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Storing carbon dioxide with the help of the ocean – but safely GEOMAR research provides important information for political decisions

04.03.2024/Kiel. With the recently published key points for the German Carbon Management Strategy and the draft amendment to the Carbon Capture and Storage Act, the Federal Ministry of Economic Affairs and Climate Action takes a major step towards the implementation of technologies for the capture and storage of carbon dioxide under the seabed. The key points on the Long-Term Strategy for Negative Emissions also drive the development towards climate protection further. Findings from GEOMAR Helmholtz Centre for Ocean Research Kiel contribute to political and social decision-making.

With two key point papers, the German Federal Ministry for Economic Affairs and Climate Protection (Bundesministerium für Wirtschaft und Klimaschutz, BMWK) fleshes out its commitment to climate protection and initiatives to balance carbon dioxide emissions that are currently unavoidable, in particular emissions from cement production and waste combustion. In addition to the key points for the German Carbon Management Strategy and the draft amendment to the Carbon Dioxide Storage Act (Kohlendioxidspeicherungsgesetz), key points for the Long-Term Strategy on Negative Emissions for Dealing with Unavoidable Residual Emissions (Langfriststrategie Negativemissionen zum Umgang mit nicht vermeidbaren Restemissionen, LNe) were also announced. The addressed measures complement the urgent need to drastically reduce greenhouse gas emissions.

GEOMAR Helmholtz Centre for Ocean Research Kiel has more than 15 years of research expertise in the storage of carbon dioxide under the seabed. In addition, GEOMAR scientists are involved in a large number of national and international research projects on marine carbon dioxide removal. For example, the research mission “Marine carbon sinks in decarbonation pathways” (CDRmare) of the German Marine Research Alliance (DAM) is coordinated at GEOMAR. As part of CDRmare, six research consortia investigate various approaches to carbon dioxide removal from the atmosphere and its storage in the ocean in close dialogue with stakeholders.

Capture and storage of carbon dioxide in the seabed

Carbon capture and storage (CCS) was developed to capture greenhouse gas emissions at their source and store them underground. According to scientific work carried out in recent years, CCS technology has been sufficiently researched and can be used. In the deep subsurface of the North Sea, it has already been practised for decades under Norwegian waters. Under the German North Sea, there are rock formations in which large quantities of carbon dioxide could be stored, too. Monitoring and precautionary measures as well as strategies for dealing with possible conflicts caused by other forms of use of the North Sea are necessary in order to minimise risks and avoid hazards.

“The announcement of the key points is an important first step. In the coming months, the German government's Carbon Management Strategy will be published, which will clearly define the sectors for which we need and want to utilise CCS. At the same time, a bill on CO₂ storage and transport will be introduced to the Bundestag. As soon as the law comes into force, companies can take action and put their CCS plans into practice,” explains Professor Dr. Klaus Wallmann. The geoscientist from Kiel leads the research network “Submarine Carbon Dioxide Storage in Geological Formations

of the German North Sea” (GEOSTOR) of the research mission CDRmare and is a member of the Carbon Management Strategy Expert Council.

However, there is still a long way to go, according to Professor Wallmann: “Suitable sites for CO₂ storage under the North Sea must be found and investigated in detail, the infrastructure for CO₂ transport must be planned and built and the separation plants at cement and lime or waste combustion plants must be constructed. In addition, public funding is needed to financially support the first CCS projects. It will therefore probably be another ten years or so before things really get underway and CO₂ is injected on an industrial scale under the seabed of the German North Sea.”

Ocean-based negative emissions

As agreed in the coalition agreement, the Long-Term Strategy on Negative Emissions for Dealing with Unavoidable Residual Emissions (Langfriststrategie Negativemissionen zum Umgang mit nicht vermeidbaren Restemissionen, LNe) will address approaches that help to achieve net greenhouse gas neutrality by 2045. The methods considered in the recently published key points paper include the conservation and restoration of seagrass meadows and algae ecosystems as well as accelerated weathering – also known as ocean alkalinity enhancement. While natural CO₂ sinks can be directly strengthened through immediate measures, for other approaches, the framework conditions for research and risk assessments must first be created.

To respond to the growing interest and increasing activities in the field of ocean-based carbon dioxide removal, the international scientific community has developed guidelines for transparent and sustainable research with substantial contributions from GEOMAR. In a three-part experiment led by GEOMAR which is part of the international project Ocean Alk-Align, scientists from various marine science disciplines investigate this year how marine ecosystems react to alkalinity enhancement from accelerated weathering. Comparable experiments have already been carried out as part of the research mission CDRmare and the Ocean-based Negative Emission Technologies (OceanNETs) project. In addition, experiments on the restoration of seagrass meadows are continuously being conducted in the Kiel Fjord.

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