet global climate targets. As detailed in Chapter 2.5, we estimate that the Nordics can bolster a CDR ecosystem removing about 85–154 $MtCO_2$ per year by 2050, thereby contributing a substantial portion of the overall need for CDR in the EU – estimated at around 233 to 256 $MtCO_2$.[59]

Substantial investment is required to achieve this scale. By 2050, this investment will increase the total demand in the economy by EUR 15–27 billion annually,[60] supporting Nordic GDP directly by EUR 6–11 billion annually by 2050. Including the indirect impact, the CDR industry will totally contribute EUR 9–17 billion to Nordic GDP, which is equivalent to 0.5–1% of the region's GDP (see Figure 25).

The industry will directly employ 48,000–83,000 people in the Nordic region, and purchases from Nordic subcontractors will support an additional 37,000–64,000 jobs (indirect impact). In total, the CDR industry will support 84,000–148,000 jobs, which corresponds to the total current employment within civil engineering in the Nordics.[61]

Two scenarios

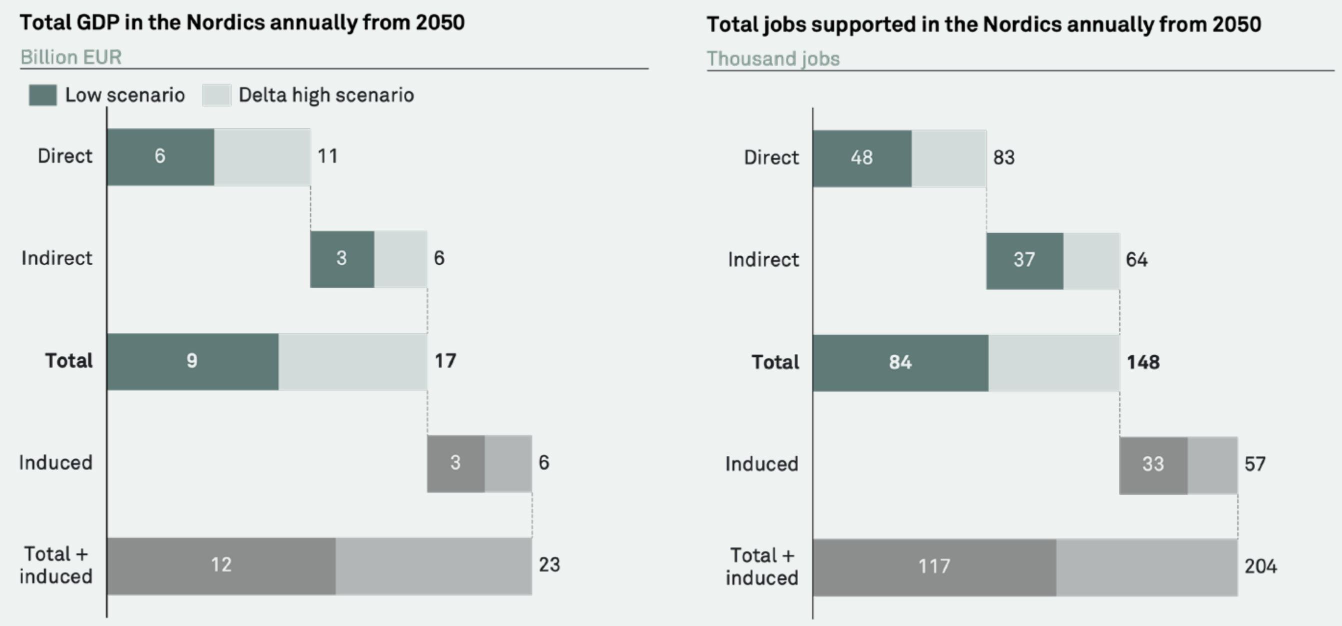
The economic potential is based on two scenarios for the Nordic CO2 removal potential, as detailed in Chapter 2.

1. 85 MtCO2 annually by 2050. This reflects a scenario where the Nordics will account for at least 35% of the total EU need for carbon removal.

2. 154 MtCO2 annually by 2050. This reflects a scenario where the Nordics will provide ~60% of the total EU need for carbon removal.

[59] European Scientific Advisory Board on Climate Change (2025)
[60] CDR potential by method times the annual average cost per method.
[60] Eurostat (2024)

Figure 25: Total economic contribution in the Nordics annually by 2050



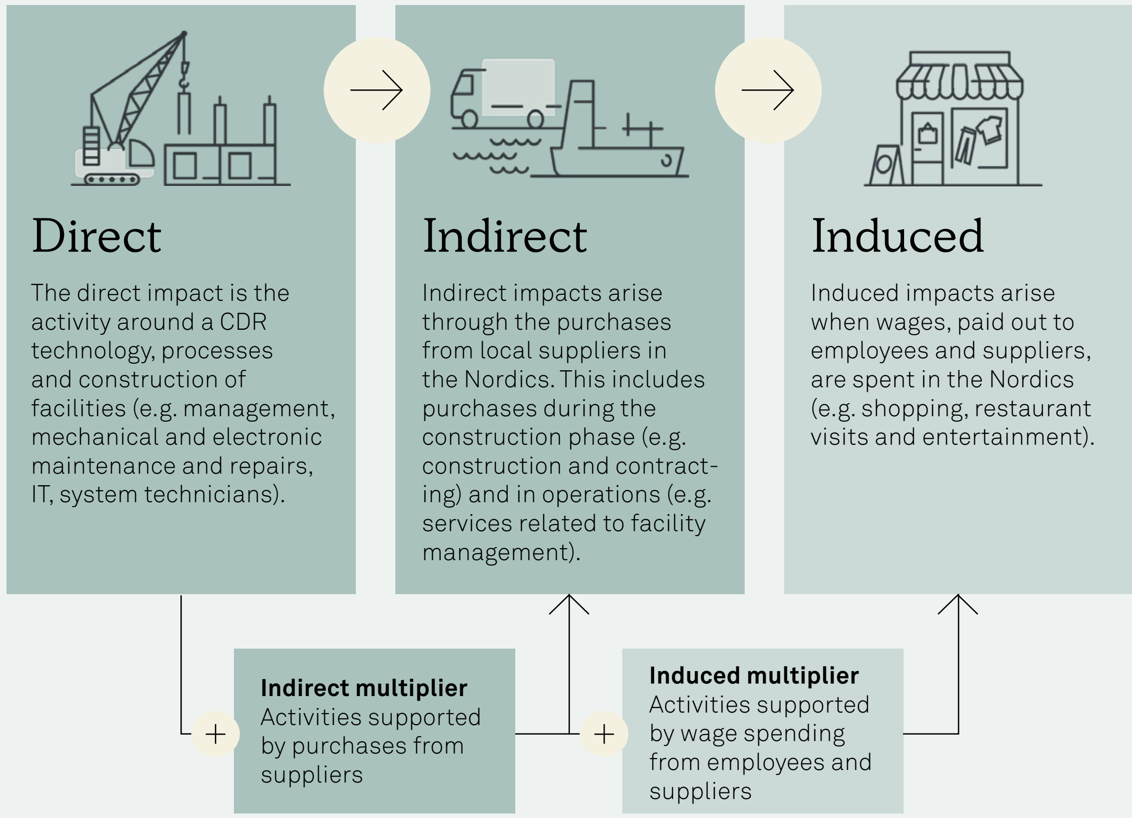
Notes: Induced effects are shown here but excluded in the rest of the report due to higher uncertainty. Going forward, the focus is on direct and indirect impacts only. The economic potential is measured in terms of GVA. GVA is the standard measure of economic value at sector level and is a major part of the GDP, which also includes net taxes.
Source: Implement Consulting Group based on the OECD STAN database for structural analysis and interviews within the CDR sector.

Economic model methodology

The activity in and around the CDR industry spreads throughout the economy in all the Nordic countries. The economic activity from the expenditure required to construct and operate the different CDR methods (direct impacts) spreads through purchases from subcontractors (indirect impacts) and to the spending of the employees and subcontractors' wages (induced impacts), see Box 1 below. We are quantifying these effects using an economic input-output model that provides multipliers for direct, indirect and induced impact on GDP and employment, based on the Nordic countries' inter-industry transactions to estimate how increased demand in the CDR industry impacts GDP and jobs in the entire Nordic economy (see appendix for detailed methodology).

This report focuses on the direct and indirect economic impacts of CDR deployment and hence excludes the induced effects. Induced effects are more uncertain, less attributable to specific interventions, and can vary significantly depending on modelling assumptions. To ensure transparency, comparability, and policy relevance, only direct and indirect impacts are reported going forward in the report.

Box 1: Explanation of the Input-Output model



Notes: We will focus on only direct and indirect effects in this report.
Source: Implement Consulting Group based on Miller and Blair (2009).

The economic potential is reflected by the GDP contribution to the economy, measured in terms of Gross Value Added (GVA). GVA serves as the standard measure of economic value at the industry level and is a significant component of GDP, which also includes net taxes. Thus, GDP contribution refers to the value added to the economy from an industry, differing from the expenditure or investment in the economy (price multiplied by volume), as used in other publicly available reports. The expenditure in one industry does not directly translate into GDP if parts of it are used to purchase inputs (goods or services) from other industries, thereby not adding value to the industry where the expenditure occurs. The same principle applies to indirect GDP contribution; only the portion of the expenditure placed in subcontracting sectors that is not used for buying inputs from other sectors or countries contributes to value added and thus GDP.

3.2 Economic potential is highly enabled by BECCS and DACCS

The economic potential differs across CDR methods, with BECCS and DACCS contributing significantly compared to other methods. By 2050, BECCS could contribute up to EUR 7 billion annually to GDP and create up to 64,000 jobs in the Nordic region, driven by its high removal potential (see Figure 26 and Figure 27).

