Danish Energy Agency

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Introduction

On 20 September 2023, a majority in the Danish Parliament signed an Agreement on a strengthened framework for CCS in Denmark (in Danish: "*Aftale om styrkede rammevilkår for CCS i Danmark*"). The agreement merged the second phase of the CCUS fund[1] and the GSR fund[2] to one combined fund (the "CCS fund") that is to be deployed in two tendering rounds. The fund will provide subsidy for the development of the value chain for carbon capture, transport and storage ("CCS").

The overall framework for the CCS fund is set out in the Agreement on strengthened framework for CCS in Denmark of 20 September 2023. The DEA therefore refers to this agreement for further information on the CCS fund.

Within the framework as set out in the political agreement, the DEA is currently in the process of preparing the tender procedure for the first tender for the deployment of the CCS fund. This includes e.g. the form of tender procedure, the model for awarding one or several contracts, the economy and subsidy scheme etc.

This note is published in connection with the prior information notice concerning the market dialogue for the first tender for the deployment of the CCS fund published by the DEA and is a general summary of the written contributions from several participants.

Participants in the market dialogue

The DEA has received 18 contributions in total. Participants from various sectors submitted inputs to the market dialogue, including two companies located in the industry sector, six energy and utilities companies, two CO_2 storage site developers, one CO_2 infrastructure developer, four interest groups, one developer of carbon capture technologies, one developer of direct air capture technology and one research institution.

In the following summaries, all information have been anonymized. Some of the specific inputs received have been excluded from this note due to its commercially sensitive nature.

[1] As established by the Danish Climate Agreement for Energy and Industry of 22 June 2020
[2] As established by the Agreement on green tax reform for industry of 24 June 2022

Readiness of CCS value chain

The participants point to technology (im)maturity, contractual agreements with sub-suppliers, and disharmonious timelines as substantial hurdles. The collective input thus reflects the complexity and remaining challenges associated with establishing a CCS value chain

While some participants express confidence in having a CCS value chain operational by 2028/2029, others voice concerns about the disharmony between the CCS Fund tender timeline in relation to the tender for onshore exploration and storage licenses. Accordingly, due to the immaturity and lack of CO_2 storage options, several participants recognize the risks associated with applying for the tender in 2024, suggesting that the 2025 tender round might be a more feasible option.

Some participants also stress the immaturity of carbon capture technology and potential risks associated with synchronizing the operation of different parts of the CCS value chain. The need for numerous contracts with technology providers, infrastructure operators, and potential buyers of Carbon Removal Credits (CRC) adds to the complexity.

The participating CO_2 storage site developers emphasize the need for a more realistic CCS Fund tender timeline, suggesting that a fully commercial CO_2 storage project may not be operational until 2030. They highlight challenges in providing guarantees for CO_2-storage by 2029 due to e.g. the extensive exploration work required for maturing a given storage site.

Preferences regarding CO_2 storage

The participants deem onshore storage to be the most cost-effective option. However, many note that the timelines for the CCS Fund tenders and the maturation of onshore CO_2 storage options do not align.

The market inputs indicate a notable interest in onshore CO_2 storage. Despite a willingness to collaborate on onshore storage and pipeline transportation, several participants point out that onshore CO_2 storage developers express hesitancy to commit to contracts at this early stage.

One participant e.g. notes that their current realistic choice is to transport CO_2 by ship to offshore storage, potentially in the Northern Sea. This decision is influenced by the timelines for onshore storage, with expectations that onshore operators won't be ready to sign binding contracts for the tenders in 2024 or 2025.

Another participant with a preference for transporting CO_2 via pipelines for onshore storage, indicates a contingency plan to ship it to an offshore CO_2 storage site in the North Sea if onshore storage does not turn out to be a viable option.

Of note, some participants did not provide specific insights into their preferences or strategies regarding CO_2 storage.

