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Carbon Dioxide Removal in the Nordic Countries: A Status Report

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Introduction

Policies and projects for carbon dioxide removal (CDR) are advancing rapidly in several Nordic countries. Permanent carbon removal initiatives often rely on close collaboration between a diverse range of stakeholders across a long value chain that frequently crosses borders. Harmonized rules and coordinated efforts on carbon removal in the Nordic countries are essential to enhance credibility among public and private actors and to create efficient value chains. However, the rapid pace of policy development might lead to differences in regulatory approaches across the Nordic countries, which can act as barriers to development.

This policy paper maps the status of policies and regulations for CDR across the Nordic countries, providing an updated analysis of developments since the first Nordic policy paper on the topic was published in 2021. Building on insights from three previous reports by ZERO and Skift, funded by the Nordic Council of Ministers, this paper highlights progress, identifies gaps, and offers recommendations for enhanced cooperation.

Background

Achieving the temperature goals of the Paris Agreement requires not only rapid emission reductions but also large-scale removal of CO₂ from the atmosphere. Carbon Dioxide Removal (CDR) solutions represent the “net” in net zero. The Nordic countries have unique potential to lead in the development and deployment of CDR solutions, thanks to their many biogenic emissions point sources, geological CO₂-storage capacities, and competence across the value chains.

Based on the previous policy papers, three policy actions are identified as important to successfully realize net negative emissions:

- **Create separate climate targets** for emission reductions and carbon removals. This is important to ensure that emission reductions are not deterred or delayed by the possibility of removing CO₂.
- **Incentivize carbon removal projects through public policies.** Removing CO₂ from the atmosphere can be seen as a public service. To reach gigaton-scale globally, policy incentives are crucial.

- **Mobilize financing through the voluntary carbon markets (VCM).** The VCM will be an important source of funding for projects.

During 2024, both Denmark and Sweden implemented and finalized their rounds of state auctions, a financial policy tool to support projects. In Norway, the carbon storage project Northern Lights is finally ready to receive CO₂, as the first open-access full-scale value chain for carbon capture and storage (CCS). By capturing the latest developments in policies and markets among the Nordic countries, this paper aims to support coordination and collaboration across the Nordics.

The following section gives an overview of the countries' climate targets and describes policies and developments related to CDR.



Sweden

Climate Targets

Sweden adopted its Climate Act in 2017, which legally commits the country to reduce emissions by 63% by 2030, 75% by 2040, and 85% by 2045, compared to 1990 levels. Additionally, the Act binds Sweden to achieve net-zero emissions by 2045. The remaining 15% can be addressed through additional measures such as carbon dioxide removal. Other measures to reach net zero include increasing the net uptake of CO₂ in the forestry and land-use sector and purchasing verified emission reductions abroad under Article 6 of the Paris Agreement.

Policy Developments

In Sweden, a public inquiry proposed a series of reversed auctions as the preferred policy scheme to incentivize the capture and storage of biogenic CO₂ (bio-CCS or BECCS) as early as 2020. However, it took some time to get the reversed auctions up and running, and the first round was launched in the fall of 2024. The budget set aside for the scheme amounts to 36 billion SEK between 2026–2046 and is operated by the Swedish Energy Agency. Only bio-CCS projects are eligible for support in the Swedish scheme, reflecting their large potential from Sweden's many biogenic emissions point sources [1].

Companies with biogenic emissions can bid in the auction to obtain financing for implementing CCS technology. The project with the lowest cost per ton of stored CO₂ that also fulfils the terms of the tender will be awarded a 15-year contract. The support is paid when the recipient documents successful geological storage of the captured CO₂, which must occur within three years of receiving state support. This means no support is paid while the facility is under construction. The winners of the first round will be announced by the end of 2024. Projects awarded funding under the scheme are allowed to sell carbon removal credits in the voluntary carbon market while retaining state support, but buyers are encouraged to declare in their climate reporting that they are contributing to climate finance rather than using it to compensate for emissions.