Figure 26: Total GDP contribution in the Nordics annually from 2050 by method

Billion EUR

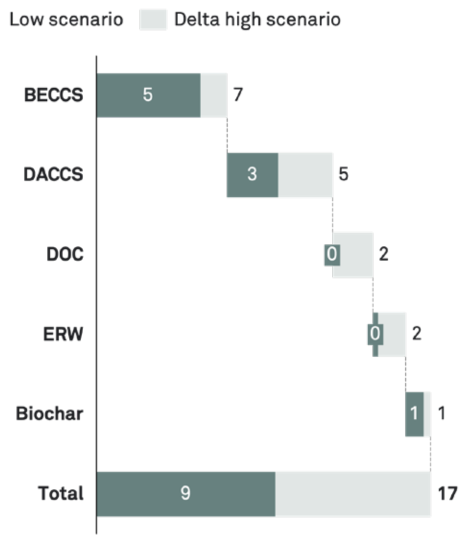
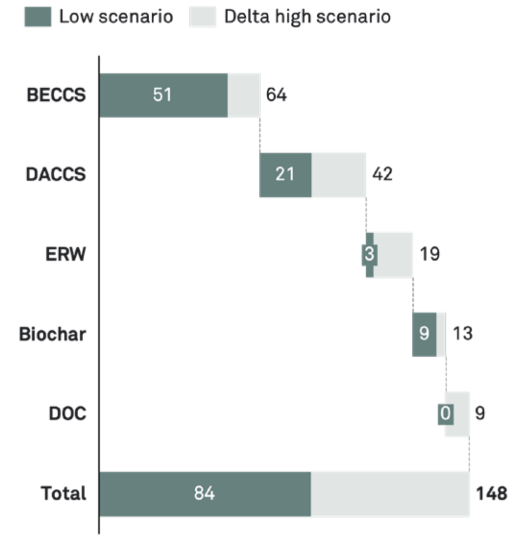


Figure 27: Total jobs supported in the Nordics annually from 2050 by method

Thousand jobs



Notes: The economic potential is measured in terms of GVA. GVA is the standard measure of economic value at sector level and is a major part of the GDP, which also includes net taxes.
Source: Implement Consulting Group based on the OECD STAN database for structural analysis and interviews within the CDR sector.

The differences between CDR methods are mainly driven by removal potential and the average annual price of removing one tonne of CO_2. When we normalise the numbers to reflect the impact per EUR 1 million invested, the methods show similar economic effects. In terms of jobs, DACCS generates the lowest number of jobs per EUR 1 million invested. The distribution of equipment for DACCS involves imports from countries outside the Nordic region, which diminishes job creation within the region. Conversely, biochar generates approximately eight jobs per EUR 1 million expenditure. This is especially driven by the low share of import from outside the Nordics, significantly impacting job creation within the Nordics.

The economic activity assessed in this study includes the activity from the whole value chain related to the CDR methods

This study examines the economic potential supported by each step of the value chain of various CDR methods, from research and innovation to the construction of specific technologies, the recurring impact from operating it, including transport and storage, all the way to MRV and certification, and finally, intermediaries selling credits (see Table 2).

Table 2: Description of activities within value chain

Research and innovation	Innovating methods for capturing and storing CO_2.
Project development	Development of projects, including legal, technical and commercial advisors.
Construction and equipment	Construction of buildings etc. as well as sourcing of the capture technology.
Operation	Daily operation needed to capture CO_2.
Transport and storage	Liquefaction, intermediate transport and storage through pipelines, trucks etc. (applicable for BECCS and DACCS) and final transport to storage sites.
MRV & certification	Measurement, reporting and verification of removed CO_2 as well as certification.
Carbon markets	Sales of CO_2 credits through intermediaries.

Notes: The order of the value chain steps may vary across CDR methods.
Source: Implement Consulting Group based on interviews within the CDR sector

Around 30% of the GDP added to the Nordic region will be generated from economic activity within *Construction and equipment*, while about 25% will be generated from activity within *Transport and storage*. Increased economic activity within *Construction and equipment* is projected to support up to 57,000 jobs annually by 2050, while the *Transport and storage* industry will support upwards of 35,000 jobs annually (see Figure 28 and Figure 29).

We are quantifying the economic potential by aggregating the economic contributions for each step in the value chain according to the two scenarios of Nordic CO_2 removal potential for each CDR method derived at in Chapter 2.5. The method of breaking down the economic potential allows identification of the unique economic contributions from each CDR method and each step of the value chain, highlighting the specific roles played by equipment suppliers, input providers, operational service providers and other key players.

Figure 28: Total GDP in the Nordics annually from 2050 by value chain steps

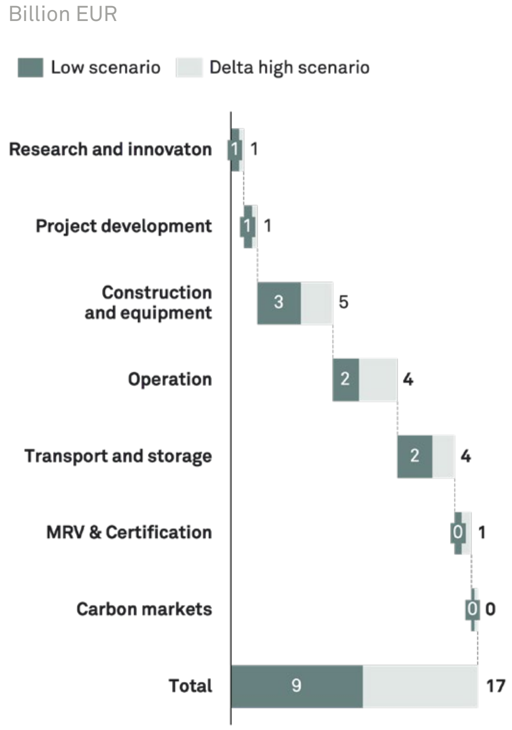
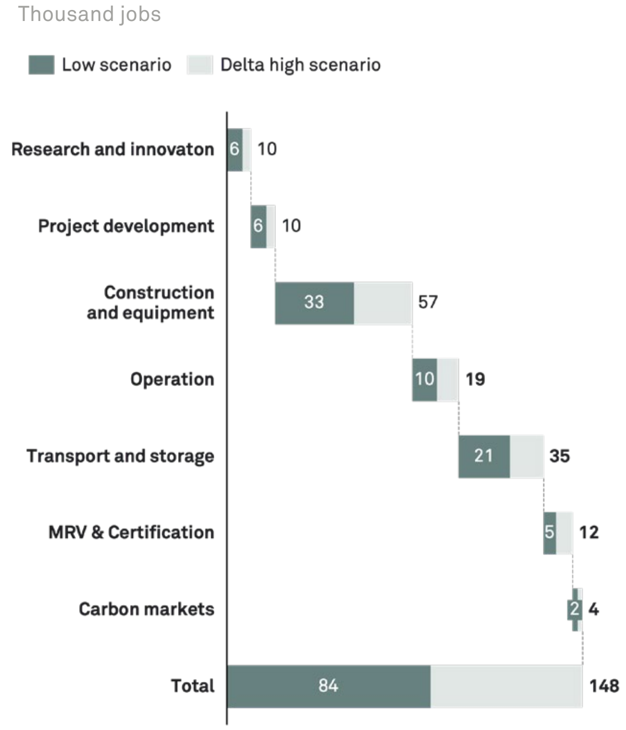


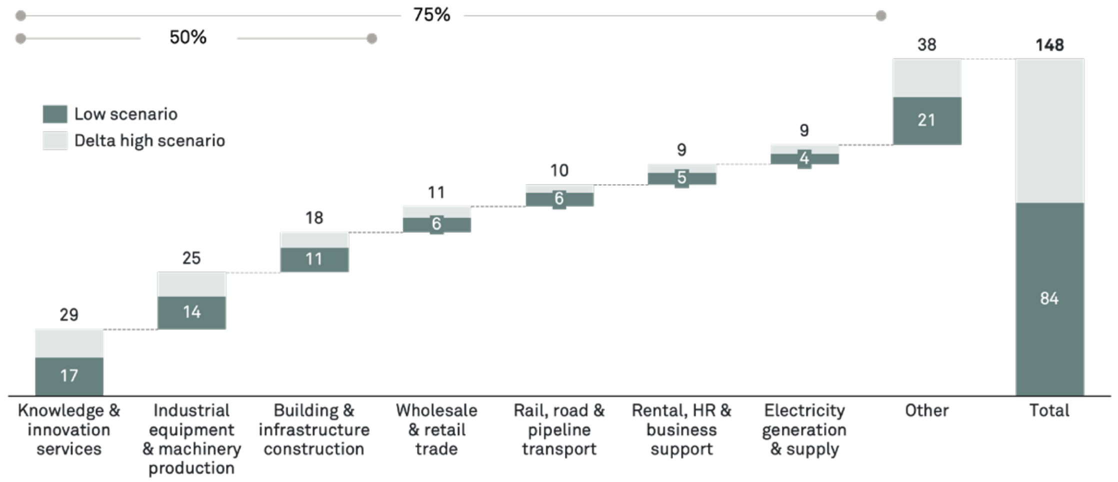
Figure 29: Total jobs supported in the Nordics annually from 2050 by value chain steps



Notes: The economic potential is measured in terms of GVA is the standard measure of economic value at sector level and is a major part of the GDP, which also includes net taxes.
Source: Implement Consulting Group based on the OECD STAN database for structural analysis and interviews within the CDR sector.

Investments in CDR will drive demand across various industries, stimulating economic activity beyond the sectors directly involved in CDR operations, hence the jobs generated will not only be within the specified industries but spread out in the Nordic economy. The industries that will benefit the most from investments in CDR in the Nordic are *Knowledge & innovation services*, *Industrial equipment & machinery production* and *Building & infrastructure construction* (see Figure 30). These three industries account for about 50% of the total jobs generated through the CDR industry. The substantial job creation within *Knowledge & innovation services* is primarily due to significant *direct* effects from *Project development* and *MRV & certification*. The CDR industry will *directly* support around 13–23,000 jobs in this sector, and an additional 4–6,000 through *indirect* effects through *Industrial equipment & machinery production* and *Building & infrastructure construction*.

Figure 30: Total jobs supported in the Nordics annually from 2050
Thousand jobs



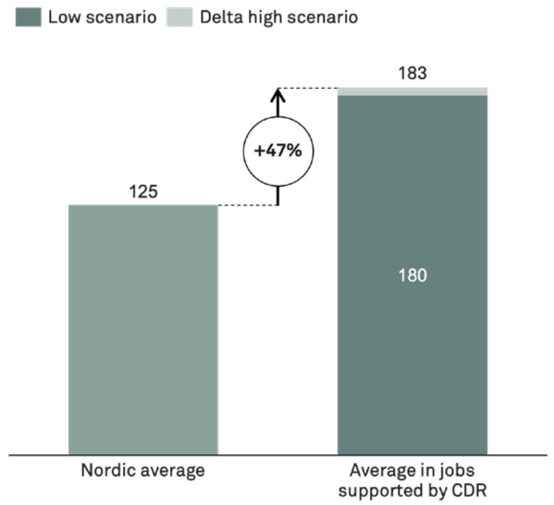
Notes: The industry split is based on the International Standard Industrial Classification (ISIC) Rev. 4 (see the U.N.'s classifications registry for more details) and it is compatible with the NACE Rev. 2. For illustration purposes, some industries have been rephrased.
Source: Implement Consulting Group based on the OECD STAN database for structural analysis and interviews within the CDR sector.

Professions within *Knowledge & innovation services* include lawyers, accountants, management consultants, engineers, and data scientists. Professions within *Industrial equipment & machinery production* include mechanical and industrial engineers, welders, and production managers. Professions within *Building & infrastructure constructions* include civil engineers, electricians, and carpenters.

