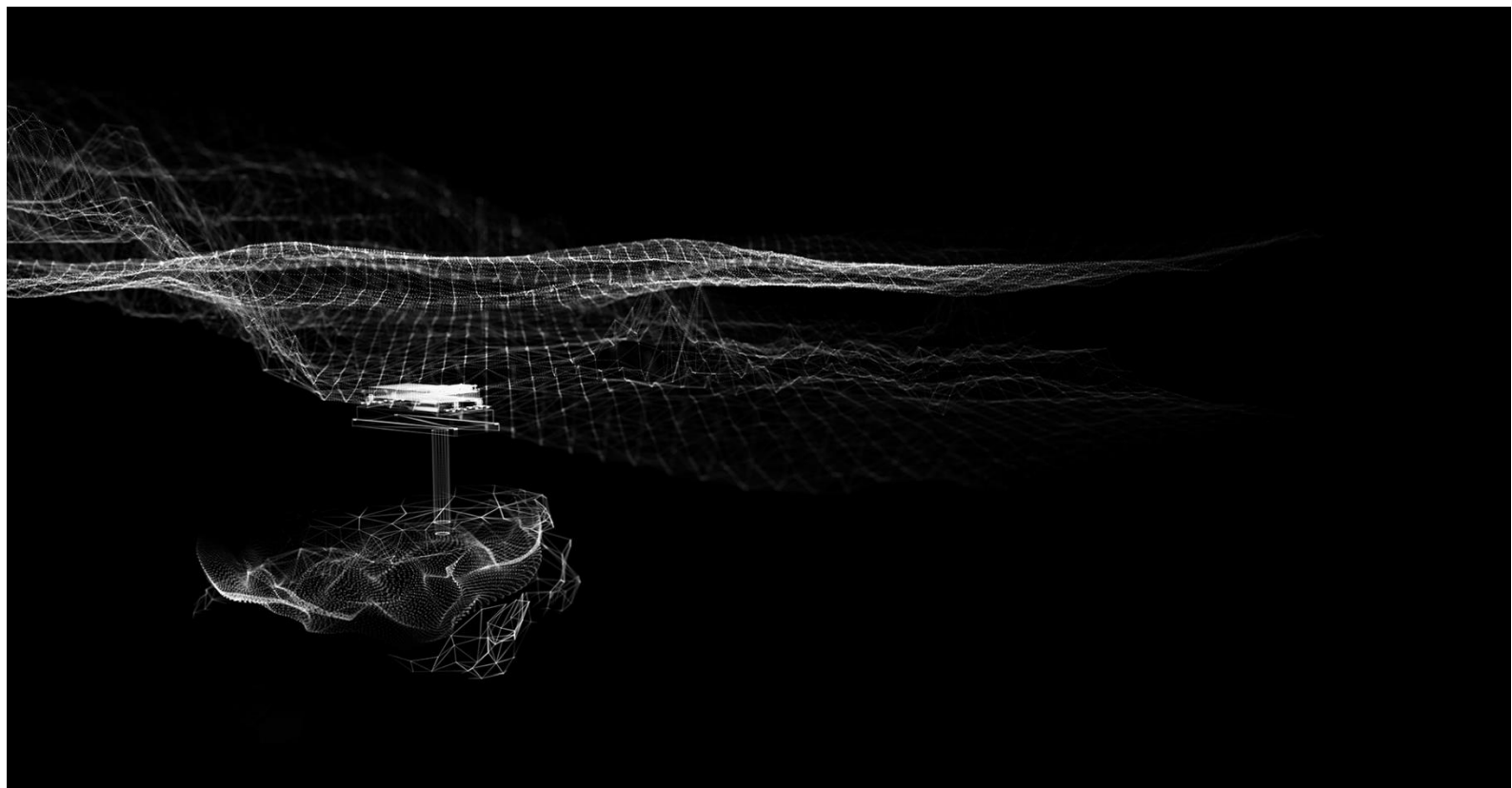


Guidelines for licence applications



Award of area for storage of CO₂ 2024-1
on the Norwegian continental shelf



**NORWEGIAN OFFSHORE
DIRECTORATE**

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General information about submitting documents

Submitting the application

Application letter, company information and application(s) with appendices must be submitted to the Ministry of Energy with copies to the Norwegian Offshore Directorate and the Norwegian Ocean Industry Authority. If submitting via L2S Authority Communication or Altinn, both the Ministry of Energy, Norwegian Offshore Directorate and Norwegian Ocean Industry Authority can be chosen as recipients of the same dispatch. Please submit the files well before the application deadline.

