PNO INNOVATION

Comparative study of Carbon Contracts for Difference and auction schemes for CCS in Europe

Carol Trisorio, Jorge Gonçalves, Ariane Kroker, Joep Raats

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Abbreviations

ADEME The French Agency for Ecological Transition

BECCS Bioenergy with Carbon Capture and Storage

BAFO Best and Final Offer

BMWE German Federal Ministry for Economic Affairs and Energy

BMWK German Federal Ministry for Economic Affairs and Climate Action

CAPEX Capital expenditures

CCfD Carbon Contracts for Difference

CHP Combined Heat and Power

CCS Carbon Capture and Storage

CCU Carbon Capture and Utilisation

CCUS Carbon Capture, Utilisation and Storage

CDR Carbon Dioxide Removal

CEEAG Climate, Energy and Environmental Aid Guidelines

CfD Contracts for Difference

CIF Carbon Capture and Storage Infrastructure Fund

MR Minimum Requirements

CISAF Climate, Environmental and State Aid Framework

DAC Direct Air Capture

DACCS Direct Air Carbon Capture and Storage

DEA Danish Energy Agency

DESNZ Department for Energy Security and Net Zero

DKK Danish Krone

EEA European Economic Area

EIO Entry into Operation

ETS Emissions Trading System

EU European Union

EUR Euro

FA Free Allowances

FEED Front-End Engineering Design

FID Financial Investment Decision

GGR Greenhouse Gas Removals

GHG Greenhouse Gas

GPID Grands Projets Industriels de Décarbonation

GSR Green Tax Reform

HM Heidelberg Materials

IDB Industrial Decarbonisation Bank

INDO Indicative Offer

IRA Inflation Reduction Act

KSV Klimaschutzverträge – Climate protection contracts

LCCC Low Carbon Contracts Company

MEP Milieukwaliteit van de Elektriciteits Productie

MMP Measurement and Monitoring Plan

MR Minimum Requirements

MRV Monitoring and Reporting Verification

Mt million tonnes

NACE Statistical classification of economic activities in the European Community

NECCS Negative Emissions via CCS

OPEX Operational expenditures

POV Point of View

PtJ Projektträger Jülich

RVO Netherlands Enterprise Agency

SDE++ Dutch scheme for producing renewable energy and applying CO_2-reducing techniques

SEK Swedish Krone

T&S Transport & Storage

UK United Kingdom

Executive summary

This comparative study analyses competitive auction schemes for carbon capture and storage (CCS) in Europe. In particular, it covers Carbon Contracts for Difference (CCfD) across the Netherlands, Germany, Denmark, the UK and France and the reversed auction mechanism in Sweden for BECCS (biogenic CCS). The goal is to define actionable insights for optimising CCfD design in Sweden. While national schemes differ significantly in scope, maturity, cost-allocation models and interaction with carbon pricing, a clear set of common success factors and structural barriers emerges.

Across Europe, the most effective schemes provide long-term revenue certainty, predictable interaction with carbon markets, and credible support across the CCS value chain. Countries that combine these features with clear contracting frameworks, robust monitoring, reporting and verification (MRV) rules and realistic timelines create more favourable investment conditions for large-scale CCS. By contrast, infrastructure gaps, asymmetric risk allocation, and administrative complexity continue to hinder deployment.

Key Findings

1. Long-term investment certainty is essential.

Most schemes provide 12–15 years of revenue support, which is critical for the bankability of capital-intensive CCS and BECCS projects. One-sided CCfDs (e.g., in the UK, Netherlands and Denmark) reduce downside risk for project developers, whereas two-sided CCfDs (Germany) offer fiscal protection for governments.

2. Coverage of the CCS value chain strongly influences feasibility.

Schemes that support capture, transport and storage within a single framework (Sweden, Denmark, UK) reduce counterparty and integration risk. In contrast, systems that exclude T&S (Germany) require developers to secure external storage independently, exposing projects to storage-availability, permitting and cross-border coordination risks.

3. Interaction with the EU ETS (or national ETS) is a defining feature.

The Netherlands and Germany directly index reference prices to carbon markets, ensuring dynamic adjustment and avoiding over- or under-compensation. France and the UK adopt fixed linear reference price paths that enhance fiscal predictability but increase market-misalignment risk.

4. Technology and feedstock eligibility vary widely.

Sweden supports only projects focused on biogenic CO_2, whereas other schemes allow fossil, biogenic, or mixed streams. This has implications for industrial sectors such as cement, where fossil CCS is often required for deep decarbonisation.

5. Infrastructure readiness is the main cross-cutting barrier.

All countries face delays or uncertainties regarding T&S capacity, port infrastructure, permitting, and cross-border storage agreements. These factors often determine whether otherwise competitive CCS bids can materialise.

6. Administrative burdens and compliance requirements shape competitiveness.

France and Germany apply stringent baseline, MRV and cost-validation rules. The Netherlands uses a highly structured, rule-based system with limited flexibility. Denmark and the UK introduce greater negotiation space, allowing more tailored risk allocation.

7. Timelines and operational requirements must reflect CCS project realities.

Several schemes initially imposed unrealistic deadlines (e.g., Sweden's 3-year storage requirement), later adjusted following industry feedback. Successful schemes incorporate realistic ramp-up periods and flexibility for infrastructure-related delays.

Overall Insights

The study demonstrates that while European CCfD instruments share a common objective—closing the cost gap between low-carbon and conventional production—their effectiveness depends on balancing fiscal discipline, market responsiveness, and whole-chain coordination.

Future policy design will need to prioritise:

- predictable long-term support,
- strong integration with carbon pricing,
- coordinated development of capture–transport–storage infrastructure,
- clear and implementable MRV frameworks, and
- transparent engagement between governments and industry.

These lessons provide actionable insights for optimising CCfD design in Sweden and other countries preparing to scale industrial CCS.

1. Introduction

Decarbonising energy-intensive industries requires substantial investment in advanced technologies such as carbon capture and storage (CCS). International experience demonstrates that Carbon Contracts for Difference (CCfD) can be a pivotal funding mechanism to support large scale CCS projects. This mechanism can provide long-term revenue certainty and can help bridging the cost differential between conventional and low-carbon production. Countries such as Denmark, Germany, the Netherlands, France and the UK have already implemented or are trialling CCfD schemes. In contrast, Sweden currently employs a reverse auction mechanism, which does not sufficiently address the requirements of large-scale industrial projects of this nature.

In order to address the financial shortfall of Heidelberg Materials' (HM) Swedish flagship CCS project in Slite, a CCfD indexed to the EU ETS price has been proposed to the Swedish government. It is crucial for the project that this proposal is advanced and structured effectively to secure its viability and enable broader industrial transformation.

The Slite CCS project is an innovative flagship set to move the construction industry towards net zero emissions at unprecedented scale. Through large-scale investment in carbon capture together with a gradual increase of biogenic fuels, the cement produced at the Slite cement plant, one of the largest cement plants in Europe, is the key enabler for near- or net zero construction in Sweden. Capturing up to 1.8 million tonnes of CO_2 the project corresponds to cutting 4 percent of current CO_2 emissions in Sweden.

The study is intended to enhance Heidelberg Materials' internal expertise in CCfD design and implementation, leveraging insights from other countries to identify optimal design features and critical considerations for the Swedish context.

1.1 Approach

This study applies a structured comparative methodology to analyse CCfDs and auction schemes for CCS across six European countries. It systematically reviews each national mechanism by examining its policy background, objectives, working principles, eligibility criteria, bid structures, payment mechanisms and performance requirements, as reflected in the individual scheme chapters (Sweden, Netherlands, Germany, Denmark, UK and France).