Jobs in the CDR industry are highly productive, with EUR 180–183,000 value added per employee annually compared to a Nordic average of EUR 125,000 (see Figure 31).

The quality of jobs supported by the CDR industry is a critical factor in assessing its overall economic contribution and the well-being of its workforce. A key metric for evaluating job quality, in this context, is the value added per employee. Value added represents the incremental wealth created by the production process, and when considered on a per-employee basis, it provides insight into the productivity and economic value generated by each worker. Productivity, in this context, refers to the efficiency with which labour is utilised in the production of goods or services.

Figure 31: Annual value added per employee in jobs supported by the CDR industry compared to the Nordic average
Thousand EUR / employee



Notes: For each of the industries in the Nordics, the value added per employee is weighted by the number of employees in each Nordic country. To calculate to Nordic average, the industry-averages are weighted by the number of people employed in each of the industries across the Nordics. The value added per employee in the CDR industry is calculated as the average value added per employee within each of the industries weighted by the number of jobs supported by the CDR industry. Numbers are from 2022.
Source: Implement Consulting Group based on Eurostat (2023).

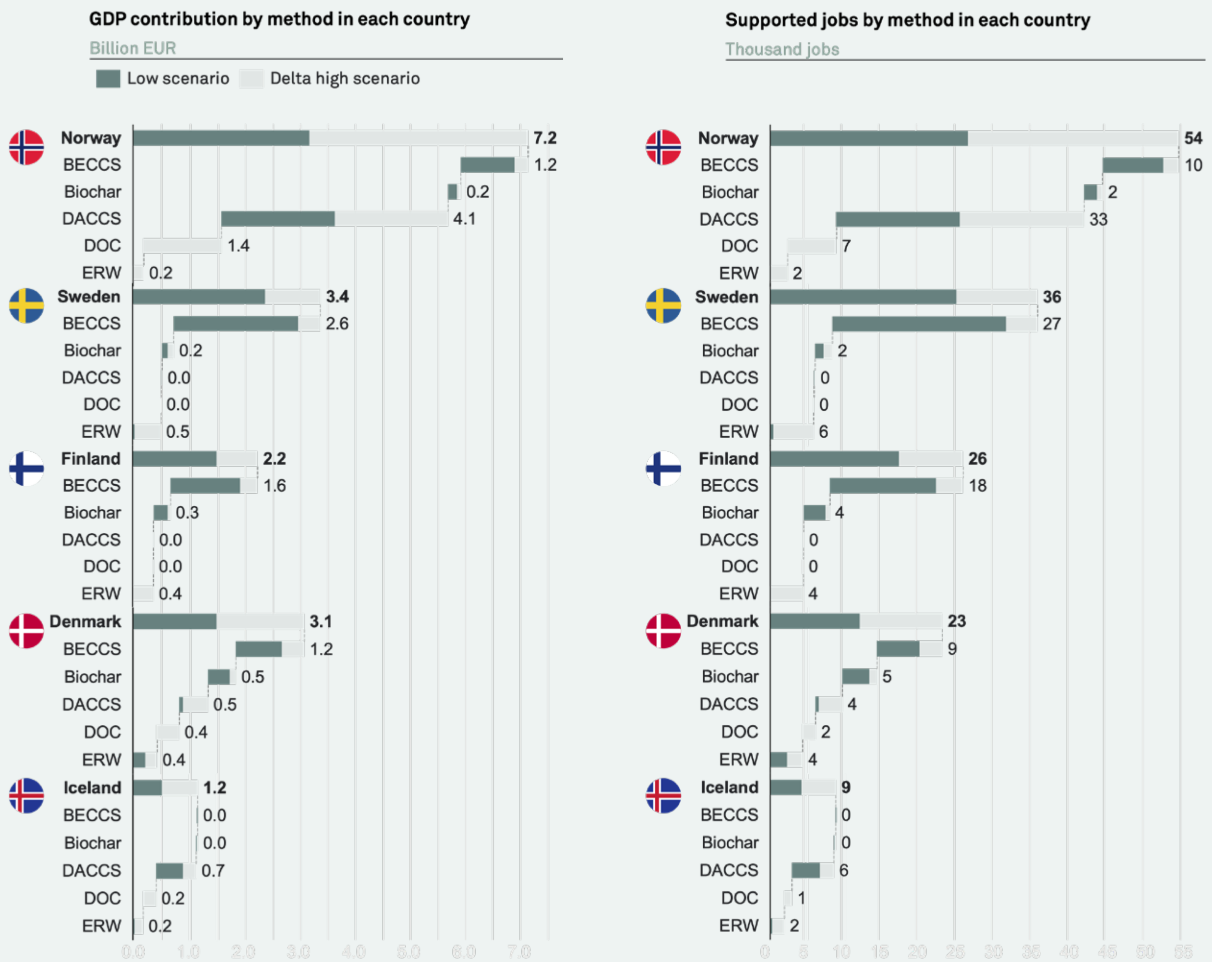
The economic value from CDR is highly enabled by a coherent Nordic region

Value is generally created in all Nordic countries, but Norway in particular supports economic contributions, with the addition of more than EUR 3.2–7.2 billion annually to GDP and 26–54,000 jobs by 2050 (see Figure 32).

Investing in CDR will benefit not only the country of the CDR method but also the Nordic region as a whole. 16% of the annual GDP contribution in the Nordics is generated through inter-Nordic collaborations, and 14% of the jobs supported in the Nordics (see Figure 33).

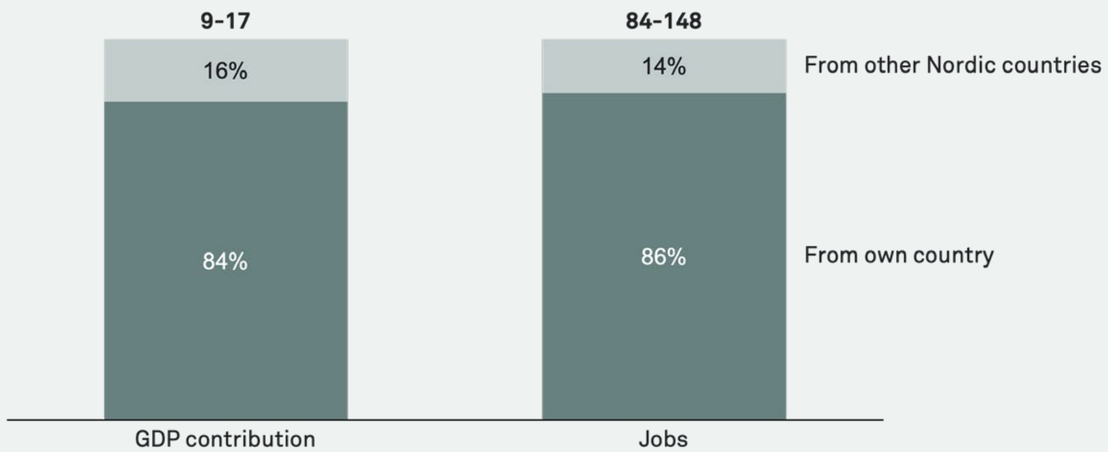
Norway accounts for a large share of the economic value generated in the Nordic region. Offshore CO_2 transport and storage facilities are expected to be predominantly located in Norway and Denmark, which Sweden, Finland, and Iceland will use since they currently lack domestic providers for CO_2 transport and storage. Consequently, economic activity will not be domestic, but generated across the Nordic region.

Figure 32: Total annual economic potential of CDR methods in the Nordic based on inter-Nordic activities by 2050



Notes: The GDP contributions and supported jobs presented in this figure are derived from the economic activities through CDR methods. These contributions are not based on the physical location of the CDR methods within the specific Nordic countries. Instead, they reflect the financial flows generated by these methods across all Nordic countries, which subsequently create economic potential and job opportunities in the respective countries.
Source: Implement Consulting Group based on the OECD STAN database for structural analysis and interviews within the CDR sector.

Figure 33: Share of economic potential delivered from other Nordic countries vs. own Nordic country
Billion EUR GDP contribution and thousand jobs



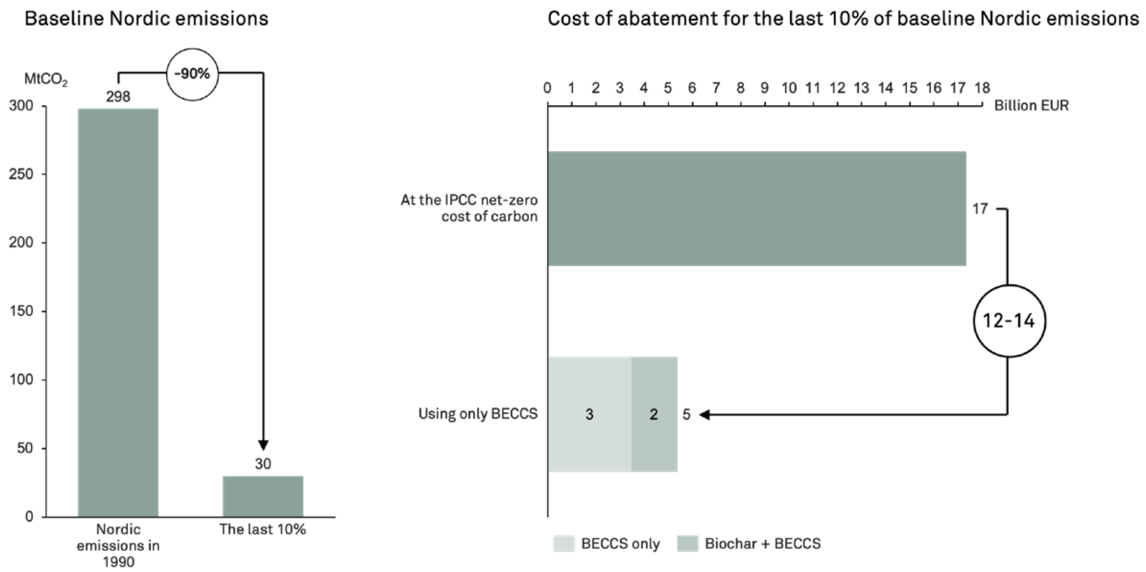
Notes: Shares in the figure are the averages of the two scenarios for the Nordic potential to remove CO2, while intervals correspond to the two scenarios.
Source: Implement Consulting Group based on the OECD STAN database for structural analysis and interviews within the CDR sector.

3.3 Carbon removals will allow the Nordic countries to reach their own climate targets more cost efficiently

A CDR industry is economically interesting not just because it generates employment opportunities and growth, but because it is a cost-efficient way for the Nordics to become net-zero. Relying only on emission reductions can lead to excessive costs and loss of value once only the very-hard-to-abate emissions are left. Alternatively, net-zero can be reached with a certain amount of CDR.