Other considerations and/or expectations for how to establish a value chain for CCS

Participants recognize the need for consortia, yet the differing timelines and costs among emitters pose challenges in formulating a single bid price. Despite these complexities, some participants note that collaboration through consortiums or partnerships remains a viable option

Some participants emphasize the importance of forming partnerships to ensure the success of the CCS project. They have launched a concession notice, expecting partners to lead subcontracting processes, involving technology and infrastructure expertise, transportation operators, and storage operators.

One participant explicitly states that ownership and operation of the CO_2 capture plant is the most advantageous option. They prioritize self-sufficiency for a seamless integration with the existing energy system. However, they plan to outsource CO_2 transportation and storage to sub-contractors.

Another participant contemplates a business case based on capturing CO_2-from either their own point sources or external point sources, exploring existing infrastructure or creating new transport and storage options

In line with this, many of the participants express preference to seek out partners for transportation and storage due to complexities beyond their expertise and financial capacity. This, however, gives rise to potential challenges as potential partners are reluctant to take responsibility for the entire CCS value chain due to its overall immaturity.

Financing

A number of participants expect income from Carbon Removal Credits (CRC), surplus heat sales, and EU ETS and national CO_2 tax savings while exploring financial means like EU Innovation Fund co-funding, and upfront funding from sustainability-focused funds.

The participants highlight savings from avoided EU ETS allowances and CO_2 taxes as primary value drivers for CCS projects. Revenue from Carbon Removal Credits is widely seen as an additive stream, especially for projects involving biogenic/atmospheric CO_2. Some participants explicitly state that they foresee revenue from carbon removal certificates.

Several participants explore diverse financial options and consider co-funding from the EU Innovation Fund.

Lastly, one of the CO_2 storage site developers emphasizes long-term revenue from CO_2 emitters paying to capture and store CO_2, supplemented by upfront funding from various sources, including e.g. sustainability-focused funds.

Timeline for tender procedure

Participants emphasize the need for a well-planned and adequately long construction phase for establishment of a CCS value chain. They highlight concerns about tight timelines, proposing various submission deadlines. Several participants recommend that timing for the tender should be aligned with onshore storage licenses for optimal outcomes.

Many of the participants stress the importance of determining a detailed timeline for the tender procedure as soon as possible, and then “sticking to it”. This is considered crucial for operators to establish contracts across the entire value chain and meet the requirement of capturing and storing CO_2 from 2029.

Several participants stress the importance of an adequately long construction phase. They emphasize the need for a short timeline from pre-qualification to contract signing, given the requirement to commence operation of the full value chain in 2029.

One participant, however, highlights the significance of setting the final offer (BAFO) deadline as late as possible, as a later deadline could lead to increased competition, emphasizing the importance of onshore storage in this respect.

Some participants, furthermore, suggests postponing the second CCS Fund tender to allow for the awarding of onshore exploration and storage licenses in Denmark, as this would enable for lower CO_2 storage prices. Some furthermore propose the possibility of allowing a two-scenario approach in the final offers based on different storage outcomes.

Regulatory challenges

Participants express concerns regarding obtainment of necessary approvals and permits in due time, highlight challenges regarding the Voluntary carbon market, and call for clarity on long-term regulatory frameworks from the Danish government.

Several participants express concerns about the regulatory landscape affecting Carbon Removal Credits (CRCs), emphasizing uncertainties due to the lack of standards, and rigorous certification schemes. Some participants also express concern that municipalities in the future will be unable to include certified negative emissions in their emissions inventories, if the negative emission has been sold as a CRC to e.g. a third party company.

Furthermore, several participants stress the need for the implementation of the Danish Green Tax Reform for Industry (GSR) before the tender procedure opens.

Several participants furthermore highlight the need – and importance - for new regulation that enables municipality owned energy and utilities companies to, inter alia, include the value of saved EU ETS allowance in their business case with some participants stressing that this new regulation should be adopted by the Danish Parliament before the tender deadline for submission of the final offer (BAFO)

Some participants raise concerns about potential delays in obtaining necessary approvals from authorities for establishing a CCS value chain given the tight timeframe.