A cross-country comparison subsequently identifies common drivers, barriers and design differences influencing large-scale CCS and BECCS deployment, culminating in a comparative assessment and a consolidated table of design features (Chapter 8 and Annex 1).

This combined qualitative and comparative approach enables a coherent evaluation of the suitability and transferability of CCfD design elements to the Swedish context.

1.2 Basics to understand the CCfD concept

Before entering into the analysis of the existing CCfDs schemes some basic concepts of Contracts for Difference have to be clarified.

A CCfD is a public contract that guarantees a fixed carbon price to an industrial emitter by covering the difference between a predefined **strike price** and a **reference (carbon) price**.

The strike price is the carbon price level needed to make a low-carbon project economically viable. This means that the strike price typically represents the levelized capital expenditure (CAPEX) and operational expenditure (OPEX)

of a project. The reference carbon price is a fixed or observable market price that is used as the benchmark against which the contract's strike price is compared. The EU ETS price or a fixed linear carbon price are typical examples of reference prices in a CCfD.

Figure 1 provides a visualization of the payment logic of CCfD under various scenarios. If the reference price falls below the strike price, the public authority pays the company the difference per tonne of verified CO_2 abated or avoided, thereby compensating for insufficient carbon market revenues (see Figure 1, blue area). Conversely, if the reference price exceeds the strike price, in a two-sided CCfD, the company pays back the difference to the authority, ensuring that the support mechanism remains symmetric and avoids windfall profits (see Figure 1, yellow area).

In order to constrain the maximum compensation (or payback) and provide greater budget predictability while still preserving the core risk-sharing logic of the instrument, two additional prices are often introduced.

A base energy or carbon price called **floor price** to cap the aid disbursement, i.e. if the reference price goes below the floor price, no compensation beyond the base energy or carbon price is paid (see Figure 1, blue striped area). An upper limit called a **ceiling price can have two functions.** It can be intended as the maximum price for strike price in the bid (as is the case for SDE++ according to different categories) or it can also be used to limit the upper end of paybacks which occur in two-sided CCfD schemes when the reference price is higher than the strike price (see Figure 1, yellow striped area). In this case, the ceiling price is intended as the maximum price for the reference price in order to limit what the applicants pays to government.

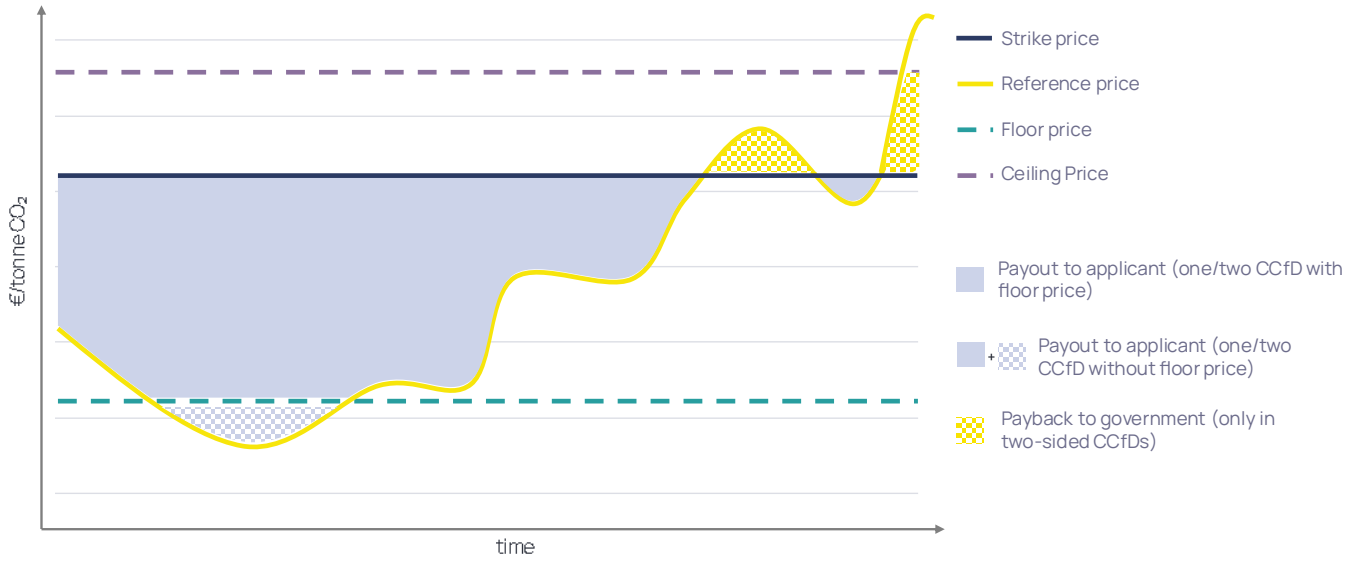

Figure 1: Graphic visualisations of payouts to applicant and paybacks to government in a one/two-sided CCfD scheme

It should also be noted that the bid price, that is, the amount which serves to rank proposals in the competitive bidding, varies from scheme to scheme. In some, the bid price is the subsidy request (difference between strike price and reference price e.g. SDE++), in others, the bid price is the strike price (French scheme).

These price terms will be used throughout the study and their characteristics are analysed more in depth in chapter 8.2 and 8.3.

1.3 Design principles

Although all CCfDs aim to stabilise carbon-price signals through a strike–reference price mechanism, their real impact depends on how governments structure several key design elements. These elements determine eligibility, risk allocation, competitiveness, bankability, and the degree of predictability for both applicants and public authorities. The following principles constitute the analytical framework used to compare national schemes in the subsequent chapters.

Eligibility criteria and technology scope

Eligibility rules define which sectors, CO_2 streams (fossil, biogenic, mixed), and technologies can participate. These criteria strongly shape which industries can realistically deploy CCS or BECCS and at what scale.

Value chain coverage (capture, transport, storage)

Schemes vary in whether they fund only capture or the full CCS chain. Integrating transport and storage reduces counterparty risk and improves bankability, while exclusion of T&S shifts significant uncertainty onto developers.

Contract duration

The number of years for which price support is guaranteed is a central driver of bankability. Most schemes run for 12–15 years, but timelines and entry into operation requirements vary widely and materially affect project feasibility.

Bidding structure and competition model

Some mechanisms use cost efficiency auctions, others apply negotiated procedures or multicriteria scoring. The bidding architecture influences transparency, competition intensity, strategic bidding behaviour, and overall cost effectiveness for governments.

Strike price determination

Schemes differ in how the strike price is defined and whether it is fixed, technology specific, or dynamically adjusted over time. The chosen method directly influences cost recovery, exposure to market volatility, and the degree of fiscal predictability.

Reference price design and carbon market interaction

Some countries anchor the reference price to the real EU ETS, others rely on fixed linear trajectories, and some apply hybrid or floor price systems. The reference price mechanism determines how closely CCfD payments track the true value of carbon and how over or under compensation risks are managed.

Payment rules and risk sharing mechanisms

Payment frequency (annual, quarterly, monthly), one or two sided compensation, rules on clawbacks, and treatment of additional revenues or cost deviations shape how operational and financial risks are allocated between the state and the developer.

Monitoring, reporting and verification (MRV)

Compliance requirements, verification frequency, and performance thresholds determine the administrative burden and operational flexibility, especially for large industrial projects with complex emission profiles.