We estimate that the Nordics can save up to EUR 12–14 billion per year by relying on CDR technologies instead of reducing all emissions. This assumes that 10% of the 1990 emission baseline is offset in 2050 by CDRs, and that the Nordics deploy a combination of biochar and BECCS.[62] If even lower-cost CDR methods can be deployed, the economic value of deploying CDR increases correspondingly (see Figure 34).

Figure 34: Estimated savings achieved by abating the last 10% of Nordic emissions with CDR
Billion EUR



Notes: Savings compared to the estimated carbon price necessary in 2050 to achieve 1.5°C warming with limited or no overshoot.
Source: Implement Consulting Group based on Intergovernmental Panel on Climate Change, IPCC (2022b), Boston Consulting Group (2024) and Boston Consulting Group (2022).

[62] We rely on a marginal abatement cost for hard-to-abate emissions of EUR 400–915 per tonne based on Intergovernmental Panel on Climate Change, IPCC (2022b).

4 From talk to tonnes: delivering on Nordic carbon removal

Carbon removal is crucial in combatting climate change, and it is apparent that the Nordic region is strongly positioned to build a robust and cost-efficient CDR ecosystem. If successful, utilising its headstart in CDR could generate both significant climate benefits and economic benefits for the Nordics, including GDP growth, new job opportunities, and a new source of export revenues.

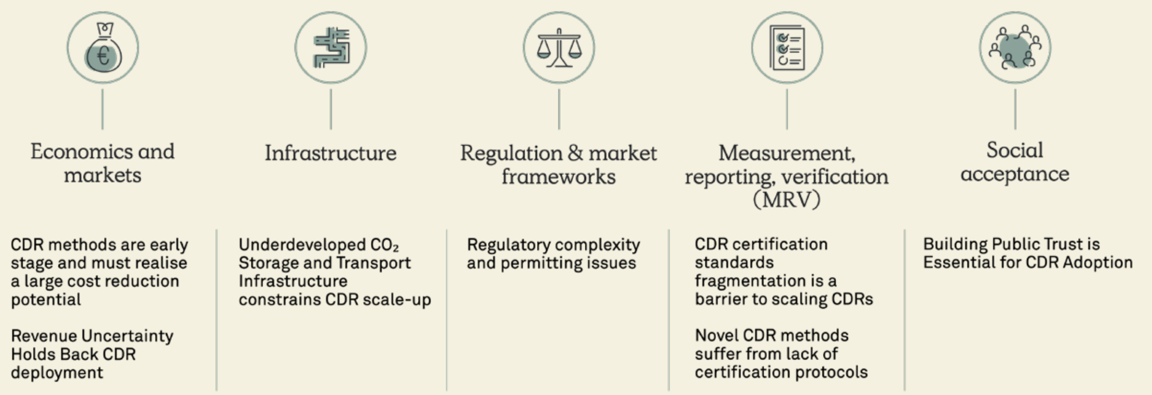
The Nordic countries will need their policymakers and industry players to work together to overcome significant barriers that stand in the way of them becoming a CDR powerhouse. In this chapter, we describe the main barriers for scaling CDR, and present 10 concrete recommendations on where Nordic action is needed.

4.1 Key barriers to scaling Nordic carbon removals

The barriers identified in this chapter are derived from a comprehensive analysis combining original quantitative and qualitative research conducted for this report, extensive desk research, and a targeted stakeholder survey capturing direct insights from more than a hundred Nordic players active in the CDR value chain.

The barriers are mainly identified in the areas of economics and markets, infrastructure, regulation, MRV and social acceptance. While many of these barriers are general, by engaging proactively, the Nordics can leverage their early frontrunner position to establish themselves as long-term leaders in permanent removals.

Figure 35: Cross-cutting barriers to scaling CDR in the Nordic region



Source: Implement Consulting Group based on primary & secondary research, stakeholder surveys and expert interviews.

CDR methods are early stage and must realise a large cost reduction potential.

Most permanent carbon removal methods have high up-front investments and are currently more expensive than alternative climate measures such as current emission reduction activities or offsets as well as nature-based carbon removals. This can be a barrier from both a project development perspective (requiring large capital commitments) and from an offtaker perspective (questioning whether to engage with expensive removal methods).

For instance, from a project development perspective, a BECCS project is a massive undertaking, requiring billions in combined capital investment (CAPEX) and operational costs (OPEX) over a project's lifetime. This requires capital partners willing to take the risk of investing in often commercially immature projects with uncertain revenue streams.

CDR methods are still in an early deployment phase, which entails higher technological risks and unit costs compared to mature projects. As more projects deploy and reach commercial scale, costs are expected to go down as a result of technological developments, learning loops, economies of scale, and the increasing maturity of the value chain. However, to ensure that multiple projects are launched, accelerating the learning curve, combining public and private funding will likely be a requirement for the foreseeable future.

Finally, it is important to recognise that permanent CDRs play a different role than less permanent methods such as nature-based removals. And that the cost of emission reductions is likely to increase substantially as we near net-zero and only the very hard-to-abate emissions are left. This implies that while permanent CDR methods might appear relatively expensive currently, these costs are important to bring down through investments and efforts today, so societies can rely on these methods to avoid even higher costs going forward.

Revenue uncertainty holds back CDR deployment

The lack of long-term revenue certainty represents possibly the most significant barrier for scaling CDR across the Nordic region. Unlike projects that reduce fossil CO_2 emissions, carbon removals do not receive financial incentives through carbon taxes or emission trading allowance schemes and have no established marketplace for their product.

The two main sources of revenue available for CDR project developers are:

1) Direct public subsidies such as the reverse auctions in Sweden and Denmark, and support from the EU Innovation Fund, and

2) Purchases of removal credits from voluntary carbon market buyers.

Some buyers in the Voluntary Carbon Market (VCM) have had a significant impact on the development of permanent CDRs. Notable buyers of CDR credits on the VCM include Microsoft, along with other players such as South Pole, Frontier, JP Morgan Chase, Airbus, Equinor, and Amazon. Despite these valuable efforts, spearheaded by Microsoft, the VCM alone cannot provide the required revenues at current cost levels and in the absence of broader corporate engagement.

Although permanent carbon removal is critical for achieving net-zero targets, most corporations have not yet committed to actively supporting the development of a robust carbon removal industry, which is essential for credible climate targets. Historically, corporates have acquired traditional carbon offsets – such as emission reductions from renewable energy projects. In approaching net-zero, they have to assume a larger responsibility to counterbalance their unabated and residual emissions, with permanent, high-quality carbon removals such has DACCS, BECCS and biochar.

While voluntary demand for permanent removals is continuously increasing and plays a crucial role, it is not realistic to assume that the VCM in its current form can, by itself, ensure the financial viability of CDR at scale. Without long-term revenue certainty, project developers struggle to make their projects bankable in the eyes of possible project financers – thereby substantially reducing the access to capital. This compounds with the large investment amounts needed to deliver especially the large BECCS and DACCS projects. Consequently, fewer large-scale CDR projects reach Final Investment Decision (FID).

Without regulatory guidance or market signals explicitly rewarding permanence and verified additionality,[63] a majority of corporates will continue to postpone purchases of the substantially more expensive long-duration removals and thus are less likely to make it out of the valley of death. Efforts such as the Oxford Principles, which clarify criteria for high-quality carbon credits, have not yet been enough to shift the vast majority of buyers in the voluntary carbon market away from the cheap offsets.

Underdeveloped CO_2 storage and transport infrastructure constrains CDR scale-up

Underdeveloped infrastructure for CO_2 transport and geological storage is currently a major barrier constraining the deployment and scaling of carbon dioxide removal solutions in general. The Nordic region is no exception. The current infrastructure remains fragmented and not coordinated to obtain future synergies. With only a few players currently capable of storing CO_2, the market is highly concentrated, creating bottlenecks in access to storage which hold back the development of e.g. BECCS projects.

Infrastructure for intermediate transport and storage, such as transport pipelines, port facilities, and storage terminals, is largely uncoordinated and heavily dependent on the success or failure of specific large CCS/BECCS projects. Projects in Denmark are currently resorting to trucking captured CO_2 to relevant locations as a short-term solution. Without readily available transport pipelines, port facilities, and storage terminals, developers must individually assume the high costs and operational complexity of establishing dedicated infrastructure project by project. Such fragmented infrastructure results in higher per-tonne transportation and storage costs.

Current dedicated CO_2 transport solutions often operate at suboptimal capacity utilisation, further elevating operating expenses. This is the case for individual point source emitters seeking access to North Sea storage sites, which have or will acquire specially built vessels that will not be running at full capacity all year round due to seasonal variations in combustion patterns of some point sources.

[63] For example, through the Green Claims Directive, SBTi, or a European compliance market for CDR.

The infrastructure gaps have particular significance given the substantial geographic dispersion of biogenic emissions sources and potential storage sites across the Nordics. Sweden and Finland have significant biogenic CO_2 sources from forestry and bioenergy sectors but lack domestic geological storage capacity, necessitating transport solutions to storage sites in Norway or Denmark. The absence of coordinated regional pipelines or optimised maritime infrastructure means that projects are developed independently without leveraging potential regional economies of scale, optimised routing, or sharing cross-border infrastructure.

Regulatory complexity and permitting issues

The CDR industry is still in its infancy, which implies that there is still uncertainty about several regulatory elements, as well as planning and permitting. This is natural in a very nascent industry, as new methods and technologies need to be tested against existing and new regulation. Much progress has already been made, e.g. with the adoption and implementation of the EU's CCS directive and with the amendment of the London Protocol allowing transport of sub-seabed storage in another state.[64] Moreover, recent bilateral agreements (2024–2025) between Sweden and Norway, Sweden and Denmark, and Finland and Norway have substantially reduced prior legal uncertainties by enabling cross-border CO_2 transport and storage.[65] These developments have markedly improved the clarity around legal frameworks, directly addressing what was previously a fundamental barrier to initiating BECCS and DACCS projects relying on cross-border solutions.

Practical barriers do, however, still exist and should be dealt with to ensure scaling of a CDR industry. This is particularly the case for novel CDR methods where permitting pathways and legal classifications can be lacking. Project developers must navigate case-by-case approvals under frameworks intended for mining, waste, soil amendments, or marine pollution – none of which were designed for CDR deployment. Moreover, ERW may trigger overlapping permits under mining and agricultural regulations, while OAE proposals risk being treated as potential marine pollution under the London Protocol.

Projects in Iceland and Norway (e.g. fjord-based OAE experiments) have proceeded under restricted scientific exemptions, but no country has yet authorised commercial-scale deployment. Some Nordic agencies (e.g. Norway's Miljødirektoratet) have begun internal work to develop ERW pilot schemes, but formal permitting systems are still outstanding.[66]

Barriers are also identified regarding lack of harmonised technical standards governing CO_2 transport and storage infrastructure, such as acceptable CO_2 purity, pipeline pressure specifications, storage site monitoring protocols, and injection practices. Such differences complicate cross-border coordination.