Norwegian Offshore Directorate and Norwegian Ocean Industry Authority

All documents with appendices must be placed in a folder named CO2 2024-1-"*companyname*"-"*applicationnumber*"of"*totalnumber*" and compressed ("zip format"). The "*totalnumber*" must reflect the number of applications your company is actually submitting via L2S or Altinn. There must be no sub-folders and the zip file must not be password-protected.

Title the submission CO2 2024-1-"*companyname*"-"*applicationnumber*"of"*totalnumber*" and submit it via L2S Authority Communication or Altinn to the Norwegian Offshore Directorate and Norwegian Ocean Industry Authority. Example for company "CCS AS" submitting an application: CO2 2024-1-CCS AS-1of1.zip

Ministry of Energy

Documents can be submitted to the Ministry of Energy in all electronic formats. L2S Authority Communication or Altinn can be used.

Overview of submissions to the Ministry of Energy, Norwegian Offshore Directorate and Norwegian Ocean Industry Authority

- Application letter
- Company information
- Application(s) with appendices

The total size of the application should not exceed 600 MB.

Shapefiles

Shapefiles for the area applied for must be named with a minimum of "AppliedArea". If the naming contains multiple elements, underscore characters must be used as separators. The shapefile shall contain a polygon showing the area applied for. The shapefile shall also contain information indicating whether or not the acreage is stratigraphically separated.

Overview and naming the content of each application

- Appendices:
 1. Application
 2. Form
 - a. ApplicationData
 - b. Geological Storage location and Quantities Stored potential data
 - c. CompanyInformation

3. Maps of area applied for
4. Shapefile with outline of area applied for

- Name the files as listed below:

File name	Format	Description
<i>Application_ "BlockNumber"</i>	.pdf	Application
<i>"BlockNumber"_ ApplicationData</i>	.xlsx	Filled out Excel workbook "ApplicationData", one Excel workbook per application
<i>"BlockNumber"_ "StorageComplex_name"_ Geological Storage complex and Quantities Stored potential.data</i>	.xlsx	Filled out Excel workbook "Geological Storage complex and potential capacity for Quantities Stored"; one Excel sheet per storage complex (copy the sheet in the same workbook if you need more complexes)
<i>"BlockNumber"_ "CompanyName"_ CompanyInformation</i>	.xlsx	Filled out Excel workbook "CompanyInformation", one Excel workbook per application
<i>"BlockNumber"_ "CompanyName"</i>	.jpg	Maps of area applied for with storage complex(es), max. 200 kb
<i>AppliedArea</i>	.shp	Shapefile with outline of area applied for

Suggested maximums are indicated for the number of pages and number of figures/tables under the various chapters in the application. If there is a need to exceed the suggested number of pages and/or number of figures/tables, this must be substantiated. Use a font size equivalent to Times New Roman 12 and single/standard line spacing. All information in figures and maps must have good resolution and be legible. All maps must have coordinates as well as a scale.

Excel workbooks for use in the applications can be found on the Norwegian Offshore Directorate website along with these instructions. The format of the Excel workbook must not be changed. The only exceptions are adding additional rows to the forms Table 1, 2 and 3, and creating the necessary number of sheets for Table 4.

All measurements (depth, area, volume, etc.) must be stated in metric units.

Forms

The forms requested for applications are collected in the Excel workbooks:

1. ApplicationData
 - a. Table 1: Application summary
 - b. Table 2: Quantities Stored Potential
 - c. Table 3: Work program and duration
2. Geological Storage complex and Quantities Stored potential data
 - a. Table 4: Geological Storage complex and potential capacity for Quantities Stored
3. Company Information
 - a. Table 5: Application list from company
 - b. Table 6: Size and experience related to petroleum and CCS
 - c. Table 7: Financial status
 - d. Table 8: Projected cash flow (only for companies without an international credit rating)

Application for stratigraphic acreage

When applying for stratigraphic acreage, the relevant application interval must be stated in Chapter 1 (Application Summary).

Application for acreage containing discoveries/shut down fields

If the area applied for contains existing discoveries and/or shut down fields, this must be included. Information about geological, technical reservoir and potential resource-related contexts or impacts from previous or existing petroleum activity must be described.