Penalty

Overall, the participants highlight the delicate balance between creating incentives for performance, while avoiding excessive financial burdens that could hinder the successful implementation of CCS projects.

The majority of the participants acknowledge that penalties can be a tool to maintain fair competition in future tenders, noting, however, that the tenderers would factor potential penalties into their bid price, leading to increased subsidy requirements.

The picture is mixed regarding the participants' preferences for a penalty system based on either non-performance or delay in commercial delay with achieving the commercial operation date (COD) on time. While penalty relating to delay of COD is favored by some participants, others raise concerns about maintaining a penalty for non-performance, noting that the incentive to deliver on their obligations is already high: the potential loss of revenue, subsidies, and 'locked' payments to transport and storage providers serves as natural disincentives.

Some participant also high light that the uncertainty around the readiness of onshore storage is a significant risk, and suggest more lenient rules for penalties related to non-performance related to a delay of an onshore CO_2 storage site.

Other substantial comments

Evaluation model

One participant comments that the evaluation model in the tender should not solely rely on a price assessment, but also consider qualitative criteria. For instance, positive emphasis should be placed on the technical maturity achieved through completing the FEED (Front-End Engineering Design) for the capture facility. There should be stringent requirements for the technical and economic maturity of the offered project to enhance the likelihood of its successful execution within the proposed framework.

Transition to CCU

One participant proposes to include a mechanism allowing the Operator to later shift from storing $CO_2$to utilizing it, for example, in Power-to-X processes. Alternatively, there should be an option to terminate the agreement with the provider/ENS (Entity Responsible for Network Service).

Subsidy adjustment during contract period

One participants suggests that the awarded price is firm and fixed in the contract period only regulated with the inflation or exceptional price fluctuations of e.g., energy prices.

Mixed CO_2 streams & Carbon removal credits

One participant underlined the absence of Danish or EU allocation rules for distinguishing between biogenic and fossil CO2 in mixed streams, which in theory view constitute a crucial aspect for selling CRCs.

Parent company guarantee

One participant recommends against including a requirement for an unlimited parent company guarantee in the tender material. Referring to the CCUS tender, they find it unnecessary and suggest, at a minimum, considering a delimited parent company guarantee in the CCS tender.

Establishment of CO_2 backbone infrastructure

Some participants advocate for the establishment of a backbone CO2-pipeline infrastructure, with the Danish state covering associated risks.

One participant also highlighted the importance of ensuring third-party access and implementing standardized CO2 specifications.

Biomass & sustainability criteria

One participant stresses the need to maintain the current definition of sustainable biomass, as changes could hinder the achievement of negative emissions in the EU.

Calculation of negative emissions & climate impact of bioenergy

One participant suggests that the tender should reward what they term “actual negative emissions”. The comment stresses that the reduction of wood reserves in forests due to the burning of wood for energy purposes to some degree should be considered as an emission, impacting the climate.

In line with this comment, another participant proposes that the tender should consider the net effect of BECCS by requiring bidders to incorporate emission factors for biomass based on the best available knowledge.

Voluntary carbon market

One participant highlights the potential role of the voluntary market for CO2 credits (VCM) in supporting CCS in Denmark. The participant suggests that if Denmark incorporates a negative emission (e.g., from a BECCS project) into its carbon accounting, and a private entity wishes to sell it as a CO_2 credit for a better business case, the credit should not be used as "compensation/offset" but rather as a "climate contribution" to Denmark's carbon accounts.

Appendix 1: Questions asked during the market dialogue

The DEA asked the participants to submit written contributions on the following questions:

Contemplated value chain and project

1.1. What are the operator's considerations and/or expectations concerning the elements of its value chain for CCS (e.g. number of capture plants, location of capture plant(s), means of transport, means of storage etc.)?

1.2. What are the operator's considerations and/or expectations for how to establish a value chain for CCS in terms of collaboration with other operators, e.g., sub-contracting, establishing partnerships, establishing hubs etc.?