While harmonisation is needed at the EU level, Nordic regulators and industry stakeholders should feed into the work by suggesting common technical standards for pipeline and shipping infrastructure, ensuring interoperability, reliability, and safety across all cross-border operations.

[64] Nordic Council of Ministers (2023)
[65] Ministry of Economic Affairs and Employment of Finland (2024) and Government Offices of Sweden (2024).
[66] Carbon Gap (2024)

CDR certification standards fragmentation is a barrier to scaling CDRs

CDR credits are certified by certification standard operators. They develop CDR method-specific protocols that set the requirements for which projects are eligible to generate CDRs and how the volume of achieved carbon removal must be monitored, reported, and verified (MRV). There are only a handful of private CDR certification standards, such as Puro.earth, Verra, or Isometric, with more than 40 distinct protocols available for permanent CDR. However, the standards do not harmonise their protocols.

While all reputable standards require financial additionality as a core criterion (i.e. the CDR would not occur without revenue from carbon credits), they can differ in how rigorously and quantitatively they assess this criterion, ranging from strict numeric financial tests to more qualitative barrier analyses. Standards also differ in the way carbon removal volumes are calculated, leading to possible situations where the same project could have different volumes of CDR certified under different standards. This lack of methodological alignment can create uncertainty among buyers about which certification reliably represents high-quality CDR and represents a barrier for market engagement. The EU is therefore developing the 'Carbon Removal Carbon Farming' (CRCF) framework, which intends to establish overarching quality criteria (such as quantification, additionality, durability) and serve as a high-level meta-framework, providing consistency across standards over time, rather than immediately harmonising all detailed technical methodologies.

Novel CDR methods suffer from lack of certification protocols

For very novel CDR methods such as enhanced rock weathering and ocean-based removal, it is highly challenging to create protocols. Each protocol needs to be based on scientific evidence that determines a clear causality between the intervention and its outcomes. This can require in-field testing over several years and building complex models. As some of these CDR methods take place on large areas of land or ocean, sampling is the only practical way to verify CDR volumes. But defining representative sampling in a highly complex ecosystem is challenging. Ensuring development of novel measurement approaches and complex scientific validation to prove removal quantity and long-term carbon sequestration, for instance, is key to scaling these CDR methods.

Building public trust is essential for CDR adoption

Although Nordic populations generally demonstrate strong climate awareness and support for environmental initiatives, research suggests that CDR is also faced with some opposition – not unlike renewables.[67] Public perception is often driven by concepts such as naturalness, familiarity, and technological complexity.

Familiarity strongly favours nature-based solutions, particularly afforestation and reforestation, widely perceived as safe, cost-effective, and beneficial due to their tangible ecological co-benefits, such as improved biodiversity, air quality, and climate resilience. In contrast, engineered approaches including DACCS and BECCS often encounter varying degrees of scepticism, primarily rooted in perceptions of technological complexity, higher costs, or association with industrial activities historically viewed as contributing to environmental degradation. Geological storage projects have also met opposition due to concerns about possible leakages.

In order to scale CDR, it is important to share knowledge and insights about the actual impact of different methods – including e.g. leakage risk of storage – to ensure credibility in the public discussion on CDR.

[67] See e.g. Baum et al. (2024), Smith et al. (2024) based on a number of countries, including some Nordic.

Figure 36: Call to Action

Clearly defined policy ambitions and road maps

1. **Strengthen Nordic synergies through a Nordic strategy**
2. **Explicitly define the role for permanent carbon removals in national policy and set specific targets**
3. **Leverage the voluntary carbon market**
4. **Support the use of quality CDRs in compliance markets such as the EU ETS**

Policy support

5. **Fund research, innovation and early-stage development of CDR technologies**
6. **Support the initial industry scaling through targeted subsidies**
7. **Generate continuous demand for carbon removal**

Nordic CO_2 transport, logistics and storage strategy

8. **Cross-border CO_2 transport & storage infrastructure coordination**

Aligned Nordic coalition in climate diplomacy

9. **Establish a Nordic position on CDR in EU and international climate policy**

4.2 From barriers to breakthroughs: a roadmap for Nordic policymakers

We have identified a number of actions that Nordic policymakers could initiate to support the development of a CDR ecosystem in the Nordics. Concretely, we outline nine different actions ranging from high-level policy ambitions and specific support instruments to speaking with a common voice in international policy dialogues.

Strengthen Nordic synergies through a Nordic strategy

Policy actions for developing a CDR ecosystem will and should in many ways be at the discretion of each individual country. However, we have identified a number of areas where greater collaboration and coordination between the Nordic countries can bring synergies not possible at individual country level. Based on this, we recommend that the Nordic countries engage in a coordinated Nordic strategy for CDR development.

Firstly, the Nordics should take a holistic approach to the overall transport and storage of captured CO_2, including pipeline and harbour infrastructure (as explained above) and to coordinate with neighbouring countries (Germany, Poland, Baltics) to ensure capacity reflects the expected demand in these countries. Coordination with the needs of CCS and CCU is, of course, required for a cost-effective realisation of a Nordic CO_2 transport infrastructure, as it enables joint planning and shared investment into pipelines, terminals, and storage sites. This helps to avoid redundant infrastructure, minimise underutilisation risks, and allow assets to be strategically planned for multiple carbon management use cases.

Secondly, the Nordics should coordinate build-out targets of e.g. point source capture on the one hand and storage capacity on the other. As the value chains will be significantly integrated across countries, countries such as Sweden and Finland can deliver large BECCS volumes, while countries such as Denmark, Norway and Iceland can deliver the storage capacities. The respective build-out targets should be coordinated.

Thirdly, the Nordics should explore collective deployment of CDR targets, ensuring that the build-out of CDR takes place where it is most cost-efficient. Carbon removals have a climate impact no matter where the CO_2 is being removed as long as the quality and durability is high. However, the cost largely depends on location conditions. For DACCS to be cost-efficient, it should be deployed in areas with low electricity prices and closeness to storage. Currently, this makes Iceland and northern Norway more attractive than Finland, for example. Consequently, it would benefit the entire Nordic region to co-deliver on a combined Nordic deployment target.

Fourthly, a Nordic CDR strategy should specify areas where regulatory and practical barriers could be overcome through collaboration. One example is to institutionalise harmonisation efforts related to CO_2 transport and infrastructure in a dedicated regional infrastructure coordination body. This could, for instance, be a strengthened version of the existing NGCCUS network under the Nordic Council of Ministers. By early 2026, this body should receive a clear mandate and resources to oversee the alignment of transport, storage, and permitting regulations, coordinate cross-border infrastructure planning, and facilitate dialogue among regulators, developers, and industry representatives. This structured coordination will ensure enduring regulatory alignment, significantly strengthening the Nordic region's competitive positioning globally.

Explicitly define the role for permanent carbon removals in national policy and set specific targets

Each Nordic country (with the exception of Norway) has set decarbonisation targets to achieve net-zero, aiming for a reduction of 90–95% by 2050. Some countries are more ambitious than others, with Finland aiming for net-zero already by 2035. Denmark, Sweden, and Finland are in addition aiming for net-negative emissions. However, considering the importance of CDR, the role of permanent carbon removals is not clearly specified in climate policies in most countries and separate targets for permanent removals are missing.

Policymakers should explicitly acknowledge the role of permanent carbon removals in achieving both net-zero and net-negative emissions and define a path to achieve these targets. This could be achieved by setting specific volume targets throughout the period towards net-zero while being open to different pathways in meeting this. Setting separate targets for both permanent removals and Land Use, Land-Use Change, and Forestry (LULUCF) sinks would add additional clarity to industry, investors, and civil society that governments have identified CDR explicitly as a necessary tool for achieving climate neutrality, and eventually climate positivity, and reduce the risk of relying on temporary removals to neutralise fossil fuel-based emissions. Additionally, a separate LULUCF target would also work to protect and enhance LULUCF sinks.

In this respect, it should be clearly defined that carbon removals will complement – rather than substitute – deep emission reductions. This could be achieved by setting dual targets: one for reductions relative to a base year and one for removals as a percentage or volume relative to the base year. Such clarity provides assurance that removal projects will not lead to reduced ambition in other climate mitigation efforts, but rather complement the efforts to achieve societal net-zero.

It is important for policymakers to differentiate between carbon removals of high permanence and low permanence to ensure climate integrity and that the necessary volumes of permanent removals are deployed. This could be done by setting specific targets for temporary, hybrid, and permanent removal pathways.

Leverage the voluntary carbon market

The voluntary carbon market has shown that it can be a powerful driver of CDR development, delivering actual results and projects in the nascent CDR industry. The largest permanent removal projects (Stockholm Exergi and Ørsted) have only been possible through a combination of public subsidies, as well as large contributions from the voluntary carbon market. Further leveraging the VCM will not only help the industry take off and reduce the possible impact on taxpayers, but also enable an earlier introduction of compliance markets for CDR, since sufficient supply of CDR volumes will be a prerequisite for obligated entities seeking to comply under a compliance scheme. While compliance markets might be a better solution longer-term, it is important for the pace of the transition to ensure contributions from the voluntary market as well.

To support this, policymakers should play an active role in shaping the narrative around permanent carbon removals as a necessary investment for existing and potential actors in the voluntary carbon market. It needs to become clear to companies and the public that supporting permanent carbon removals by purchasing carbon removal certificates is neither greenwashing, nor a convenient substitute for significant emission reductions, but a fundamental part of achieving any credible mitigation pathway.

National policymakers could play a more active role by engaging with VCM initiatives that shape corporate climate action. These include initiatives such as the Science-Based Targets initiative (SBTi), a voluntary initiative that helps companies set emission reduction targets aligned with climate science, and the Integrity Council for the Voluntary Carbon Market (ICVCM), which establishes quality benchmarks for carbon credits through its Core Carbon Principles (CCPs). While these are voluntary initiatives, they significantly influence corporate decisions on high-quality, permanent carbon removal purchases, essential for scaling CDR. Policymakers could engage directly with SBTi to encourage stronger incentives and clearer corporate guidance on permanent carbon removals and highlight initiatives such as ICVCM's CCPs to provide companies with clarity on quality benchmarks and integrity criteria within the voluntary carbon market.

For a sense of scale, currently, SBTi provides very limited incentives for companies to engage with permanent removals, especially in the short term. Nordic companies are showing strong climate ambitions, with over 1,000 Nordic companies already signed up to SBTi. Of these, 216 have validated net-zero targets, representing approximately 12% of the global total (1,764) and 18% of Europe's total (1,171). Consequently, through more supportive guidance from e.g. SBTi – emphasising the need to supplement emission reductions with early action on permanent carbon removals – a large voluntary carbon market contribution could be realised from Nordic companies.