Denmark

Climate targets

The Danish Climate Act from 2020 commits the country to reduce emissions by 70% by 2030 and achieve net zero by 2050 compared to 1990 levels. In 2022, the Danish government raised its climate ambitions, setting a target to achieve climate neutrality by 2045 and reduce emissions by 110% compared to 1990 levels by 2050. To reach this ambitious 110% goal, Denmark expects to counterbalance residual emissions in 2050 with carbon removal solutions such as BECCS, DACCS, biochar, and forest sinks.

Policy Developments

To incentivize CCS and CDR, Denmark has established two subsidy funds, the CCUS Fund and the NECCS Fund. The CCUS Fund provides support for projects involving both fossil and biogenic sources, as well as Direct Air Capture with Carbon Capture and Storage (DACCS). Contracts under the CCUS Fund provide funding for 20+ years. The NECCS Fund, on the other hand, provides support for capturing and storing solely biogenic CO₂ from smaller and more cost-efficient projects, with contracts lasting a maximum of eight years [2].

This dual approach ensures that lower-cost, quicker-to-implement projects are prioritized under the NECCS Fund, while the CCUS Fund addresses higher-risk, higher-cost projects that require substantial infrastructure investment. Carbon removal projects receiving funding are also allowed to sell carbon removal credits in the voluntary carbon market while keeping state support.

The CCUS Fund was launched in 2023, with a contract awarded to Ørsted Bioenergy and Thermal Power A/S. This project aims to capture and store 430,000 tonnes of biogenic CO₂ annually from 2026. The NECCS Fund was launched in 2024, awarding contracts to Carbon Capture Scotland Ltd, BioCirc CO₂ ApS, and Bioman ApS, which collectively aim to capture and store 160,350 tonnes of biogenic CO₂ annually from 2026 to 2032 [3].

In October 2024, the third round of financing was opened. It was also announced that the CCUS Fund and the Green Tax Reform Fund will be integrated into a broader CCS Fund with a budget of 28 billion DKK, awarding contracts over a 15-year period. The fund is estimated to stimulate the capture and storage of 2.3 million tonnes of CO₂ annually from 2030. Denmark's Green Tripartite Agreement also allocated approximately 10 billion DKK for biochar production and use in the agricultural sector through 2045 [4].

Finland

Climate targets

Finland holds one of the world's most ambitious legally binding net-zero targets, aiming to reach net-zero emissions by 2035. The country's Climate Change Act sets emission reduction goals of 60% by 2030, 80% by 2040, and 90%—with an aspiration for 95%—by 2050, all relative to 1990 levels. Although the Climate Change Act does not impose binding targets for permanent carbon removals, meeting Finland's net-zero target will likely rely on contributions from the land use, land-use change, and forestry sector (LULU-CF) and technological CDR solutions.

Policy Developments

The Sustainable Growth Program for Finland, part of the Resilience and Recovery Plan, allocates 136 million euros to support clean hydrogen technologies and CCUS in industrial applications. While most of the funding focuses on hydrogen and CCUS, the plan also references bio-CCS as an integral technology for reducing emissions. However, projects for CDR remain mostly in the engineering and piloting phases in Finland, and there are no direct financial policy tools for removals in the country.

The Finnish government has also developed a guide to good practices for voluntary carbon markets to support voluntary mitigation action using carbon credits [5]. Like Sweden, Finland has significant potential for bio-CCS due to its forest-based industries that emit biogenic CO₂. However, Finland lacks domestic geological CO₂ storage capacity, making cross-border transport to Norwegian or Danish storages a likely short-term solution. Alternatively, utilizing captured CO₂ to create products may offer a cost-efficient path for Finland.

Norway

Climate targets

Norway's Climate Change Act sets an emission reduction target of 50–55% by 2030 and aims to become a low-emission society by 2050, with emissions reductions in the range of 90–95% by 2050 compared to 1990 levels. However, there is still no legally enshrined net-zero target.

Policy Developments

Norway has yet to establish individual targets for CDR and implement a dedicated policy instrument to finance further projects. However, recent developments indicate that the latter will change.