2. Sweden: Reverse auction for Bio-CCS

2.1 Background

Unlike the other countries analysed in this study, Sweden does not use a CCfD scheme; instead, it operates a reverse auction. Sweden's reversed auction instrument for Bioenergy with Carbon Capture and Storage (BECCS or Bio-CCS) arises from the country's commitment to achieving net-zero carbon emissions by 2045. Under the Climate Act, Sweden aims to reduce domestic emissions by at least 85% compared to 1990 levels. However, recognizing that complete elimination of the remaining 15% of emissions may not be feasible, Sweden allows for supplementary measures to offset this residual emission. Bio-CCS is highlighted by the Swedish Energy Agency as a key complementary measure, with national technical potential of at least ~10 $MtCO_2$/yr by 2045.

For the purpose of meeting national climate targets, Bio-CCS removals must be retained within Sweden's national accounting (Nationally Determined Contributions - NDCs) and cannot be simultaneously claimed by other countries' national accounting. This will be under HM and Swedish Authorities control, since a transaction in a voluntary market that affects NDCs (under Article 6 of the Paris Agreement) requires that the CO_2 removal supplier (HM) requests an authorization of use for trading credits from the corresponding designated (Swedish) authority.[1] National climate inventory reporting and voluntary credits coexist, but the precise legal accounting and prevention of double claims is still under development and a policy debate on separating national greenhouse gas accounting from corporate carbon accounting is ongoing. To some extent, the Paris Agreement Article 6, the EU Carbon Removals and Carbon Farming Regulation[2] (CRCF) and issuing organisations (e.g. Puro.earth Article 6 Procedures) already aim to tackle this issue.

The Swedish Energy Agency (Energimyndigheten) designed the support as a reverse auction that awards investment and operating aid per tonne of biogenic CO_2 captured, transported and geologically stored in verified sites. The scheme received EU State-aid approval on 2 July 2024 (case SA.107009) and is governed by SFS 2024:626, which empowers the Agency to run one or more reverse auctions and set each call's conditions.

The Swedish scheme had initially a budget allocation of SEK 36 billion (≈ EUR 3 billion) , then adjusted *of SEK 30.7 billion (≈ EUR 2.82 billion) disbursed over 2026–2046 period. The first call opening in 2024 has seen 6 applications and has awarded Stockholm Exergi as sole winner with ~SEK 20 billion over 15 years. Capturing and storing over 11 million tonnes of biogenic CO_2. A second auction round with a budget of SEK 10 billion (≈ EUR 0.83 billion) has opened on 17th December 2025. The application must be submitted by 13th August 2026.*

2.2 Purpose and goal

Sweden's overarching purpose and goal of the introduction of this scheme evolves around the strategic acceleration of BECCS-technology. In Sweden, several sectors face significant decarbonisation challenges,

[1] Without the authorisation, the credits traded in voluntary carbon markets do not shift the savings out of the host country, with climate mitigation outcome thereby remains inside the host country's NDC accounting.

[2] The voluntary Carbon Removals and Carbon Farming Regulation (CRCF) framework that creates certification standards for removal activities like Bio-CCS tries to avoid this indicating that '*all carbon removals and soil emission reductions generated under this Regulation shall contribute to the achievement of the Union's NDC and its climate objectives and not to third-party-NDCs or international compliance schemes.*' However, CRCF does not cover the entire EU-carbon removal credit landscape.

particularly the **pulp and paper industry, biomass-based power generation, and district heating systems** that rely on biomass-fuelled plants. Many CO_2-emitting industries are located near the coast-line being a geographical feature enabling transportation of captured CO_2 by sea to geological storage sites beneath the North Sea.

In addition, the Swedish government sees that Bio-CCS is associated with technical, commercial, legal and political risks. The proposed system is designed to share the possible risks between the state and businesses. The scheme initially aimed to reach the target volume of 2 million tonnes of stored biogenic CO_2 per year.

2.3 Working principle

The support is allocated through a **reverse auction** in which applicants submit bids (SEK/tonne) corresponding to the compensation they request for capturing, transporting and geologically storing a defined quantity of biogenic CO_2. The Swedish Energy Agency acts as the auctioneer and awards support to eligible applications offering the lowest total requested support per tonne (bid plus other public support), subject to the call conditions. It's a competitive bidding process and the mechanism works effectively when there are multiple sellers.

The Swedish Energy Agency plans on utilizing reverse auctions for BECCS projects to minimise the necessary level of support (**cost-effectiveness**) to obtain a certain amount of sequestered CO_2. The Agency expects at least two auctions aiming for a total around 2 Mt/year of stored CO_2. The support period is set at maximum 15 years (latest until 2046), giving companies a reasonable investment period, while not hampering the effect of technology development. The support **will cover both investment (CAPEX) and operational costs (OPEX)**.

Eligibility: **Support is only given for biogenic CO_2**. Companies with mixed emissions must distinguish between biogenic and fossil emission volumes (reporting on annual basis). Storage needs to take place 4 years after the support is rewarded by the Swedish Energy Agency.

Selection process: The closed bid in the auction refers to geologically stored biogenic CO_2 including the costs for transport and storage. Within the bidding period, bids may be placed, changed or withdrawn. The bid is considered binding when the bidding period has ended. The bids are ranked from the lowest to the highest subsidy amount per tonne CO_2 up to the auctioned quantity (bid plus any other public support covering the same project costs). In the first round, the **ceiling price was set for SEK 3,000/tonne** (≈ EUR 274/tonne). For the second call opening, the ceiling price will not be announced until after the call for entries has closed.

Bid structure: The bid must contain the bidders identity (and customer identity if the bidder is placing a bid on their behalf), the volume expressed in number of tonnes of CO_2 with **minimum annual volume of 50,000 tonnes**, and increments of 10,000 tonnes) and the price in Swedish kronor that the Swedish state must pay per tonnes of sequestered CO_2. Beyond the bid price, the application must state the public support that the applicant has received for investment and operation in relation to the activity that generates negative emissions, other financing or income that the applicant has in relation to the activity that generates negative emissions, and all costs for the capture, transport and geological storage of carbon dioxide of biogenic origin generated from activities in Sweden

Payment mechanism: Annual payments are based on verified actual storage volumes. Adjustment rules are in place: 1) 100 % of new public support is deducted; 2) 90 % of new revenues or financing are deducted; 3) if total project costs fall by more than 20 % compared to the bid, the aid is reduced by 90 % of the excess savings; 4) cost increases are not compensated beyond the amount of aid granted at aid decision. **Pre-payments** have initially been considered but are **not foreseen** under the final regulation.

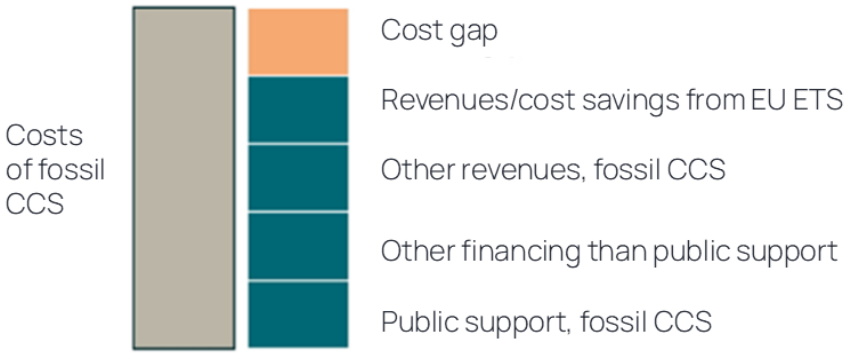

Figure 2 : Deduction mechanism under the Swedish auction. The cost gap is calculated as costs allocated to the fossil part for CCS minus the economic benefits in the form of revenues or cost savings from emission allowances, any other revenue allocated to the fossil part and any public support and financing other than public support for the fossil part. © Energimyndigheten

Further details on the scheme design are included in Annex 1.