Nordic policymakers should clarify the treatment of carbon removal claims in government-subsidised CDR projects that also sell certificates on voluntary markets. Specifically, policymakers should confirm that host countries providing subsidies can report these removals towards their national climate targets, while companies purchasing subsidised certificates can credibly use them for voluntary compensation claims. This approach aligns clearly with established international practices, including the EU ETS and Paris Agreement guidelines, under which national and voluntary corporate climate actions coexist transparently without causing double-counting concerns. Policymakers can further safeguard market integrity by encouraging transparent corporate disclosures that explicitly acknowledge public subsidies and clearly indicate that removals are formally accounted for by the host country.

Support inclusion of CDR in compliance markets such as the EU ETS

While the voluntary carbon market has the potential to drive at least some of the change, policymakers should as quickly as possibly support the introduction of some kind of compliance mechanism for CDR. A strong possibility is some form of inclusion of CDRs within the EU ETS, an approach currently under discussion. Another option could be designing a separate CDR trading system, potentially covering emitters both within and beyond the current ETS scope.

A compliance market for CDRs would create a more predictable long-term demand for CDRs by expanding the demand base. Such a compliance market could be designed at different jurisdictional levels, e.g. at EU, national or even common Nordic level. A joint Nordic CDR compliance system could provide a robust and cost-effective means to support common Nordic CDR deployment targets, provided sufficient political backing exists.

Fund research, innovation, and early-stage development of CDR technologies

A key role for public support is in research, innovation and early-stage development of new technologies and solutions. Ensuring enough support for these purposes is critical for the development of the CDR methods needed in the future. Dedicated funding earmarked for CDR would make it possible to accelerate innovation and prove viability. First of a kind inventions and early testing of new technologies cannot be driven by carbon pricing or similar market-pull schemes but must rely on targeted support. Several novel methods such as direct ocean capture or ocean alkalinity enhancement could potentially play a large role in future CDR portfolios, but still require innovation and deployment support to reach technological maturity.

Existing programmes supporting R&D and demonstration include Denmark's Energy Technology Development and Demonstration Programme (EUDP), Sweden's Industriklivet, and equivalent programmes in Finland, Norway, and Iceland. These and other programmes should increase their focus on CDR and allow cross-border projects where relevant. Dedicated programmes should also support enabling infrastructure, including market frameworks, robust MRV systems, and digital platforms.

Support the initial industry scaling through targeted subsidies

Deployment of CDR currently requires public subsidies to support the initial scale-up of the industry. Such subsidy mechanisms are particularly important in the early stages of industrial development, when actors rely on achieving a critical mass of initial projects. Reaching this critical mass helps drive investment decisions across the value chain, leading to cost reductions and efficiency gains over time.

Public subsidy schemes such as the reverse auctions in both Sweden and Denmark are critical to ensure that actual project investment decisions are taken. Similar initiatives should be introduced across the Nordic region.[68] Unlike the short-term commitments typical in voluntary carbon markets, subsidy schemes offer the stable cash flows companies need to build investor confidence, demonstrate revenue predictability, and secure favourable long-term financing terms.

By actively committing public resources, Nordic governments can create immediate and predictable revenue streams for companies, supporting critical project milestones from operational break-even to commercial scaling – while supporting the development of the entire value chains around these projects. The design of the subsidy schemes could take different shapes and forms, recognising that private developers currently need offtake certainty.

To explicitly address barriers related to private-sector capital constraints, Nordic governments could further enhance coordination with regional and national development banks – including the Nordic Investment Bank (NIB) and national entities like Denmark's EKF, Finland's Finnvera, Norway's GIEK, and Sweden's EKN – to provide specialised concessional finance structures and loan guarantees. These instruments significantly reduce investment risk for private-sector actors, thereby directly leveraging substantial volumes of the private capital required to scale capital-intensive CDR infrastructure.

The proposed EU Industrial Decarbonisation Bank (IDB) – which is expected to pool existing EU-level funding resources and mechanisms under a coordinated framework – could potentially play an important role in facilitating efficient access to and deployment of existing finance instruments, improving clarity and reducing administrative burdens for Nordic project developers. Establishing structured dialogues between national and regional development banks is essential for clearly defining co-investment roles, standardising financing terms, and accelerating cross-border regional infrastructure investments. Such strategic coordination ensures Nordic carbon removal projects efficiently access layered public financial support and robustly leverage EU-level financial structures, thus maximising resource efficiency, reducing overall investment risk, and amplifying market impact.

Strategically, governments should employ a diversified portfolio approach, deliberately allocating support across multiple carbon removal methods. Such an approach should individually target the various CDR methods that are relevant in the Nordics, including BECCS, DACCS, biochar as well as emerging CDR methods (e.g. enhanced rock weathering, ocean alkalinity enhancement and direct ocean capture).

Generating continuous demand for carbon removal

Predictable and growing demand for carbon removals is required to achieve the large-scale volumes of removed carbon that are necessary for net-zero. Predictable revenue streams that make projects bankable are paramount for the important push to large-scale deployment. Once the technological and commercial maturity of the different CDR methods increases, policymakers can start looking to more permanent policy options for generating continuous demand for carbon removal.

In addition to adopting the compliance market instruments described above, other market-pull instruments such as open-ended contracts-for-differences or fixed tax credits – similar to the 45Q in the IRA – could also be introduced. These instruments would provide stable and predictable contributions to the business case for individual

[68] The Norwegian parliament has asked the government to design a support scheme for carbon removals with inspiration from the Danish, Swedish, German, Dutch and French auction models.

CDR projects. They are most useful when existing value chains have already been established and cost reductions have been achieved, ensuring that public subsidies per tonnes of CO_2 removed are limited.

Generally, a range of instruments are at the disposal of policymakers, all with different impact (see Table 3). It is important that the policy instruments of choice are tailored to the specific CDR methods – as also outlined above – ensuring a focus on innovation and scaling to commercial size for the novel methods, and a focus on market-pull instruments when methods and value chains mature commercially.

Cross-border CO_2 transport & storage infrastructure coordination

Meeting Nordic climate targets will require significant infrastructure to manage large volumes of CO_2. This applies not only to BECCS and DACCS, but also to CCS from fossil-based sources, as well as CCU. Transport and storage of CO_2 is currently a major cost component of BECCS and DACCS projects. This logistical service depends on large-scale infrastructure investments to process the CO_2, transport it inland and at sea and finally sequester it underground. Currently several plans and development projects are ongoing in the Nordics, including both offshore and onshore storage, and CO_2 hubs for collecting and bundling the CO_2 before final transport to storage (as described in Chapter 2).

Policymakers in the Nordics should define the infrastructure investments needed to minimise the overall costs of transport and storage in close collaboration with industry. This could include identifying and explicitly signalling prioritised CO_2 infrastructure corridors (both pipelines and maritime), convene structured stakeholder and investor dialogues to encourage private-sector alignment on shared infrastructure projects, as well as address any regulatory impediments.

Establish a Nordic position on CDR in EU climate policy

EU regulation provides an overarching framework for CDR policy in Europe. It is an important entity for Nordic countries to actively engage. The upcoming Danish Presidency of the EU Council of Ministers in the second half of 2025 presents a unique window for advancing ambitious CDR policies at the EU level. A coordinated Nordic effort during this Presidency and in the years to come could shape important policies for the deployment of CDRs, including in the Nordics.

Several EU policies relevant for CDR are on the horizon in the short term, for which the Nordic countries could define a common approach (see Table 4).

EU ETS and Compliance Markets: The ongoing public consultation for the revision of the ETS represents an important opportunity for the integration of carbon removal credits into the ETS. Nordic countries could advocate for this inclusion or the creation of a dedicated compliance system for carbon removals. Regardless of the precise instrument chosen, establishing explicit market demand signals is important to generate predictable revenue streams, enabling long-term financial viability. The Nordic countries could advocate for a phased introduction of CRCF-certified removals into compliance markets, potentially starting with pilot-scale initiatives once robust certification methodologies are established. It is important to maintain climate integrity and integrity of the ETS system as high-quality permanent removals are incentives.

Table 3: Policy instruments

Policy Instrument	Carbon Contracts for Difference (CCfD)	Reverse Auction Subsidy	Sequestration Tax Credit	Investment Tax Credit	Direct Procurement	Reverse Carbon Tax Payment	Blended Finance	Public Loan Guarantee
Description	Establishes a guaranteed minimum ("strike") price for carbon removal credits; pays providers the difference if market prices fall below this level.	Selects carbon removal providers through competitive bidding; winning bidders receive fixed subsidies per tonne of verified CO_2 permanently stored.	Offers a performance-based tax credit per tonne of CO_2 captured and permanently stored, directly reducing provider's tax liability or paid as direct cash payments.	Provides refundable tax credits to cover a significant portion (up to 60%) of upfront capital expenses for installing carbon capture or direct air capture equipment.	Directly purchases verified carbon removal credits from providers, paying an agreed price per tonne delivered and permanently stored.	Pays providers a fixed amount per verified tonne of CO_2 removed, typically mirroring the national carbon tax rate, thereby creating immediate demand.	Combines private capital with government and philanthropic funds, typically through grants or concessional finance, to lower investment risk and mobilise private financing into early-stage or higher-risk carbon removal projects.	Guarantees private-sector loans for carbon removal projects, substantially reducing the financial risk for lenders, lowering borrowing costs, and enabling access to capital-intensive financing.
Intended Effect	Provide revenue certainty and stability, making carbon removal economically viable and attractive despite volatile or uncertain market prices.	Drive efficient allocation of public funding by securing maximum volumes of carbon removals at lowest possible cost through competitive market pressure.	Directly subsidise ongoing operational costs of carbon capture, enhancing financial viability and incentivising scale-up of carbon removal technologies.	Overcome upfront capital cost barriers, facilitating quicker investment decisions and accelerating deployment of carbon removal infrastructure.	Accelerate early market development by creating secure, guaranteed demand for carbon removals, ensuring project viability during market infancy.	Stimulate rapid and predictable market scale-up by providing consistent revenue per tonne, aligning incentives with established national carbon taxation frameworks.	Bridge funding gaps and reduce private-sector investment risk, facilitating early deployment and commercial viability of innovative or higher-risk carbon removal technologies.	Enable large-scale, capital-intensive carbon removal projects by significantly enhancing access to affordable financing, accelerating commercial-scale project development.
Carbon Credit Ownership	Project developer	Project developer (VCM resale possible; government implicitly claims towards NDC)	Project developer	Project developer	Government	Project developer	Project developer	Project developer
Examples (incl. non-CDR cases)	**UK Renewable Energy CfD (Dogger Bank Offshore Wind Farm):** CfD agreement providing guaranteed electricity strike price for offshore wind energy generation (~GBP 9 billion contract, 3.6 GW capacity over 15 years). Developers sell energy into wholesale markets; Government pays difference when market prices fall below strike price.	**Swedish BECCS Reverse Auction (Stockholm Exergi):** Awarded ~EUR 1.7 billion (SEK 20 billion) subsidy contract in 2023-2024 auction, for permanent storage of ~800,000 tonnes CO_2/year (11 Mt total over 15 years). **Danish CCUS & CCS Reverse Auction:** Awarding DKK 16 billion & DKK 27 billion to the lowest bidder.	**U.S. Section 45Q Tax Credit:** Actively incentivising projects such as Occidental's Direct Air Capture hubs in Texas; credits range from USD 85 – USD 180 per tonne CO_2 permanently stored, clearly operational and primary driver behind large CCS/DAC investments across the U.S.	**Canada CCUS Investment Tax Credit (ITC):** Operational since 2022, refundable credit covering up to 60% of capital costs for CCS and DAC equipment; total impact ~USD 7.6 billion through 2030.	**U.S. DOE Carbon Removal Purchase Pilot:** USD 35 million allocated in 2024-2025 to directly purchase verified carbon removal credits from multiple projects (DAC, Biochar, BECCS, etc.).	**Norway Reverse Carbon Tax (Proposed by Environment Agency):** Recommended fixed rate of NOK 2,000/t (EUR 180/t) per verified tonne of CO_2 removed and permanently stored (DACCS/BECCS). Not operational (previously at the proposal stage).	**Breakthrough Energy Catalyst (Deep Sky DAC Project, Canada):** Operational blended finance initiative providing a ~USD 40 million concessional funding grant, combining philanthropic (Gates Foundation), corporate, and private funds to accelerate deployment of direct air capture (DAC). Catalyst absorbs early-stage financial risk.	**U.S. DOE Loan Programs Office:** DOE approved a USD 1.04 billion conditional loan guarantee in 2021 for Monolith's carbon black and clean hydrogen project with CCS. Demonstrates large-scale carbon management investment driven by loan guarantees.