Application content

1 Application summary

The application summary must be the first part of the application. It should be approx. three pages and must contain the following:

- A. Overview of applicants and acreage applied for with block designations in the completed form "Table 1: Application summary"
(Table 1 must also be included in the Excel workbook "ApplicationData")
- B. The purpose of the application in the form of a project description.
- C. Acreage description with completed form "Table 2: Quantities Stored potential".
(Table 2 must also be included in the Excel workbook "ApplicationData")
- D. Maps with geographical coordinates, block numbers and a scale showing the area applied for with outlines of the storage complexes listed in the form "Table 2: Quantities Storage potential" and presented in the application.
(The map must also be enclosed as a separate .jpg file)
- E. Completed form "Table 3: Work program and duration".
(Table 3 must also be included in the Excel workbook "ApplicationData")

1.1 Overview

State the licence pursuant to the *Regulations relating to exploitation of subsea reservoirs on the continental shelf for storage of CO₂ and relating to transportation of CO₂ on the continental shelf (Storage Regulations)* that is the subject of the application, applicants and the area applied for. If the application is for stratigraphic acreage, state the relevant interval. Fill out the form "Table 1: Application summary" with necessary data. If the storage complex is a shut down field, this must be clearly stated.

1.2 Project description

A description of the planned project, including CO₂ source, transport and development concept.

The Norwegian authorities want to facilitate socio-economically profitable storage of CO₂ on the Norwegian continental shelf. Companies with the necessary expertise and which have matured industrially sound and profitable projects can apply for a licence tailored to the activity's needs.

1.3 Potential for CO₂ storage

The storage location, storage complex and hydraulic unit of the project must be defined.

Briefly summarise the potential for CO₂ storage in the area applied for, and display it on maps with outlines of the storage complexes referenced in the application and which are listed in the form "Table 2: Quantities Stored potential". Use different coloured outlines for different stratigraphic levels. Key data for storage complexes referenced in the application must be listed in the form "Table 2: Quantities Stored potential".

1.4 Overview of previous activity in the area applied for

Reference shall be made to historical licences in the area applied for, with reference to own or others' studies, for example based on publicly available Status Reports found on the Norwegian Offshore Directorate's Factpages. This shall be listed chronologically. It must be clearly stated whether the storage complex applied for is part of an existing or new geological exploration model used in previous licences.

1.5 Maps

Map over the area applied for and outline of the storage location that have been mapped and described in Table 2 shall be included with the geographical coordinates, block numbers and scale. The geographical corner coordinates for the area applied for must be listed in a table. As regards applications for stratigraphic licences, the relevant acreage must be shaded. The map shall show the outline of the storage complex, as well as the outline of the total hydraulic unit of which the storage complex is a part of. Shape files must be enclosed as separate files for all requested outlines.

1.6 Work program and duration

A brief description of the applicant's proposed work program for and duration of the licence must be stated in the form "Table 3: Work program and duration". Examples of/proposed work programs, and decisions that must be used, are provided under the form. Other activities can also be entered. The primary focus of the work program is to reduce the risk associated with storing CO₂ safely and form a basis for planning prudent injection and migration within the storage location. Include Table 3 in the summary. A description of the program must be provided in Chapter 4 of the application.

2 Description of the CCS project

The applicant must demonstrate that awarding a new licence is a necessary prerequisite for implementing and further developing concrete, profitable projects for capture, transport and storage of CO₂.

A description of the value chain for the most relevant project, including capture player(s), transport solution, development solution and storage location must be presented. If subcontractors will be used for transport, onshore plants or other key elements, this must be briefly described. If different business models and solutions are being considered, the most relevant ones must be described.

Profitability calculations, including net present value and break even, must be shown for the most

relevant solution. Assumptions, including tariffs, discount rate, exchange rates and prices etc., must be presented. Briefly explain the most important uncertainties, as well as the status of and plans for commercial negotiations.

3 Geological and technological assessment

The applicant's description should generally use what is described in Appendix I to the CO₂ Storage Regulations – '*Criteria for describing and assessing the potential storage location and surrounding area*'. Here the applicant must document a sufficient geological understanding, thereby substantiating that the area can be matured into a secure storage complex.

Insofar as possible, the definitions must conform with international standards. Specifications and definitions must conform with defined classification system.

3.1 Databases and utilising data

Seismic, well data and other types of data that were used in the evaluation must be described. Emphasis shall be placed on how data is utilised and to what extent the applicant has carried out new interpretations and analyses.

Any external reports, purchased studies and other non-public information used in the application must be acknowledged. Should not exceed 5 pages including maps and tables.