3. The Netherlands: Stimulation of Sustainable Energy Production & Climate Transition (SDE++)

3.1 Background

SDE++ is the Netherlands' core instrument for supporting unprofitable large-scale decarbonisation and renewable energy projects. Introduced in 2020 as an expansion of the previous SDE+ scheme (2008–2019). SDE++ moved from a technology-specific renewable energy (and also CCS) subsidy towards a large-scale roll-out of technologies for renewable energy production and other technologies that reduce carbon dioxide (CO_2) emissions. Both SDE+ and SDE++ reserve high annual budgets, with EUR 12 billion and EUR 5 billion allocated in 2018 and 2019 for SDE+, respectively, and between EUR 5 billion and EUR 13 billion between 2020 and 2025. The observed fluctuations in annual SDE+ and SDE++ budget envelopes do not reflect instability in policy commitment, but rather the Netherlands' prudent fiscal approach. There are pre-established annual budget ceilings based on the full granted application amount per tonne multiplied by maximum annual volume of all the projects. Ultimately, SDE++ contracts create long-term (up to 15-year) contingent liabilities whose actual payout depends on future ETS market prices and annual budgets, which are adjusted to ensure fiscal stability and compliance with national and EU budgetary rules. This conservative budgeting approach allows the Dutch government to absorb market uncertainty while maintaining a stable and credible investment framework for capital-intensive technologies such as CCS.

Between 2003 and 2007 there was an SDE+ precursor renewable energy subsidy scheme called MEP (Milieukwaliteit van de ElektriciteitsProductie) that provided a premium on top of the market price for green electricity/CHP that did not have a floor correction price. This resulted in high government expenses when the reference 'grey' market prices dropped very low. This is the reason the SDE++ has a minimum correction amount (see in working principle).

This evolution transformed the scheme into an operating subsidy that results in a de facto CCfD, compensating investors for the unprofitable component of CO_2-reducing technologies compared to a conventional reference process. Project developers that intend to produce renewable energy or implement pre-specified CO_2-reducing techniques may be eligible for the SDE++ grant. The subsidy is paid out during the operational period, and it compensates the difference between the cost price of the renewable energy (or the reduction in CO_2 emissions) and the market value of the product that is generated by the technology (CO_2 or energy).

The most recent scheme call opened on the 7th of October and closed on the 6th of November 2025 with a total budget of EUR 8 billion and different windows (application phases). The grant intensity ranged from EUR 75 /t CO_2 (phase 1, closed on 13 October 2025) to EUR 400 /t CO_2 (phase 5, closed on the 3rd of November 2025).

On CCUS, the following application stats for this call were:

- *Total number of applications: 58*
- *Total budget claim: EUR 10,458 million*
- *Total CO_2 reduction: 2,469,872 tonnes CO_2/year*
- *Average subsidy intensity: EUR 280 per tonne CO_2*

For CO_2-reducing technologies such as CCS, this reference market value is explicitly linked to the prevailing EU ETS carbon price. The SDE++ support therefore functions as a CCfD by paying the difference between the levelised

cost of CO_2 abatement (*strike price* – each category and sub-category in SDE++ have a max. EUR / tonne CO_2 that the applicant can request) and the realised carbon price: when the ETS price is below the project's abatement cost, the subsidy bridges the gap, while higher carbon prices mechanically reduce the support paid with a limit of 0 EUR/tonne CO_2 of subsidy (in case ETS equals or goes over strike price). In this way, SDE++ provides revenue certainty for capital-intensive decarbonisation investments while preserving exposure to the carbon market and avoiding overcompensation.

3.2 Purpose and goal

The SDE++ scheme focuses on the large-scale stimulation and rollout of technologies for renewable energy production and other CO_2 emission reduction technologies in the Netherlands to enable a cost-effective energy transition and broad-decarbonization of the Dutch economy, tackling on the following themes: renewable electricity (i.e. solar, wind, hydropower), heat (Combined Heat and Power, CHP), and -gas, low-carbon heat production (i.e. geothermal, waste heat, aqua-thermal) and low-carbon production including CCUS, renewable fuels and electrolytic hydrogen (H_2) production. It supports businesses or organisations, profit, non-profit or otherwise from different sectors that plan to set-up and operate the production facility themselves.

The scheme aims to close the cost gap ("onrendabele top") by compensating the difference between a technology-specific base amount (reflecting the levelised cost of production or CO_2 abatement) and a correction amount that represents the relevant market value.

For renewable energy technologies, this correction amount is linked to the market value of the energy carrier produced (e.g. electricity or gas). For CO_2-reducing technologies such as CCS, the correction amount is instead linked to the EU ETS carbon price. In this case, the subsidy equals the difference between the calculated cost per tonne of CO_2 avoided and the realised carbon price.

It thus functions as a technology-neutral mechanism aimed at achieving national climate goals (49–55% GHG reduction by 2030) at the least cost. For CCS and BECCS, the SDE++ provides predictable revenue support for carbon capture, Transport and Storage (T&S) components, complementing the EU ETS by guaranteeing a minimum CO_2 price for captured and stored emissions. It is designed to incentivise investments in high-impact, hard-to-abate sectors while maintaining competitive neutrality among technologies.

3.3 Working principle

The SDE++ is a one-sided exploitation grant/operating subsidy that stimulates operation of energy transition technologies for a period of 12 or 15 years depending on the technology used through a CCfD. It is a multi-annual incentive that compensates the 'unprofitable top/component' of the technology in question.

Eligibility: It provides subsidies for the use of techniques for the generation of renewable energy and the reduction of CO_2, across five categories: renewable electricity, renewable heat, renewable gas, low-carbon heat and low-carbon production (where CCUS projects are included).

Selection process: Applicants from all categories compete on grant intensity, auctioned in pre-determined "windows" or submission phases starting at 75 EUR/tonne CO_2 and increasing up to 300–400 EUR/tonne CO_2 (see Table 1). These are evaluated in the order received ("first come first serve principle") within these phase limits until the budget is depleted, creating an implicit carbon price discovery process. When the budget is depleted, the last successful applications on the day of depletion are selected based on their subsidy intensity, prioritizing projects with the lowest subsidy intensity.

Applicants are incentivised to submit early and bid at or below the phase limit to secure access to the budget. Furthermore, bidding close to the upper phase limit increases the risk of being outcompeted if the budget is depleted and projects with lower subsidy intensities are prioritised. In practice, this encourages bidders to reveal their true minimum required support rather than systematically bidding at the maximum phase ceiling, thereby limiting strategic overbidding while preserving competitive pressure across technologies.

Table 1: SDE++ application phases in 2025.

Phase	Start and end date 2025	Subsidy intensity phase limit (EUR /tonne CO_2)
1	7 October	75
2	13 October	150
3	20 October	225
4	27 October	300
5	3 November	400

Bid structure: Each technology category can apply for a maximum subsidy intensity (=ceiling price), calculated by an independent institute on behalf of the Dutch Member State, which can be translated in a technology specific bid price. To increase the chances of getting funded, applicants can opt to bid for a lower price in an earlier application window, resulting in a lower grant amount. Nevertheless, the project should always yield a profitable business case with the requested grant.

Payment mechanism: The operating subsidy is based on performance, compensating the difference between a project's cost price (the 'base amount' = strike price) and the market-based 'correction amount' (= reference price), which reflects actual potential revenues from energy sales or avoided carbon costs. The base amount is a fixed value over the entire subsidy duration and not inflation-adjusted, while the latter is determined and adjusted annually. The base carbon/energy price (=floor price) is the lowest unit price for which the base amount is corrected for the entire subsidy duration. It corresponds to two-thirds of the long-term ETS long-term price forecast, which is the average expected revenue over the entire duration of the SDE++ subsidy, functioning as a floor price for investors. Figure 3 illustrates how this system works.