In 2023, the Norwegian Environmental Agency proposed policy tools to incentivize carbon removal, recommending reverse auctions, similar to Swedish and Danish systems, or a reversed CO₂ tax inspired by the U.S. 45Q tax credit. The latter offers fixed tax reductions for actors capturing and permanently storing CO₂.

A 2024 report commissioned by the Ministry of Energy proposed setting up a program structured as a series of auctions. The initial auction round would focus on cost-effective project development and infrastructure establishment, with subsequent rounds targeting specific sectors, technologies, or locations based on strategic priorities. In the fall 2024 budget agreement, the government committed to establishing a support scheme using serial auctions to realize emissions reductions and carbon removal from industrial sources and waste incineration. This scheme is expected to be in place before the state budget for 2026 [6].

Latest Project Developments

The **Northern Lights** transport and storage facility at Øygarden was officially opened in the fall of 2024, marking a significant milestone for Norway's CCS ambitions. The facility—a joint venture between Equinor, Shell, and TotalEnergies—is the transport and storage component of the Longship project. CO₂ will be received and temporarily stored at the terminal before being transported by pipeline to permanent storage locations in the North Sea.

The carbon capture facility at **Heidelberg Material's** cement plant in Porsgrunn also achieved mechanical completion in December 2024. This facility is expected to capture approximately 400,000 tonnes of CO₂ annually upon its planned opening in 2025.

The third part of the Longship project, **Hafslund Celsio's** waste incineration plant Klemetsrud in Oslo, was put on hold in 2023 due to budget overruns. Since then, they released an updated project basis in August 2024 with a reduction in the amount of captured CO₂, from 400,000 to 350,000 tonnes annually. The Norwegian government has also increased support for the project through the state budget to account for the increased cost. A final investment decision is set to be made in January 2025, with the aim of starting up the capture facilities in 2029. In addition to the increased financial support, the Norwegian government opens for Hafslund Celsio to sell credits on the Voluntary Carbon Market without having a reduction of state support equivalent to the value of the credits sold. This signals that the government will allow this in further projects as well.

Stockholm Exergi, which received a €180 million grant from the EU Innovation Fund for their planned BECCS project at their biomass-powered waste-to-energy plant in Stockholm, signed an agreement with Microsoft covering 3.33 million tonnes of permanent carbon removals. This deal is the second contract Stockholm Exergi has made for the sale of carbon removal credits, with the first being a deal with Frontier worth over 500 million SEK. The final investment decision for the BECCS project is expected to be made in Q4 2024. The winners of the first Swedish auction round are also expected in late 2024.

Ørsted has also entered into an agreement with Microsoft for the sale of carbon credits. This agreement is for Ørsted to sell 1 million tonnes of carbon removal and builds upon an already existing commitment to buy 2.67 million tonnes, which brings the total of the deals between Ørsted and Microsoft to 3.67 million tonnes. Equinor has also reached an agreement with Ørsted for the purchase of credits equivalent to 330,000 tonnes CO₂ over a ten-year period. Ørsted's BECCS projects, for which they signed a contract with the Danish government following the CCUS Fund tendering, are set to be operational by the beginning of 2026.

Project Greensand has completed and verified the pilot project for the storage of CO₂ at the Nini West reservoir in the North Sea, and the 23 consortium partners have submitted their final report, potentially paving the way for the development of large-scale CCS in Denmark. The final investment decision for the project was also reached in December 2024. Norway has also continued to issue exploration licenses related to CO₂ storage on the Norwegian continental shelf in eight separate rounds since 2018, with the latest licenses issued in the summer of 2024.

Puro Earth is a leading carbon crediting platform focused on enabling high-quality, durable carbon dioxide removal (CDR) projects, particularly in the Nordic region. Based in Finland, Puro.earth has developed a marketplace for verified carbon removal credits, with a strong emphasis on methodologies such as biochar, BECCS, and other long-lived carbon removal processes. By certifying projects under their Puro Standard, which ensures scientific rigor, additionality, and permanence, Puro.earth plays an important role in mobilizing financing for CDR projects through the voluntary carbon market (VCM). In 2024, Puro launched its policy demand map, providing an overview of policies for CDR and guidelines for defining net zero [8].

