

---

# Optimal Deployment of BECCS and DACCS around the North Sea

Romain Presty\*<sup>†1,2</sup>

<sup>1</sup>IFP Energies nouvelles – IFPEN, IFP Energies nouvelles, 1 et 4 avenue de Bois-Préau, 92852  
Rueil-Malmaison, France. – France

<sup>2</sup>Centrale Supélec – CentraleSupélec, Saclay, France. – France

## Abstract

The Intergovernmental Panel on Climate Change (IPCC) emphasizes that reaching the 1.5°C climate target requires large-scale deployment of Carbon Dioxide Removal (CDR) technologies. Among engineered options, Bioenergy with Carbon Capture and Storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS) are considered essential to offset residual emissions from hard-to-abate sectors and to achieve net-negative emissions trajectories. However, significant uncertainties persist regarding the cost-effective pathways for their deployment, particularly at the regional level. This study addresses this gap by developing a dynamic, spatially explicit, cost-optimization model that examines how, where, and when BECCS and DACCS should be deployed across seven European countries and regions bordering the North Sea: France, the United Kingdom, Germany, Benelux, Denmark, Sweden, and Norway, from 2025 to 2050.

The model minimizes the discounted cost per ton of net CO removed while accounting for techno-economic parameters, infrastructure constraints, learning-by-doing effects, and the evolving decarbonization of electricity grids. It integrates lifecycle emissions, three-year construction delays, national capacity limits, and differentiated costs for transport and storage based on proximity to North Sea infrastructure projects such as Northern Lights. The model adopts earning rates and uses country-specific biogenic CO potentials and electricity decarbonization pathways.

The results reveal a two-phase deployment strategy. In the early period (2025–2040), BECCS dominates due to its relative cost advantage and integration with existing biomass infrastructures. Countries such as the UK and Sweden lead the deployment, leveraging biomass availability and early access to transport and storage facilities. However, as biomass constraints become binding and electricity grids increasingly decarbonize, DACCS emerges as the dominant removal technology after 2040. Early DACCS investments occur in Norway due to its near-zero carbon electricity, followed by France and the UK as capital costs decline. By 2050, DACCS overtakes BECCS in terms of annual removals.

Economic results show an average removal cost of approximately €270 per ton of CO, though substantial geographical disparities exist. Countries such as the UK and Sweden bear the highest cumulative costs, while Denmark and the Benelux region incur lower burdens due to size constraints and limited biomass availability. When costs are expressed relative to national GDP, Sweden and Norway appear particularly exposed, raising important questions

---

\*Speaker

<sup>†</sup>Corresponding author: [romain.presty@ifpen.fr](mailto:romain.presty@ifpen.fr)

of fairness and the need for coordinated burden-sharing mechanisms.

The study highlights three critical enabling factors for successful CDR deployment: (i) sustainable biomass supply, (ii) access to low-carbon electricity, and (iii) proximity to CO transport and storage infrastructure. It emphasizes the need for targeted European policies, including regulatory support for sustainable biomass, accelerated grid decarbonization, and investment in shared cross-border CO infrastructure.

**Keywords:** CDR, BECCS, DACCS, Spatial model, Europe