Figure 3 : SDE++ example mechanism for reimbursement of the unprofitable component SDE++. Solar PV ≥ 1 MWp roof-bound (non-grid supply).

This working principle is chosen as in most cases the cost price of low-carbon technologies is higher than the cost price of their less sustainable counterpart which makes CO_2 avoidance not profitable (ETS price for carbon

abatement projects)[3]. If the correction amount (= reference price) is equal to, or lower than the base energy price or base greenhouse gas price (two-thirds of the long-term (ETS) price[4]= floor price), the applicant will be granted the maximum subsidy. If the correction amount is higher than the application amount (= strike price), the applicant will not receive a subsidy, as they will receive enough money from reduced ETS costs. CCS projects have no obligation to pay back the grant if the market value exceeds the application amount (one-side CCfD). There is however a claw-back mechanism that allows reclaiming part of the grant if in a given year after entry into operation the state aid levels are surpassed. The payment is made per verified tonne of CO_2 abated or per MWh of renewable energy produced. In this way, the SDE++ grant can fluctuate over the years but the maximum budget reservation from the Governments perspective is fixed. In SDE++ for CCS, if a project captures more CO_2 than the eligible volume in a given year, the "extra" verified tonnes can be banked and used in later years to compensate for years with lower-than-expected capture. This banking is limited to 25% of the annual eligible CO_2 volume, so temporary over-performance can cushion later under-performance without losing subsidy.

Further details on the scheme design are included in Annex 1.

[3] If the technology concerned helps prevent the purchase or generates revenue from the sale of CO_2 emissions allowances under the EU-ETS, this too is taken into account in the correction amount.
[4] The long-term price unweighted average of the actual energy, product or ETS price over the subsidy period, based on estimated price movements.

4. Germany: Förderprogramm CO_2 Differenzverträge (Klimaschutzverträge)

4.1 Background

Following the ambitions to become climate neutral by 2045, Germany started in 2022 preparations to implement a new grant scheme on the basis of CCfD, in German *CO_2 Differenzverträge* (previously called '*Klimaschutzverträge*',) to compensate energy-intensive companies for extra costs associated with climate-friendly production. CO_2 reductions in basic material industries such as steel, cement, paper, glass and chemicals are envisaged. The climate contracts are set to save approximately 350 million tonnes of CO_2 in total by 2045 (a third of Germany's industry emissions).

Beyond climate protection, the scheme is envisaged to ensure Germany's future as a competitive industry location, in an answer to market dynamics like the Inflation Reduction Act (IRA) launched by the United States. It aims to de-risk transformative technologies (e.g. green hydrogen, electrification, and carbon capture and storage or utilisation – CCS/CCU), mobilise private investment, and stimulate new industrial value chains.

The first auction launched in March 2024, and 15 projects awarded in October 2024 (total value ≈ EUR 2.8 billion). None were CCS, since at the time this technology was not eligible.[5]

A revised guideline for the second round received EU approval on 24 March 2025, expanding eligibility to CCS/CCU and industrial steam projects and lowering the minimum threshold to 5,000 tonnes CO_2-eq per year. The change of government led to delays, and the current government is revising the funding guideline again. A second bidding round was announced on October 6, 2025 (total value ≈ max. EUR 6 billion), but it is not yet clear if and when it will start. Please note a revision of the funding guideline is still ongoing, the guideline is subject to changes.

4.2 Purpose and goal

With the CCfD scheme, Germany wants to support energy-intensive industries/enterprises or industrial consortia to decarbonise and switch to climate-friendly production technology despite higher costs and increased price risk. The focus remains on large industrial emitters, but under the 2025 guideline, small and medium-sized enterprises (SMEs) are also eligible if their projects achieve a minimum baseline of 5,000 tonnes of CO_2-equivalent per year (reduced from 10,000 tonnes).

The scheme aims to provide compensation for additional CAPEX and OPEX costs for switching to climate-neutral production compared to conventional systems. By linking payments to CO_2 and energy price developments, it hedges price risks, closes funding gaps, and provides predictable cash flows that improve investment viability. This should provide the companies the financial stability required to make the transition to climate neutral production methods. In addition, stimulating learning-by-doing positive externalities, support new infrastructure development and enhance the market development and competitiveness of climate-friendly technologies.

[5] https://www.klimaschutzvertraege.info/news/habeck_hands_over_ccfds

4.3 Working principle

The German CCfD is a two-sided exploitation grant/operating subsidy. They compensate energy-intensive industries for the additional investment (CAPEX) and operating (OPEX) costs of climate-friendly production processes compared to conventional reference systems, thereby de-risking the transition and triggering market transformation. Each contract has a 15-year duration, covering both investment and operation.

Eligibility: To qualify, projects must:

- Achieve **at least 60 % GHG reduction** vs. the reference system within three years after operational start; and
- **Reach 90 % GHG reduction** by the end of the 15-year contract.
- Entry into operation within **36 months** from the funding decision; the call may set up to 48 months. Further extension (including to **60 months**) is possible under justified conditions (e.g., CCS value-chain delays).

Selection process: Funding is granted based on a competitive auction. Applicants submit a base bid price (EUR/t CO_2 avoided), representing the minimum CO_2 price required to make their climate-neutral production competitive. Bids **are ranked solely by cost-efficiency**, calculated as base bid price + discounted value of other approved public funding per tonne of CO_2 avoided over the project lifetime. The application process for the German CCfD is divided in **two phases**. A preparatory phase in which that serves as eligibility check and pre-qualification in which the applicants share the project concept and preliminary data on costs, CO_2 savings and energy carriers. The admitted applicants can pass to the second phase of competitive bidding. **No negotiation** of strike prices or terms is allowed; the contract templates are available as part of the call documents and the submitted bid components are maintained in case of selection of the candidate. Based on previous auctions the award decision takes up to 2-3 months and the contract finalisation further 1-2 months.

Bid structure: In the German scheme, the bid price represents the applicant's estimate of the additional cost per tonne of CO_2 avoided when switching from the conventional reference system to the proposed transformative production route (see Figure 4, left side). To determine this price, the bidder compares all expected costs of the low-carbon process—such as energy use, operation, maintenance, and capital recovery—with the corresponding costs of producing the same output using the efficient conventional reference technology.

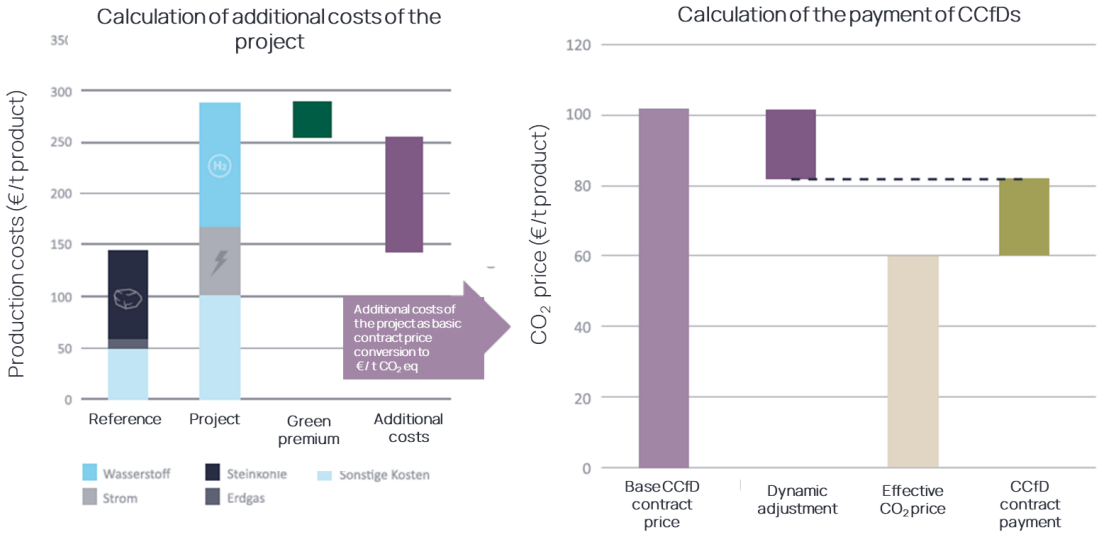

Figure 4: Overview of calculation of additional costs of the project and the payment of CCfDs

Any other public subsidies that have already been approved at the time of application must be taken into account in this calculation. Green product premiums, however, are not deducted when determining the bid price; they may only be (partially) deducted later in the annual payment calculation if the BMWK activates this mechanism in the specific call. The resulting net difference in production costs over the contract period is then divided by the expected CO_2 reductions, giving a cost-per-tonne value that forms the bid price submitted in the auction.

