Norway grants

# PROGRAMME 'APPLIED RESEARCH'

# DESCRIPTION OF THE CALL SUB-AREAS POLNOR CCS 2019 CALL

## Introduction

CCS (Carbon Capture and Storage) is no longer a theoretical possibility. The technology is well-developed on a scientific level and is now ready to move past the pilot and demonstration stage.

It is also recognized by the EU as a crucial instrument to reach European emission reduction targets, which are critical in face of climate change happening in the world.

Norway is one of the world's leading developers and users of CCS, with two operational installation in place. The POLNOR CCS 2019 Call wants to tap into this experience and creates a chance for Polish and Norwegian researchers and entrepreneurs to develop common, scientifically excellent projects that will accelerate the time to deployment for CCS technology in both countries.

The call is open for projects in the following sub-areas:

- Full value chain analysis
- Social science related to deployment of CCS
- Storage pilots
- New knowledge that facilitates large-scale $CO_2$ storage
- Development of $CO_2$ capture solutions integrated in power and industry processes

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# Description of the call sub-areas

## Full value chain analysis

Under this topic R&D gaps in the full CCS chain should be addressed, including $CO_2$ capture, transport, storage, piloting components and full chain elements, and incorporating related case studies for social acceptance.

Projects should focus on integrating $CO_2$ capture in power and industrial installations, whilst addressing the full CCUS chain. Safety and risk along the whole value chain should be addressed. Coping with the large volumes of $CO_2$ to be collected from power plants and industry, will require $CO_2$ infrastructure, or network, comprising both transport and storage. Projects should elaborate a detailed plan on how to use the results, i.e. the subsequent transport and/or underground storage of the captured $CO_2$ including planning of possible $CO_2$ infrastructure or network.

In relation to introducing CCS technology the environmental impact of capture processes and potential leaks in connection with transport and/or storage should be addressed. It will be desirable to carry out Life Cycle Assessment (LCA analyses), both to map the total environmental footprint of a complete CCS/chain (carbon: capture, transport and storage) and to assess individual components and processes. Models and procedures for this should be established. Projects should produce new knowledge about the potential environmental impacts associated with the realisation of large-scale CCS.

*Expected outcome:* Identifying safety and environmental impacts (e.g. during transportation and storage), as well as financial (e.g. cost of capture; cost of integration), and implementing issues (e.g.; operation and logistics of industrial and power clusters) for deploying a full CCS chain. Models for evaluating risk, cost and environmental impact of whole CCS chain and procedures and models developed for environmental impact analyses should also be included in the outcome.

## Social science related to deployment of CCS

A key for successful deployment of CCS is enhanced public and political awareness of possible hazards and benefits associated with CCS. This call therefore opens for social science studies that can pave the way for realistic assessment of CCS by the general public and the political systems in Norway and Poland. Reference should be made to international studies and best practice manuals for public and political awareness published by the IEA GHG and GCCSI.

Public funding instruments and incentives will be crucial to the implementation of carbon capture and storage. Consequently, insight into the potential role of such instruments and incentives is needed as a basis for public policy in this area. Other relevant topics in this area may include business models, studies of legislation and standards, information and competence-building to accelerate CCS implementation. It is important that topics are viewed in an international perspective, particularly for Europe. There is also a need to understand which factors are conducive to the spread of CCS technology. This may encompass business management or business models addressing CCS in the aim of commercialisation.

Another social science subject is sustainability-related studies with a focus on biomass production in connection with Bio-CCS.

*Expected outcomes:* Advice on how to handle public concern and political challenges with respect to CCS in a realistic manner. New business models for commercialisation of CCS. Advice or regulatory framework for introducing CCS. Guidelines for introducing sustainable Bio-CCS on a larger scale.

## Storage pilots

Knowledge, methods and technologies to monitor storage sites and the geosphere above a storage site should be further developed and tested. Testing of methods and tools is most effective in actual and real injection projects. This also deals with methods and procedures to counteract possible undesirable incidents and environmental impact. Increased lifetimes of equipment and installations used in development and monitoring of a storage site will simplify operations and can contribute to reducing costs. This call therefore encourages applications on onshore storage pilots. If possible, it is recommended to build on already existing infrastructure. Applicants are particularly encouraged to incorporate innovative thinking and interdisciplinary cooperation into $CO_2$ storage technology development efforts.

*Expected outcomes:* Experience from injection, monitoring and validation of models that describe the storage site, the $CO_2$ plume and the migration of $CO_2$.

## New knowledge that facilitates large-scale $CO_2$ storage

Geological storage of $CO_2$ requires that $CO_2$ remains safely stored for thousands of years. New knowledge on how to avoid migration of $CO_2$ out of the storage reservoir is required. Improved or new monitoring methods and technologies are required to ensure safe transport and storage of $CO_2$. Also,

identification and geological characterisation of storage sites for $CO_2$ (including the 3D architecture of the storage complex) in promising regions of future deployment (onshore or offshore) for Norway and Poland.

*Expected outcomes:* Recommendations for how to prevent unintended migration of $CO_2$ including guidelines for characterisation of possible storage sites and required monitoring plan for the operational and post-operational phase. Improved understanding of the required monitoring frequency, resolution, methods and costs. Mitigation options in case of unintended migration of $CO_2$.

## Development of $CO_2$ capture solutions integrated in power and industry processes

The Programme is seeking proposals related to bringing upcoming technologies to a higher TRL and validation in a relevant environment, especially if no suitable demonstration or pilot plants are available. R&D should focus on gaps that can bring the technology to a higher TRL. This includes technology gaps and improvements of mature technology such as amine emission reduction from post combustion technologies. Projects should, whenever possible, intend to collaborate with existing and future pilots and/or demonstration plants.

Important technical aspects to address are the optimised integration and scalability of capture plant within power and industrial processes. This can identify the benefits of solutions dependent of the available local resources, requirements and surrounding conditions. Project proposals should include an assessment of the potential of the proposed technologies to boost efficiency and cut costs compared with the more mature technologies.

*Expected outcomes:* Improved and matured solutions for $CO_2$ capture technologies. Better understanding and evaluation on how $CO_2$ capture technologies can be integrated in processes, and how $CO_2$ capture efficiency can be improved and costs reduced.