Seismic database Seismic that has been included in the evaluation must be listed with survey name and type of seismic, and must be clearly indicated on a database map of the area applied for. It will be beneficial to address data quality and data improvement measures here.

Well database Well data that have been used in the evaluation must be listed by name and clearly indicated on a database map of the area applied for. Key wells must be marked and commented on/substantiated.

Studies Acknowledge relevant internal or purchased academic studies with clear references, e.g. reprocessing/geophysical special studies, geochemistry studies, sealing analyses / leakage studies, geomechanical studies, etc.

3.2 Geological overview

This chapter must contain seismic mapping and reservoir conditions that are considered to be relevant for evaluating safe storage and the storage complex addressed in the application. The documentation should not exceed 5 pages of text in addition to up to 20 figures.

Seismic mapping Describe which horizons have been interpreted, well correlation and depth conversion method. As a minimum, the following figures must be included:

- Well correlation that includes relevant wells
- Synthetic seismogram documenting well correlation

- Seismic line showing calibration of seismic interpretation in relation to well(s)

Regional geology

Briefly describe the area's primary stratigraphic, sedimentological and structural features. As a minimum, the following figures must be included:

- Chrono- and lithostratigraphic column showing levels for identified primary and secondary storage complex(es)
- Palaeogeographical maps illustrating the extent of the primary reservoir and sealing formations for mapped storage complexes
- Maps showing the structural geological framework in the area

3.3 Evaluation of storage capacity

Mapping and evaluation of the storage capacity of the primary and secondary storage complex in the area applied for. The storage complex can also include shut down fields.

The primary storage complex must be described in detail, while any secondary storage complexes can be described in less detail. The primary storage complex includes what the applicant considers to have the highest probability of being further matured to a secure storage complex with sufficient capacity.

Critical factors for the integrity and capacity of the storage complex shall be addressed. Examples of critical factors that must be described include reservoir properties, the extent of reservoirs and sealing in the area applied for. Evaluation and discussion of critical factors shall be related to the proposed work programme (ref. section 4 below).

Mapping

As regards the primary and secondary storage complex, the application must describe how they have been mapped with type of trap, sealing and expected reservoir properties. If the storage complex is a shut down field, this must be clearly stated.

The evaluation must particularly address aspects deemed to be critical for the injected volume over time, pressure build-up, migration, sealing, etc.

The static model must be described briefly, up to 1 page. The reasoning behind the chosen parameter, assumptions and assessments for the model shall be included.

The following documentation must be included for primary and secondary storage complexes:

- An overview map with coordinates and outlines of the storage complex, as well as the position of seismic lines and geological profiles
- Two seismic and geological profiles in intersecting directions
- Time maps or depth maps in the same scale for the reservoir horizon(s)
- Seismic attribute maps as needed

Other figures can be included to the extent they are relevant for describing the primary and secondary storage complexes.

Storage capacity

For each storage complex, applicants must describe the procedure(s) for calculating

- rock volume with range of uncertainty
- potential storage capacity with range of uncertainty
- storage efficiency factor used in the evaluation

The description must include the method used to calculate uncertainty, and substantiate the choice of reservoir and fluid parameters used to calculate storage capacity.

The storage capacity the applicant have plans for in the described project ("Planned Project Storage Capacity") and the overall theoretical potential storage capacity must be listed in the form "Table 2: ApplicationData" for the primary storage complex(es). As regards secondary storage complexes, the table should be completed with the maximum level of detail.

**Technical
reservoir aspects**

Provide a description of the planned injection strategy for the storage complexes, the presumed migration of injected CO₂, the most important reservoir uncertainties and expected challenges. An injection profile must be included and described.

The applicant must illustrate how the geological and areal-related distribution of injected CO₂ is expected to be distributed within the area applied for, as well as the expected pressure development in the area.

CO₂ migration and pressure development in the hydraulic unit must be described along with pressure and saturation maps. An overview map must be included that shows the outline of dynamically modelled pressure- and saturation maps;

- 1) 10 years after start-up,
- 2) at assumed time of shut down,
- 3) 20 years after the assumed time of shut down, and
- 4) after 1000 years or when CO₂ is immobile.

Activities in nearby licences that affect pressure development in the area applied for should be taken into account. Uncertainties shall be highlighted.

Acreage that is not described as a need in relation to the project will normally not be awarded.

Explain how uncertainties, such as reservoir communication, injectivity, aquifer support and pressure development, may affect the course of injection and how these challenges can be handled.

The trapping mechanisms for the storage complex over time should be described.