Payment mechanism: Once the contract starts, the bid price becomes the base contract price ("Basis-Vertragspreis" = strike price), and this amount is dynamically adjusted each year to reflect real market developments (see Figure 4, right side). Two elements drive this adjustment. First, the scheme compensates for fluctuations in the prices of key energy carriers by comparing actual annual prices with predefined basis prices and adjusting the contract value depending on whether costs have risen or fallen for both the reference system and the transformative process. This ensures that only the real cost delta is covered. Second, the contract price is adjusted to account for how the actual energy mix and emission reductions in a given year deviate from the original plan. The dynamically adjusted contract price is then compared with the "effective CO_2 price" (= reference price), which takes into account costs and revenues resulting from the EU ETS 1. It is calculated multiplying the CO_2 price in the EU ETS 1, by a factor considering the GHG of the reference system and the GHG emissions of the project, as well as the free assignments of EU ETS 1 emission allowances for the subsidised project and for the reference system, and the GHG emissions reductions actually achieved compared to the reference system.

If the effective CO_2 price is lower than the adjusted contract price, the state pays the difference to the project. The payout amount is limited by the maximum annual funding amount, which is predetermined by the funding authority ("Absicherungspreis"=floor price). If the effective CO_2 price rises above the adjusted contract price, the project pays a surplus back to the state (two-sided CCfD scheme). This mechanism ensures that support reflects real operating conditions, avoids over-compensation, and gradually tapers off as carbon prices increase and the transformative technology becomes competitive.

Further details on the scheme design are included in Annex 1.

5. Denmark: CCUS, NECSS and CCS fund

5.1 Background

The Danish Energy Agency (DEA) plays a central role in implementing Denmark's climate policy and achieving the ambitious targets of the Danish Climate Act (*Klimaloven*). Carbon capture and storage (CCS) is a key pillar in this strategy. Over the past few years, Denmark has developed a set of targeted funding instruments that gradually evolved from pilot-scale initiatives to large-scale market mechanisms.

The first of these, the **CCUS Fund**, was established under the *Climate Agreement for Energy and Industry* (June 2020) with a total framework of DKK 16 billion (≈EUR 2.14 billion) for 2024–2048. Designed as a market-based and technologically neutral mechanism, the fund aimed to support large-scale deployment of CCS across the entire value chain — from capture to transport and storage — for both fossil and biogenic CO_2. The first tender round (Phase 1) was concluded in 2023, resulting in a single full-scale award to Ørsted Bioenergy & Thermal Power A/S, which will capture and store approximately 430,00 tonnes of CO_2 per year from 2026. The CCUS Fund as such is no longer active.

Parallel to this initiative, the **NECCS Fund** (Negative Emissions via CCS) was introduced under the *Finance Act 2022*. With a total budget of DKK 2.56 billion (≈EUR 343 million) and an operational window from 2025 to 2032, the NECCS Fund focuses exclusively on biogenic and atmospheric CO_2 to achieve *negative emissions*. It targets CO_2 capture from sources such as biogas upgrading, biomass-based power and heat production (BECCS), the biogenic share of waste incineration, and direct air capture (DACCS). The objective is to reach 0.5 million tonnes of CO_2 removals annually from 2026.

In September 2023, the Danish Parliament further streamlined the national CCS framework by adopting an agreement to merge the upcoming CCUS Fund Phase 2 and the Green Tax Reform (GSR) Fund into a new, unified **CCS Fund**. This large-scale fund — launched in October 2024 — has a total budget of DKK 28 billion (≈EUR 3.75 billion) and will provide 15-year contracts (2029–2044) to support industrial clusters and regional CCS hubs. The CCS Fund thus builds directly on the experience gained from the CCUS and NECCS programs and is now the cornerstone of Denmark's long-term CCS policy framework.

The CCUS Fund (2023) awarded one large contract to a full-chain CCS project operated by a major Danish energy utility—this project involves capture at a biomass-fired combined-heat-and-power plant and offshore geological storage.[6] The NECCS Fund (2024) has awarded three projects with a support level of 968.5-2,600 DKK/tonne CO_2.[7] The CCS Fund (2025–26) has seen initially 16 bidders which only 1 final bid submitted in February 2026. According to a survey[8] involving 8 of the 16 participants, the main difficulties leading to withdrawal were:

- *Uncertainty in the CCS value chain including lack of guaranteed and competitive storage capacity by 2030 and exposure to penalties if storage is delayed.*
- *Contractual structure too risky (e.g., penalty clauses for delay, guarantee requirements, heavy risk allocation to project developers)*
- *Price ceiling (1,750 DKK /tonne ≈EUR 234.5) too low relative to risk-adjusted cost estimates*
- *Tight timeline requirements, i.e. operational by 2030 and environmental permit before final bid*

[6] https://ens.dk/en/press/first-tender-ccus-subsidy-scheme-has-been-finalized-danish-energy-agency-awards-contract
[7] https://ens.dk/en/press/three-new-ccs-projects-have-been-pledged-support-capture-and-store-biogenic-co2
[8] KPMG (2026), Market experiences from the Danish CCS tender

5.2 Purpose and goal

Objective of the CCUS Fund was to facilitate the reduction of CO_2 emissions by financing projects related to carbon capture, transportation, and storage, covering the entire CCS value chain. It encompassed projects related to both fossil and biogenic CO_2 emissions.

Objective of the NECCS Fund is to support projects that enable the removal of carbon dioxide from the atmosphere, either directly (DACCS - Direct Air Carbon Capture and Storage) or by capturing emissions from biogenic sources like biogas upgrading, biomass-based power and heat production, and carbon captured from waste incineration plants.

Objective of the CCS Fund is to scale the CCS market by supporting industrial clusters, cross-sector infrastructure, and long-term value chain deployment.

All funds are aimed at contributing to the realisation of Denmark's climate targets, outlined in the Klimaloven (Danish Climate Act). All schemes operate under the *Guidelines on State Aid for Climate, Environmental Protection and Energy (CEEAG, 2022)* and require European Commission approval prior to implementation.

The DEA's role is to contract Operators — individual entities or consortia — who assume responsibility for the full CCS value chain. Operators must ensure all required permits, certificates, and approvals are obtained and must deliver verified, permanent CO_2 storage in compliance with Denmark's National Inventory Report.

5.3 Working principle

The NECCS/CCS funds are market-based service subsidies for Contracts of Delivered Quantity.