Source: Implement Consulting Group based on work from Carbon Gap

Table 4: EU CDR policies on the horizon

European Union	Short-term (0–2 yrs)	Medium-term (3–5 yrs)	Long-term (5+ yrs)
Market-based Instruments	• **EU ETS Innovation Fund**: CDR projects could be selected in the next funding calls • **Carbon Border Adjustment Mechanism (CBAM) Revision**: Revision to extend the scope of CBAM in 2025, and simplification measures under the 2025 Omnibus Package	• **CBAM Full Implementation**: Scheduled for 2026, with importers paying for embedded emissions in covered sectors	• **CBAM Expansion**: Potential extension to additional sectors by 2030. CDR could be integrated to fulfill CBAM obligations
Regulatory & Legal	• **Carbon Removal Carbon Farming Regulation (CRCF)**: Entry into force in 2025, methodologies being developed • **Net-Zero Industry Act (NZIA)**: Entered into force in 2024, aiming to fast-track CCS and net-zero technology deployment • **LULUCF Regulation**: 2030 targets set for net annual LULUCF removals • **Clean Industrial Deal**: Published in 2025, includes upcoming Industrial Decarbonisation Accelerator Act and Industrial Decarbonisation Bank • **EU ETS Revision Consultation**: Public consultation launched in April 2025 ahead of the ETS revision in 2026 • **EU 2040 climate targets:** proposal in Q2-Q3 2025	• **Post 2030 EU climate policy framework**: New policy developments to reach the 2040 climate targets	• **Full Integration of CDR**: Development of new CDR polices to ensure the EU reaches climate neutrality in 2050, such as CDR obligations
Funding & Financial	• **Innovation Fund**: Continued support for CDR technologies • **Industrial Decarbonization Bank**: Proposed EUR 100 billion fund to support low-carbon technologies, where CDR could be eligible • **Pilot Procurement Programmes for CDR**: Initiatives to fund permanent carbon removal projects. Preliminary discussions around an EU Buyer's club, dedicated removal fund, and more to support short-term demand.	• **EU Sustainable Finance Taxonomy**: The taxonomy could be extended to include more CDR-related activities • Large-scale CDR procurement vehicle	• **Dedicated CDR Funding Mechanisms**: Potential development post-2030
Procurement & Demand	• **Green Claims Directive**: Adoption expected in 2025 • **Corporate Sustainability Reporting Directive (CSRD) Revision**: Proposed changes under the Omnibus Package to reduce scope and simplify reporting	• **Corporate Adoption of CDR**: The CSRD and the CRCF could likely increase demand for CDR	• **Mandatory EU Procurement Targets**: Potential EU-mandated annual procurement of CRCF-credits
Infrastructure & Technology	• **NZIA**: Mandatory target of 50 MtCO2 of annual geological storage capacity on oil& gas producers • **Clean Industrial Deal**: Focus on decarbonizing energy-intensive industries	• **EU TEN-E Regulation**:Could be expanded to explicitly support CDR deployment	• **Pan-European CO_2 Infrastructure**: Potential development to facilitate large-scale CDR
Transparency & Standards	• **CRCF Certification**: Implementation of certification frameworks • **CSRD Revision**: Adjustments based on Omnibus Package revisions	• **Refinement of CRCF Methodologies**: Based on practical implementation experiences and extension for potential new innovative CDR methods	• **EU standards as global CDR benchmark:** The EU CRCF could become a global benchmark, including for international mechanisms such as the PACM

Source: Implement Consulting Group based on work from Carbon Gap

Carbon Removals and Carbon Farming Regulation (CRCF): The fundamental objective of the CRCF is to establish quality criteria defining what qualifies as certified carbon removal across Europe, creating clear guidance for certification methodologies. Crucially, these methodologies will be further detailed through upcoming delegated acts by the European Commission, translating general criteria into specific, actionable requirements. The core issue is ensuring that these delegated acts properly account for local and regional parameters. Without explicit recognition of region-specific factors – such as Iceland's geological basalt storage or biomass sourcing rules tailored to Nordic conditions for BECCS and biochar – the methodologies risk being impractical or misaligned with local realities.

Nordic countries can concretely support CRCF implementation by formally submitting detailed technical recommendations and specific methodological proposals during the European Commission's public consultations and stakeholder dialogues on the delegated acts. They should ensure that Nordic-specific scientific evidence and pilot project data –particularly for novel carbon removal methods such as enhanced rock weathering, direct ocean capture, and ocean and river alkalinity enhancement – are directly communicated and utilised in methodology development. Furthermore, countries should call for explicit EU roadmaps to detail timelines, milestones, and regulatory criteria for emerging carbon removal solutions.

EU 2040 Climate Targets: Nordic alignment around clearly defined, separate targets for emissions reductions, permanent carbon removals, and nature-based (LULUCF) sinks within the EU 2040 targets would allow for clear policy signals to scale up CDR projects.

Clean Industrial Deal and Innovation Fund: The proposed Industrial Decarbonisation Accelerator Act and accompanying Industrial Decarbonisation Bank, which envisages leveraging approximately EUR 100 billion in combined EU and private funding, presents significant opportunities. Ensuring that carbon removal methods are explicitly included within these instruments' mandates could be a strong catalyst also for Nordic deployment.

Green Claims Directive: The Green Claims Directive is an EU initiative aimed at ensuring that environmental claims made by companies are clear, accurate, and substantiated, thereby preventing misleading or exaggerated statements around climate claims. It is scheduled to be finalised at the EU level later this year, after which Nordic countries will enter a critical two-year transposition period, during which Member States convert EU directives into national legislation and practical guidance. During this period, Nordic governments should proactively clarify how private companies can credibly and transparently use voluntary carbon removal credits in their environmental and net-zero claims, even before achieving full net-zero status. Clear national guidance on making these claims is essential to resolve existing uncertainty, build market confidence, and accelerate corporate investments in permanent carbon removals.

EU Sustainable Finance Taxonomy and Financial Instrument Classification: Currently, CDR credits are not classified as financial instruments under EU financial market rules (MiFID II). A classification of CDR credits as financial instruments would on the one hand invite financial actors to engage in the market, enable more standardised trading, clear accounting guidelines, collateral eligibility, and a pathway towards robust liquidity on regulated exchanges. On the other hand, classifying CDR credits as financial instruments would likely require new reporting obligations. This means that careful considerations are necessary before any overhaul of existing regulation is initiated. But until new regulations are in place, many lead market participants are holding off from engaging with the market.

Separately, policymakers should explore integrating CDRs into the EU Taxonomy as a sustainable economic activity, conditional on robust technical screening criteria aligned with the CRCF. Doing so would signal its environmental credibility, reduce market uncertainty, and help mobilize additional sustainable investment.

Article 6 of the Paris Agreement and Corresponding Adjustments:

Nordic countries should actively prepare for future participation in international carbon markets under Article 6 of the Paris Agreement. Article 6.2 facilitates direct carbon credit trading between countries, whereas Article 6.4 establishes a centralised governance system supervised by the UN. Both require countries to issue clear and credible Corresponding Adjustments (CAs) – national-level accounting entries ensuring that carbon removals or emission reductions are properly accounted for in national inventories when transferred between countries. To prepare concretely for this, Nordic governments should ensure that the necessary administrative and legal infrastructure is in place to facilitate such transactions. Well-functioning Article 6 markets could potentially ensure that cost-efficient high quality carbon removals in the Nordic could support other countries in reaching their climate targets.

One specific operational example is the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), a global market-based mechanism requiring airlines to offset emissions growth from international flights through eligible carbon credits. Carbon removal standards are currently being assessed against CORSIA's existing eligibility criteria. Due to aviation being outside national accounting boundaries under UNFCC, an eligible carbon credit needs to be associated with a Corresponding Adjustment. Consequently, in order to tap into this market, it is important for policymakers to clarify the specific operational infrastructure and processes to facilitate Article 6 and CORSIA transactions.

Regulation of ocean-based carbon removal: Given extensive Nordic coastlines and potential for ocean-based CDR, active regional participation in ongoing regulatory negotiations under e.g. the London Convention is strategically important. For any ocean-CDR activity in the high seas, clear and comprehensive governance will be needed to ensure environmental safety, scientific integrity, and compliance with international law. Today, ocean-CDR is governed by the existing international treaties and agreements that protect the ocean and marine life. But because they generally were not written with CDR in mind, comprehensive and proactive regulation of carbon removal activities may require more specific governance frameworks. [69] Examples include the Convention on Biological Diversity (CBD), the London Protocol and the London Convention.

To ensure the development of ocean-based methods, in a scientific and environmentally robust manner, the Nordic countries should engage in these regulatory discussions to ensure that unnecessary regulatory impediments are not holding the development back.