Discussion and policy recommendations

As carbon dioxide removal (CDR) policies and projects continue to advance across the Nordic region, it is timely to identify pathways for more effective public policymaking and regional collaboration. This chapter highlights key considerations and presents actionable policy recommendations to accelerate the deployment of CDR.

Establish separate targets and policy frameworks for carbon removals

The importance of establishing separate climate targets for emission reductions and carbon removals cannot be overstated. This distinction ensures that efforts to reduce emissions is the top priority while CDR plays a complementary role in addressing residual emissions. Both Sweden and Denmark have recognized this by implementing frameworks that allow for clear and separate accounting of emissions reductions and removals. However, Finland and Norway still lack specific CDR targets, which risks that CDR replace emission reductions instead of creating negative emissions. A clear separation of targets across all Nordic countries would enhance accountability and drive progress in both areas.

Implement policy tools to incentivize carbon removal

Public policies, as described above, are developing in several countries. In the absence of a tax on biogenic CO₂, or other incentives to remove CO₂ from the atmosphere, subsidies are often the preferred policy of choice. So far, reversed auctions seem to be the preferred solution in Nordic countries. However, there are several possible policy options to encourage CDR. Both obligations, tax-credits and building infrastructure can incentivize projects.

Harmonize guidelines on participation in the voluntary carbon market

The voluntary carbon market (VCM) plays a pivotal role in financing high-quality carbon removal projects, yet its credibility often suffers from concerns about additionality, permanence, and verification. Standardized and harmonized frameworks for VCM participation and reporting are urgently needed to bolster its legitimacy.

Standardized and harmonized frameworks for participation in the voluntary market and reporting rules would help build credibility. In the development of a policy tool, Sweden and Denmark allowed co-financing with the VCM but have slightly different approaches to reporting. The Finnish government has given more general advice on the use of credits, and Norway has allowed co-financing for the Hafslund Celsio project, but none of the latter have guidelines for reporting.

The EU is currently developing its Carbon Removal Certification Framework (CRCF). The CRCF has been in development since 2021 and has now been approved. The certification scheme will ensure integrity and prevent double counting of removals, which is crucial for building a credible market.

Coordinate infrastructure development

Effective carbon management hinges on well-coordinated value chains involving capture, transportation, and storage. Building the necessary infrastructure—pipelines, temporary storage sites, and logistics systems—requires significant upfront investment, posing challenges particularly for smaller facilities like waste-to-energy plants. In cases where capture sites are in remote areas, the absence of transport infrastructure further complicates deployment.

Public investment in foundational infrastructure can unlock private-sector investments in capture and storage by reducing risks and barriers. This is especially critical for countries like Finland, which lack domestic geological CO₂ storage options and must rely on cross-border solutions. By planning and coordinating seamless cross-border transportation and storage systems, Nordic countries can derisk private **investments** and establish an integrated infrastructure network. Such cooperation would position the region as a global leader in CCS and CDR deployment, showcasing the viability of cross-border value chains in carbon management.

Concluding remarks

There have been several major developments in CCS and carbon removal in the Nordic countries since the first Climate Neutral Nordics policy paper was published in 2021. Denmark has completed three rounds of its fund scheme, with Sweden recently completing its first auction. Norway has also announced its own plan to develop an auction scheme, directly referencing Sweden and Denmark's auctions as sources of inspiration.

CCS and CDR projects in the region have been progressing, with several nearing completion. Notably, the Northern Lights CO₂ transport and storage facility is ready to receive CO₂, and the Brevik CCS Project has achieved mechanical completion. In addition, both Ørsted and Stockholm Exergi's BECCS projects have sold their first credits on the VCM, and Project Greensand has taken a final investment decision, bringing Denmark closer to storing CO₂.

To accelerate the upscaling of carbon management in the region, this paper recommends that countries create separate targets for carbon removal, implement public policy incentives to realize projects, harmonize guidelines on participation in the voluntary carbon market, and coordinate infrastructure development.

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