The minimum requirements (MR) slightly differ between the two funds. The operator shall establish and operate the value chain (NECCS MR-1) or is responsible to achieve the CO_2 emission avoidance in accordance with the contract (CCS MR-1), based on all certificates, approvals and permits necessary (MR-2). The captured CO_2 should originate from plants in Denmark and comply with the minimum quantity set (NECCS MR-4; CCS MR-3).

5.3.1 NECCS Fund

The NECCS fund supports negative emissions from CO_2 capture and storage **from biogenic sources and subsequent storage underground for a fixed period of 8 years**. It is regarded as a service contract. The NECCS fund functions like a one-sided CCfD scheme. In the context of the project, the DEA does not provide asset-related capital expenditure (CAPEX) support for project development or construction of installations. Instead, it relies on the Operator's role, which is responsible for the capture and storage of CO_2.

Eligibility: In addition to the previously mentioned MRs, it is required that the Contracted Quantity is of biogenic or atmospheric origin. The service must result in CO_2 reductions in the Danish National Inventory Report (Danmark's Nationale Drivhusgasregnskab, NECCS MR-3). The delivery of captured and stored CO_2 must begin in 2026 and continue until and including 2032 (NECCS- MR5).

Selection Process: For the evaluation of which offers have the **best price-quality ratio**, the DEA uses a scoring model with a financial framework. The selection of one or more contracts is based on best price-quality ration, consisting

of **best Offered Rate** (60%)[9], **project maturity** (20%)[10] and **offered 2025-Quantity**[11] (20%). The NECCS fund is structured as a single-round open tender, with a deadline for submission, and evaluation period and final award and contract signing. Unlike the earlier CCUS Fund, the NECCS procedure does not include formal negotiation rounds.

Bid structure: The Offered Rate in the NECCS fund is proposed directly by the bidder as a fixed price per tonne of biogenic or atmospheric CO_2 captured and permanently stored, expressed in DKK per tonne (excluding VAT, in 2023-prices). Further bid components are described in the comparative table in Annex 1. There is an allocated **annual subsidy cap for each awarded contract** (or all contracts combined) cannot exceed DKK 319,900,000 per year (2023 prices; ≈EUR 42.87 million) and no unused funds can be carried forward.

Payment mechanism: The payment frequency is **quarterly** in arrears, based on verified Delivered Quantity for the NECCS fund. If the operator achieves a larger quantity than the Contracted Quantity in any given year, additional subsidy may be received to the extent that there are funds available within the limits of the maximum allocated subsidy.

The **penalty framework** combines a clear financial sanction with built-in operational flexibility. Operators face a penalty when their annual CO_2 delivery falls below the contracted volume, calculated as one third of the yearly subsidy rate multiplied by the shortfall. A two-step threshold (80 % by default, raised to 95 % after repeated under-delivery) determines when penalties apply, but the system also allows operators to "catch up" later: over-delivery in the following year can offset earlier deficits, fully or partially cancelling penalties. This structure encourages consistent performance while recognizing that early operational fluctuations may occur.

5.3.2 CCS Fund

The CCS fund supports the sequestration of CO_2 for a fixed period of 15 years, relevant for large point sources and regional clusters. Similar to the first CCUS tender, the CCS fund tender rounds will allow some flexibility for opt-out after 2030, which means it will be possible to opt out of the contract if a winner of a contract deems it more profitable to sell the CO_2 captured for industrial purposes, for example. The CCS fund has an overall scheme-level budget cap (DKK28.66 billion for 2029-2044 period; ≈EUR 3.84 billion). The CCS fund functions like a one-sided CCfD.

Eligibility: For the CCS Fund, the operator shall ensure that the annual quantity of CO_2 which as a **minimum** shall be **100,000 tonnes of CO_2** is captured and stored each calendar year from year 2030 and until and including 2044 (CCS MR-3; with optional early-delivery year 2029). Finally, the operator must properly account for of the delivered quantity to be paid the subsidy (CCS MR-5). In cases where the Operator's performance falls short of the Contracted Quantity in a given year, the Danish Energy Agency (DEA) imposes penalties.

Selection process: Similar to the first CCUS tender, the CCS fund tender incorporates a **negotiated procedure**, enabling the DEA to negotiate various aspects of the tender documents and the offers received. This enables a dialogue with market players. All (general) requirements that are not Minimum Requirements (previously explained) are subject to negotiation, may be changed or withdrawn during the tender procedure. This can include e.g. baseline financial assumptions (i.e. ETS exposure assumptions, CO_2 tax assumptions, Carbon-credit revenue

[9] The Offered Rate (= Bid Price) is a single, fixed amount in DKK per tonne of biogenic or atmospheric CO_2 permanently stored (excluding VAT, in 2023-prices) proposed by the bidder, which must reflect the bidder's full expected cost of delivering the entire CCS value chain The lowest valid Offered Rate submitted in the competition will receive the highest score in the evaluation model.
[10] Evaluated on the basis of the tenderer's Project Description and Project Schedule.
[11] The 2025-Quantity is the quantity of CO_2 which the tenderer will be obliged to capture and permanently store from start of operation until 31 December 2025

assumptions), project scope adjustments (i.e. adjusting ramp-up phase, changes in T&S provider) or project timeline adjustments. The negotiation phase includes one or more rounds of negotiations. (1) Initial Negotiation Round: after submitting the 1st Indicative Offers (INDO), DEA conducts negotiation meetings with eligible tenderers. Further offers may be requested if needed. (2) 2nd Negotiation Round: following the submission of INDO2, a 2nd round of negotiations follows. The purpose is to provide tenderers with an opportunity to negotiate terms. The negotiation phase concludes with the submission of Best and Final Offers (BAFO) by all tenderers. The DEA applies a similar competitive evaluation approach but with an updated weighting structure and additional financial adjustments. The award criteria include **Subsidy** (80%; based on the Evaluation Amount)[12] and **Project Maturity** (20%)[13]. The Evaluation Amount, which combines the bidder's Offered Rate with an evaluation-technical supplement reflecting tax savings and expected carbon-price effects, forms the basis of the financial assessment.

Bid structure: In the CCS Fund, the bidder proposes an **Offered Rate** (=bid price), expressed as a fixed amount in DKK per tonne of CO_2 (excluding VAT, in 2025-prices), which constitutes the central financial bid element and represents the bidder's required gross support per tonne of CO_2 permanently stored. In addition, bidders must specify a Contracted Quantity, consisting of an Annual Quantity for each year 2030–2044 (with a minimum of 100,000 tonnes CO_2 per year) and may optionally offer a 2029-Quantity for early delivery[14]. Further details on bid components are available in Annex 1.

Payment mechanism: The subsidy will be paid per tonne of CO_2 permanently stored, based on the yearly Subsidy Rate derived from the bidder's Offered Rate (DKK/t CO_2 excl. VAT, 2025-prices), which is adjusted for inflation and further corrected annually for ETS allowance savings, CO_2 tax effects, carbon-credit revenues, and other baseline parameters through the Annual Settlement mechanism. The payment frequency is **monthly** for the CCS fund, based on the verified Delivered Quantity. The subsidy amount is subject to an annual subsidy cap, limiting the maximum available amount of subsidy per year.

Instead of a fixed penalty rate, the DEA recalculates payments annually through an "**Annual Settlement**" mechanism. If verified CO_2 storage is below the contracted level, any over-paid subsidy is reclaimed or deducted from future payments, and over-delivery in later years cannot recover past shortfalls. This design removes the recovery option and links payment strictly to verified performance. Consequently, while the NECCS Fund shares risk between the state and the operator through a mix of incentives and flexibility, the CCS Fund transfers nearly all operational and timing risk to the operator, making payment contingent solely on actual, documented storage results.

