

Unofficial translation

Report to the Storting No. 9

(2010–2011)

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Full-scale carbon capture and storage

*Recommendations of the Ministry of Petroleum and Energy of 4 March 2011,
approved by the Council of State on the same day.*

(Government Stoltenberg II)

1 Introduction and summary

In connection with the re-balancing of the State budget for 2010 (Proposition 35 S (2010–2011)), the Government expressed its intention to provide the Storting with a more detailed review of the work done in connection with CO₂ capture at Mongstad in early 2011. This report discusses the status of CO₂ capture efforts in Norway and other relevant countries. The work done at Mongstad is a key part of the government's policy, and discussion of the work therefore comprises the majority of this report.

Chapter 2 discusses *The role of carbon capture and storage (CCS) in energy and climate policy*. Necessary welfare development outside the OECD countries will bring with it a significant increase in global energy consumption. Fossil fuels will be required for energy supply purposes for decades to come. Both the International Energy Agency and the UN Intergovernmental Panel on Climate Change are of the view that CO₂ capture and storage will be a key measure for reducing greenhouse gas emissions. Through measures like the Sleipner project, Norway has developed significant expertise relating to CO₂ storage in geological formations. Together with the CCS projects of other countries, the CLIMIT programme, the CO₂ Technology Centre Mongstad (TCM) and full-scale CO₂-capture at Mongstad will provide new knowledge and assist in the development of more efficient and cheaper CCS solutions. The full-scale facility and the technology centre at Mongstad will provide unique experience in establishing CO₂ capture at existing gas-fired power plants. Full-scale CCS at Mongstad will limit Norway's emissions of greenhouse gases. An equally important aim is to ensure that the technology and expertise Norway is developing are also utilised outside Norway.

Chapter 3, *CO₂ capture at Mongstad*, discusses the technology centre, the efforts being made to implement full-scale CO₂ capture at Mongstad, the need for greater knowledge about the effects on health and the environment of using amine technology, and Gassnova and Statoil's assessments relating to this work. In view of the information that has emerged about the need for greater knowledge about the potential effects on health and the environment of using amine technology, an implementation plan is described that envisages the use of alternative technologies in further planning efforts. Until now, the plan has been to conduct qualification of amine technology parallel to the design of the CO₂ capture plant itself. This project model, in envisaging the simultaneous use of multiple, alternative CO₂ capture technologies, would increase the risk of

unforeseen events and increased costs. In order to reduce this risk, a model has been adopted under which the qualification of technology will primarily be conducted before the design of the Mongstad plant. All known technologies for capturing CO₂ from flue gas emitted by coal- and gas-fired power stations are immature and, even though some technologies are more developed than others, there is a need for long-term development efforts.

The adjusted project model implies that the next phase of the planning efforts will involve securing sufficient knowledge of and insight into relevant technologies. The technology qualification programme will cover technologies that may be suitable for CO₂ capture from existing gas-fired power plants. The objective is to qualify at least one capture technology that can be used. The next phase, the design of the plant, will involve, among other things, detailed investigations of the integration of the selected primary technology with the thermal power station, the infrastructure and the surrounding plants. The technology qualification phase is estimated to last three years. The plan for the technology qualification phase will be subject to uncertainty, as it is uncertain when the desired results will be achieved. If a capture technology should be sufficiently developed and qualified earlier than this, the phase will be shortened. The subsequent planning work is expected to take around two years. Current information indicates that the government will be able to submit a comprehensive decision-making basis to the Storting no later than 2016.

Moreover, there is discussion of the planned organisation of the cooperation between the State, represented by Gassnova, and Statoil regarding the further planning work. The starting point is the preparation of two agreements. The first agreement will regulate the planning phase up to the completion of an investment basis, while the second agreement will regulate development and operation. The agreement relating to the planning phase will form the basis for ESA notification, and is subject to ESA approval. The State and Statoil share responsibility for achieving full-scale CO₂ capture, but the two parties' roles and contributions in this context differ. The State's contribution is primarily to finance the CO₂ capture plant, while Statoil is to implement the project. The plan is for Gassnova to exercise the State's rights and fulfil the State's obligations under the agreement. Statoil, as project implementer, is to report to a joint steering committee comprising representatives from Statoil and Gassnova.

The government is giving high priority to achieving full-scale CCS at the lowest possible cost. Gassnova has been tasked with conducting an investigation that is intended to contribute to a broad-based, up-to-date overview of the possibilities for achieving full-scale CCS beyond the Mongstad project. The results of this investigation will form part of the government's preparation of its Climate Report and the government's work on CCS. The investigation will be undertaken parallel to the qualification of technology as part of the Mongstad project.

Chapter 4 discusses *Transportation and storage of CO₂*. It is clear from the implementation agreement between Statoil and the State from 2006 that the State is responsible for the transportation and storage of CO₂ from Mongstad. The ongoing planning work is proceeding on the assumption that a solution will be implemented for the transportation and safe storage of CO₂ by the time that the planned full-scale CO₂ capture plant is commissioned. Gassco and Gassnova's planning work this far has

included studies of relevant storage sites, the seabed and solutions for a CO₂ pipeline from Mongstad.

Gassnova has undertaken a preliminary study of different models for organising the ownership, development and operation of the transportation and storage of CO₂ from Mongstad. The leading expertise relating to CO₂ transportation and storage is possessed by stakeholders and companies involved in oil and gas activities on the Norwegian Shelf. The Government finds it important to utilise the knowledge of these stakeholders, and industry participation is an objective in the effort to develop an ownership and operation model.

Chapters 5 and 6 respectively focus on *Technology, knowledge and expertise* and *CCS internationally*, as well as Norway's role in this context. There is a need to develop technology and build up expertise in a wide field, ranging from long-term research to the construction of full-scale plants for the capture, transportation and safe storage of CO₂. Norway's efforts take this need into account. Internationally, work on CO₂ capture in the energy sector is primarily focused on coal-fired power stations. Norway's efforts are to a much greater extent directed at CO₂ capture from gas-fired power stations. Norway's work thus supplements international efforts. But knowledge gained at Mongstad will also be of relevance to other CCS projects around the world. The transfer of experience from Norwegian projects to other countries will help to promote CCS internationally. At the same time, participation in international cooperation will help to strengthen efforts to build up the expertise of Norwegian industry, research institutions and authorities.

Chapter 7 deals with the *Financial and administrative consequences* of the proposals in the report.