[69] Lebling & Savoldelli (2025)

From fragmentation to integration: a holistic pathway for Nordic carbon removal

Developing a successful permanent carbon removal ecosystem in the Nordics requires a holistic and coordinated approach that has policymakers, businesses, NGOs, and investors working collectively. The effectiveness of the recommended actions outlined in this report does not stem solely from their individual direct impacts, but importantly from how these actions influence and reinforce each other across the carbon removal value chains.

The Nordic countries now stand at a crossroads, uniquely positioned to establish a global blueprint for delivering meaningful climate action at an unprecedented scale. The pathway is clear, the foundations strong, and the collective capability undeniable. By seizing this historic opportunity to move decisively from ambition to action – from talk to tonnes – the Nordics can not only achieve their own ambitious climate targets, but also inspire and accelerate global transformation, demonstrating to the world what genuine climate leadership looks like in practice.

5 Appendix

Economic modelling methodology

The analysis is based on quantitative economic modelling using national accounts data

To quantify the impact of CDR, we have applied an input-output model that is based on data from the national accounts describing the flow of final and intermediate goods and services between industries.

The relationship between an industry's input and output is assumed to be constant in input-output models, which implies that industries operate under constant returns to scale.[70]

Based on the input-output model, we have calculated a set of multipliers reflecting the expenditure of the CDR industry, allowing us to assess the economic impacts of construction, operation, transport and storage on the rest of the economy. We use the input-output model to compute the GDP (value added) and employment multipliers.

Data sources

This study relies on three complementary sources:

OECD Structural Analysis Database (STAN) 2025 ed. [71]
This data provided harmonised national input-output tables for 45 industries.[72] As the CDR industry is not developed yet, it is not a part of the 45 industries. Therefore, we have composed the CDR industry based on 16 different industries present in the STAN database:

Professional, scientific and technical activities
Construction
Administrative and support services
Computer, electronic and optical products
Electrical equipment
Machinery and equipment n.e.c.
Electricity, gas, steam and air conditioning supply
Chemical and chemical products
Manufacturing n.e.c.: repair and installation of machinery and equipment
Mining and quarrying, non-energy producing products
Agriculture, hunting, forestry
Land transport and transport via pipelines
Mining and quarrying, energy producing products
Water transport
IT and other information services
Financial and insurance activities

In addition to the input-output tables, the STAN database provides employment data (total employment) by industry. By May 2025, data for Denmark was not yet published in the 2025 version of the STAN database. Instead, we used data from OECD collections of official System of National Accounts (SNA) by economic activity statistics for Denmark.

These data build the foundation for the multipliers for value added and jobs based on 2020 numbers, which are the most recent data. Multipliers are computed in national currencies using the average exchange rates from 2020.

Cost per tonne of CO_2 removed for each CDR method
We use estimated costs per tonne of CO_2 removed based on IPCC for DACCS, BECCS, ERW and biochar. Additionally, key players within the CDR industry shared their expectations of prices for DOC.

Tonnes of CO_2 removed by each CDR industry by each Nordic country
We estimate two scenarios for the Nordic CDR potential: one where the Nordics can remove 35% of the total EU carbon removal need and another where the Nordic can remove ~60%.

Key assumptions about input

Input to the model is the demand shock to the economy from, i.e. the expenditure from CDR. For each method, annual average costs per tonne of CO_2 removed are split out on:

Value chain steps. Value chain steps include research and innovation, project development, construction and equipment, operation, transport and storage, MRV& certification, and finally carbon market.

Industries. Within each value chain step relevant industries (16 in total) are identified and costs within the value chain step are split into these industries. For example, the industry representing research and innovation for all methods is professional, scientific and technical activities.

Import from other Nordic countries. We assume that a share of the spend on CDR in one Nordic country will necessitate import from other Nordic countries as well as countries outside the Nordics. For each value chain step, import shares are estimated. For example, a BECCS facility in Finland is assumed to import most of the transport and storage from Norway and Denmark and have little impact domestically in Finland, but a large impact in Denmark and Norway. Meanwhile, a BECCS facility located in Norway is assumed to have transport and storage performed domestically and thus only have an impact in Norway. This maps the expenditures in all Nordic countries within each industry, within each value chain step and within each method.

Key assumptions about impacts

Impacts are measured in terms of GDP (value added) and jobs. The investments and employees needed in the CDR industry will come from other sectors in the economy and thus the impact is not in addition to today's GDP and employment. All numbers are reported in EUR using the average exchange rates between national currencies and EUR for 2025. Impacts are based on multipliers computed using input-output tables and employment numbers from national accounts. These are validated and adjusted based on interviews with market experts.

The impact presented in this study is reported as average annual effects over the lifetime of each CDR method. In reality, it is more likely that impacts will be characterised by bursts driven especially by investments in construction and major renovations, leading to higher impact during these periods and lower in periods with less investments.

[70] Miller & Blair (2009) page 16.
[71] OECD (2025)
[72] OECD (2023)

The part of the expenditure assumed to be spent outside the Nordics will support GDP and jobs in other countries, which is *not* included in the estimates. Across CDR methods, we assume that ~19% of the annual cost of CDR is *directly* imported from outside the Nordics. This includes equipment, for example. Additional to the ~19%, there are *indirect* imports from other countries to each industry. For example, construction in Finland additionally includes imports from other countries, i.e. of steel. The model does *not* capture the value this would generate.

Co-benefits in other industries, such as increased agricultural yield rates through biochar or ERW, as well as increasing electricity production through BECCS, are not quantified. However, all enabling infrastructure, such as CO_2 transport infrastructure and plant component supply, is included. Additionally, goods and services bought from outside the Nordics are excluded, as this does not contribute to the Nordic economy.

Estimation of carbon removal potentials

Table 5: Implement assumptions made for each CDR method potential

Method	Limiting factor	Our assumption
BECCS	Access to biogenic emissions from accessible point sources	We limit the potential to existing biogenic point sources, excluding the possibility of new biogenic emission sources arising, e.g. due to new bioenergy combined heat and power plants. Reductions of biogenic point sources due to political ambitions to e.g. decrease biogenic combined heat and power plants in the national heating mix are also taken into consideration.
DACCS	Access to electricity, both generation capacity and grid connections Access to geological CO_2 storage sites High CAPEX and OPEX	In theory, there is a very high limit for how much additional renewable electricity generation could be deployed in remote areas, say in Northern Norway. In practice, however, build-out restrictions will limit the total potential. We assume a potential more closely linked to the overall EU need for DACCS, which we consider quite conservative compared to other studies. We additionally assume that DACCS will be developed in Nordic regions with direct access to CO_2 storage sites, such as Norway, Iceland and Denmark. While the location of DACCS in other Nordic countries is technically possible, economically close proximity to the storage site is preferred to keep transport costs and emissions low.
Biochar	Access to residual biomass Access to 'storage' areas (storage means the final destination of the product, which could be everything from farmland or greenhouses to building materials. Biochar could theoretically be placed in any land area – however, this would prevent reaping economic value from the co-benefits)	We consider access to biomass as the primary limiting factor for scaling biochar in the Nordics. Biomass – even residual – is thought to be a scarce, and therefore valuable, resource going forward. We consider 'storage' opportunities to be limited (despite this theoretically not being the case), as we accept that biochar would need to capture the value from its co-benefits to be an attractive CDR method. Consequently, we consider the potential more limited in countries with less available farmland.

ERW	Access to 'storage' areas. ERW needs to be stored in areas suitable for weathering, including e.g. types of farmland Temperature. Weathering processes are typically more effective under higher temperature such as in tropical areas	We consider access to suitable storage locations as the limiting factor for scaling enhanced rock weathering, as Greenlandic rock flour is available in large quantities. We consider only 50% of Nordic farmland to be suitable for the application of Greenlandic rock flour due to requirements for e.g. the pH content of the soil. In our conservative scenario, we only include ERW for countries located close to Greenland. Our market conversations have shown that locations within shorter reach are preferred for the initial scaling of ERW to keep transport costs and emissions low. The application of olivine and basalt is not considered in our estimation. Both olivine and basalt are less efficient in colder climates. Olivine additionally contains heavy metals, which limits its applicability on EU farmland.
DOC	Access to electricity, both generation capacity and grid connections Access to geological CO_2 storage sites	In theory, there is a very high limit for how much additional renewable electricity generation could be deployed in remote areas, e.g. in Northern Norway. In practice, however, such build-out restrictions will limit the total potential. We assume a potential which mirrors the overall EU need for DACCS, which we consider quite conservative compared to other studies. We do, however, estimate a lower potential for DOC than DACCS in the Nordics due to the comparatively lower technological readiness of DOC. Additionally, we only consider DOC economically feasible in countries with access to offshore storage – to reduce transport costs – and low electricity prices.

Glossary

BECCS Bioenergy with Carbon Capture and Storage

CA Corresponding Adjustment

CAPEX Capital Expenditures

CBD Convention on Biological Diversity

CCS Carbon Capture and Storage

CDR Carbon Dioxide Removal

CORSIA Carbon Offsetting and Reduction Scheme for International Aviation

CRC Carbon Removal Certificate

CRCF Carbon Removal Carbon Farming Regulation

DACCS Direct Air Carbon Capture and Storage

DOC Direct Ocean Capture

ERW Enhanced Rock Weathering

ETS Emissions Trading System

EUDP Energy Technology Development and Demonstration Programme

FID Final Investment Decision

GDP Gross Domestic Product

GVA Gross Value Added

GHG Greenhouse Gas

Gt Gigatonnes

ICAO International Civil Aviation Organisation

ICROA International Carbon Reduction and Offset Alliance

ICVCM Integrity Council for the Voluntary Carbon Market

IDB Industrial Decarbonisation Bank

IEA International Energy Agency

IPCC Intergovernmental Panel on Climate Change

LULUCF Land Use, Land-Use Change, and Forestry

MRV Measurement, Reporting & Verification

Mt Million tonnes

NBS Nature-Based Solutions

NGO Non-Governmental Organisation

NIB Nordic Investment Bank

OAE Ocean Alkalinity Enhancement

OECD Organisation for Economic Co-operation and Development

OPEX Operating Expenses

ppm parts per million

RAE River Alkalinity Enhancement

SBTi Science-Based Targets initiative

SNA System of National Accounts

STAN Structural Analysis

VCM Voluntary Carbon Market

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Contact

Valter Selen
valter@nordiccarbonremoval.org

Alexander Makela
alexander@carbongap.org

Oscar Schily
oscar@carbongap.org

Alexis Dunand
alexis@carbongap.org

Martin Bo Hansen
mhan@implement.dk

Morten Bæk
moba@implement.dk

Pernille Noer
peno@implement.dk

Laura Marie Knudsen
lamk@implement.dk

Tara Dastmalchian
tada@implement.dk

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