> 1.2.1. Does the operator consider it relevant or possible to participate in the tender procedure with other operators e.g., for the purpose of fulfilling minimum requirements regarding quantity of CO2 or economic standing, if such are included in the tender documents.

1.3. When does the operator expect that each part of its contemplated value chain for CCS will be in operation?

1.4. Does the operator currently consider itself ready for participating in the tender scheduled for publication in June 2024 and/or the tender scheduled for publication in June 2025 taking into account the requirement of capture and storage from 2029?

1.5. Which barriers and/or risks does the operator expect to be the most significant regarding the project during the contract?

2. Tender procedure

2.1. Within the assumption that the tender is scheduled for publication in June 2024 and the requirement of capture and storage from 2029, what are the operator's considerations regarding the timing of the following phases of the tender procedure:

> 2.1.1. Deadline for submission of application for prequalification
> 2.1.2. Deadline for submission of initial tender
> 2.1.3. Deadline for submission of final tender
> 2.1.4. Timing of notification of the award decision

2.1.5. Timing of entering into contract

2.2. If the operator has any considerations regarding the timing of the second tender of the CCS fund, which is scheduled for publication in June 2025 with a requirement of capture and storage from 2029, please elaborate.

3. Financing

3.1. By which financial means (other than subsidy from the DEA) does the operator expect to establish its business case?

3.2. What are the operator's expectations to revenues and savings from the ETS quota system during the contract?
3.3. What are the operator's expectations to revenues from sale of certificates (voluntary credits) related to capture and storage of biogenic CO2 or atmospheric CO2?

4. Quantity of CO2 for CCS

4.1. Does the operator expect to base its value chain for CCS on capture of biogenic CO2, fossil CO2, both biogenic and fossil CO2 or atmospheric CO2?

4.1.1. To the extent the operator expects to base its value chain on capture of both biogenic and fossil CO2, does the operator expect the proportion between biogenic CO2 respectively fossil CO2 to be stable or unstable during the contract from year to year? If the operator expects the proportion to be unstable, please elaborate on whether and how this influences the operator's project and/or business case, and the time horizon for the operator to foresee any changes in the proportion.

4.2. What quantity of captured and stored CO2 does the operator for a contract with the DEA expect to guarantee annually from (and including) 2028 or 2029 until end of the contract?

4.2.1. What quantity of CO2 does the operator expect to be able to capture annually?

4.2.1.1. What is the difference between the quantity of CO2 that the operator is able to capture annually and the quantity of CO_2 that the operator will guarantee annually in a contract with the DEA (i.e. the buffer capacity)?

4.2.1.2. Is the operator able to estimate any buffer capacity in advance and with a certainty of such buffer capacity being realized? If so, how far in advance (monthly basis, from year to year etc.), and with which degree of certainty?

4.2.2. Would the number of contracts that the DEA would be able to award based on the tender procedure influence the quantity of CO2 that the operator wishes to offer annually? If, yes please elaborate on such influence.

4.2.3. Does the operator consider it relevant if the tender documents allow for submitting offer with different quantities and different subsidy per ton of CO2 captured and stored?

4.3. To the operator's knowledge, are there any minimum limit(s) for the quantity of CO2 that an operator will need to be able to commit to capturing in relation to transport and/or storage providers?

4.4. What are the operator's considerations towards the contract including either i) a penalty for delay with achieving the commercial operation date on time or ii) a penalty for non-performance with respect to capturing and storing the contracted quantities after the commercial operation date?

5. Regulatory aspects

5.1. Does the operator consider that there are any regulatory outstandings of importance for the operator from i) a Danish legislative perspective, iii) EU legislative perspective and iii) other? Please elaborate on the impact of such regulatory outstandings with regards to e.g. the preparation of an offer, the business case, the subsidy per ton, etc.

6. Substantial comments

6.1. Does the operator have any substantial comments for the DEA?