Pressure depletion from surrounding petroleum fields or pressure build-up from surrounding injection wells should be addressed and included in the evaluation. If the primary or secondary storage complex borders an exploitation or exploration licence, the application must address how this may affect the planned injection throughout the project's lifetime.

A dynamic reservoir model must be used for the documentation.

Leakage risk

The application must address factors that may be critical for secure storage over time. Describe the extent and integrity of the storage complex' sealing formations. Describe potential leakage routes that have been assessed with associated basic data, including risk in relation to nearby wells. Please comment specifically on key wells described in Chapter 3.1 of the well database. If there are adjacent petroleum fields and/or existing wells, the application must describe any potential risk of leakage to or impact on existing facilities.

If CO₂ migrates out of the area applied for, the presumed timing of this, as well as its proportional share of the total storage capacity must be stated in the application.

Probability of success The probability is an expression of how the applicant assesses risk and critical factors associated with the storage complex. The application must describe the plan for reducing the risk. Examples of critical factors include the integrity of existing wells in the area, sealing and pressure development in the reservoir over time.

The likelihood must be calculated based on the probability that

- a suitable reservoir is present which can retain CO₂ ($P_{\text{reservoir}}$)
- there are no CO₂ leakage routes out of the storage complex ($P_{\text{containment}}$)
- the reservoir properties provide effective injectivity ($P_{\text{injectivity}}$)

These three factors must be multiplied and entered in "Table 2: Quantities Stored Potential" and "Table 4: Geological Storage complex and potential capacity for Quantities Stored".

This probability must be justified in the text of the application. The work program must describe how the risks will be addressed further in an effort to reduce overall risk.

The documentation should not exceed 10 pages of text, including:

- 5 pages for the primary storage complex(es), in addition to relevant figures/maps
- 1 page of text in addition to figures for each secondary storage complex

The form "Table 4: Geological Storage complex and potential capacity for Quantities Stored" must be filled out with the data/parameters used to evaluate the mapped primary and secondary storage complexes with a high and low estimate. As regards secondary storage complexes, the table must be completed with as much data as possible.

3.4 Coexistence

Description of how the proposed activity in the area applied for will affect, or be affected by, nearby active production licences, licences for offshore wind, and other relevant offshore stakeholders. The factors to be described include CO₂ migration, pressure communication between the licences and any limitations associated with necessary data acquisition and monitoring.

If the storage complex in the area applied for is part of a hydraulic unit that extends into other licences, as well as beyond the Norwegian continental shelf, this must be described.

3.5 Synergies with other CO₂ storage licences

Brief description of potential synergies with other nearby active licences; production licences and exploration and exploitation licences. This e.g. applies as regards the power supply, control centre, infrastructure or other cooperation beyond the licence applied for.

3.6 Technological assumptions and development plan

As regards the mapped primary storage complex or group of complexes, a description must be provided of what is presumed to be the most optimal development solution for the area. Relevant alternative solutions can also be addressed. The description must be limited to about three pages including illustrations.

In connection with planned utilisation of facilities currently being used in other activities on the shelf, provide a more detailed description of opportunities, technical or commercial challenges, lifetime, etc. Relevant development alternatives must be presented and compared. The injection strategy, operating model, wells, facilities, transport solution and potential cooperation with other players should be part of the description. New solutions or new technology should be particularly emphasised.

3.7 Monitoring

A plan for monitoring the storage complex with a description of how the applicant expects to carry this out in all relevant phases of the project, cf. Sections 5-4 and 5-7 of the CO₂ Storage Regulations, as well as Appendix II.

4 Work program

Information about the work program for the area applied for, listed in the form "Table 3: Work program and duration", must be addressed in more detail and substantiated. The entire work program must be described, with emphasis on the first phase. See examples and wording in the form "Table 3: Work Program and duration". The applicant must clearly show how the work program provides an optimal process for reducing uncertainties, as well as any critical factors identified for the storage complexes.

Briefly address the following:

- relevant geophysical and/or geological data sets being considered / planned for use
- the schedule for the different phases of the studies and/or development plans for the storage complexes

If the application comprises secondary storage complexes, please describe how they will be matured.

The description can be limited to approx. two pages of text.

The form "Table 3: Work program and duration" should preferably be in Norwegian.

5 Environmental factors

Comment on any special environmental provisions associated with the area applied for, and how this will be handled during the research phase and during development and injection. The documentation can be limited to two pages of text.

6 References

References to reports, studies and publications used in the evaluation work.