[12] Evaluated on the basis of the Evaluation Amount, calculated as Offered Rate + VAT of Offered Rate + evaluation-technical supplement. The evaluation-technical supplement is a per-tonne financial adjustment added to the Offered Rate during bid evaluation to reflect expected ETS, CO_2 tax, and credit-related effects, allowing the DEA to rank bids based on net public cost rather than gross subsidy alone.
[13] Evaluated on the basis of the tenderer's Project Description, Project Schedule, Authority Approval Plan and Risk Management Plan
[14] The 2029-Quantity represents an optional early-delivery quantity of CO_2 that the bidder commits to capture and permanently store in 2029, before the mandatory Annual Quantities begin in 2030.

6. UK: Industrial Carbon Capture (ICC) business model

6.1 Background

The Net Zero Strategy, first published in 2021, sets out the government's target to reach net-zero GHG emissions by 2050. In the CCUS Net Zero Investment roadmap, the UK government previewed four CCUS clusters: two by the mid-2020s – HyNet and East Coast Clusters (Track-1) and two further by 2030 (Track-2), with a goal of capturing 20–30 million tonnes CO_2/year across the economy by 2030. The government has allocated £20 billion to CCUS funding, the majority of which is expected to cover the 'CCUS business models'. As the strategy matured, the government has increasingly recognised that large-scale CCS deployment was constrained not only by high capital costs but also by the absence of an investable CO_2 T&S system, limited visibility on long-term carbon prices, and the risk exposure industrial emitters faced when relying on emerging T&S networks.

In response, the Carbon Capture and Storage Infrastructure Fund (CIF) was introduced in 2020 as a £1 billion capital support mechanism designed to co-fund early CCUS/T&S projects, thereby facilitating the establishment of initial CCUS clusters. As policy evolved and the UK progressed from cluster selection to commercial-scale implementation, the approach shifted from standalone grants to a suite of sector-specific CCUS business models. These models—including Industrial Carbon Capture (ICC), Power BECCS and Greenhouse Gas Removals (GGR) — built around dual CfDs (electricity + carbon CfD), incorporate both capital and ongoing revenue support within structured, contract-based frameworks. Power BECCS and GGR focus on biomass-power plants (BECCS) and atmospheric carbon (DACCS). The three models are long-term revenue-stabilisation contracts with a strike price and a reference carbon price—i.e. they all function as CCfDs, but for different types of projects. Only ICC has moved into the contract-award phase. Power BECCS and GGR are still pre-award.

For the purposes of this study, the focus is on the **ICC business model**, which awarded funding to the HM **Padeswood cement plant** and that focuses on large-scale industrial point-source CCS. It provides long-term contractual revenue support per tonne of CO_2 captured and stored, structured around fixed or indexed strike prices, project-specific cost recovery, and detailed risk-sharing provisions with the state-owned Low Carbon Contracts Company (LCCC). As the scheme evolved, the ICC model has moved from initial draft terms to more comprehensive commercial templates, culminating in the updated contract structures published in 2025 and in the first ICC contracts signed with early industrial projects.

Between 2021 and 2022, projects were selected for Track-1 clusters and passed to a next phase of due diligence. In 2024, out of 8 large-scale CCUS projects, 3 got awarded funding, and only 2 moved to FID (Padeswood included – in September 2025[15]). New 2025 ICC contract templates note that the allocation process for future rounds is still under development.

6.2 Purpose and goal

The UK ICC scheme aims to **support the decarbonisation of energy-intensive / hard-to-abate industries and waste management facilities**, especially where capturing carbon is the only practical solution. The 2025 ICC Business Models Update also indicates that the ICC/Waste ICC models aims to unlock private investment in capture plants by de-risking revenues and cross-chain risks (T&S availability), protect competitiveness and jobs by avoiding

[15] CCS project: Final Investment Decision | Heidelberg Materials

carbon leakage as UK ETS/CBAM-type measures tighten and ultimately supporting the CCUS "Vision" of creating a self-sustaining CCUS market and industrial clusters by the 2030s, with Exchequer (Treasury) support tapering over time as carbon prices and private markets deepen. The Department for Energy Security and Net Zero (DESNZ), along with LCCC is responsible for operating this mechanism.

ICC offers long-term financial support similar to Contracts for Difference (CfD), covering extra operating costs, regulated T&S fees, and repayment of investments made in carbon capture equipment. Projects in energy intensive industries and dedicated waste-to-energy plus hazardous-waste incinerators under the Waste ICC variant, can qualify if they use approved capture technology and meet UK ETS requirements, which include giving up annual Free Allowances (included in the financial model).

Through predictable payments for each tonne of CO_2 captured and stored, and initial capital co-funding from the CIF, the ICC scheme lowers financial risks and makes it easier for companies to secure investments. This encourages the adoption of carbon capture technologies throughout the UK's industrial clusters.

The Padeswood CCUS business case shows how the project secures domestic cement supply, support net-zero-compatible growth, and leverage the UK's very large offshore storage resource, which can support export of storage services.

6.3 Working principle

The UK ICC scheme functions as a **long-term CCfD-style revenue support contract** between the emitter and the LCCC. Unlike other schemes in Europe e.g. Danish CCUS Fund or Dutch SDE++, ICC **is not allocated via competitive auctions**, but through **bilateral negotiations** with projects selected in the CCUS cluster sequencing process (Track-1 HyNet and East Coast Clusters, with 8 project emitters).

Eligibility: The ICC applies to industrial emitters (cement, waste-to-energy[16], chemicals, refineries, iron/steel, lime, CHP) and projects must deploy eligible capture technology, connect to a regulated CO_2 T&S network and meet technical and operability specifications under the CCS Network Code.

Applicants need to demonstrate **initial capture rate of at least 80%** or the estimate capture rate minus 10 percentage points (≥max(80%, estimate – 10pp) and to achieve ≥80% average per billing period. If the project underperforms there is a reduced capex return until performance stabilises and a termination clause threshold at 60% sustained underperformance. These are reflected in the ICC Business Model and Templates Updates in 2025. During the initial term, emitters must forfeit a portion of Free Allowances, compensating the forfeited allowances at the reference price, with some allowances remaining for residual emissions.

Selection process: Track-1/2 determined cluster access of the projects. The ICC contract is a business model applied after this selection. For initial projects in the first two clusters, submitted projects were scored for deliverability (30% weighting), emissions reduction (25%), economic benefits (20%), cost considerations (15%) and learning and innovation (10%), with the project cost not being the principal consideration. This served to assess which projects could proceed to ICC contract negotiations.

Negotiations for ICC contracts followed that list, leading to ICC contract awards beginning in 2024, where Padeswood was awarded. Future allocation rounds (Track-2 and beyond) are "under development" in the 2025 templates. This means that there is no bidding and EUR/t ranking, with project-specific negotiated strike prices,

[16] Waste incineration plants participate via a variant Waste ICC contract.

taking into account deliverability, system integration, cluster impacts. This results in more customised contracts than uniform bidding templates and it has a strong integration with regulated T&S networks, which are absent in other EU auctions.

Bid structure: The **strike price** consists of OPEX Strike Price (project-specific, indexed) and CAPEX Payment Rate calculated via a formula defined by ICC (payment & return over early years). Contracts are a minimum of 10 years, with the option to extend by up to five additional years.

Payment mechanism: The ICC payment mechanism consists of a fixed volume-based CAPEX repayment component and a CfD-style OPEX component, both paid during the project's operation (see Figure 6 on the next page). OPEX support is calculated using a negotiated Strike Price and a predefined reference price trajectory during the Initial Term (**fixed reference carbon price trajectory** for years 1–10 – see Figure 5 - and the **UK ETS price** for the extra optional 5 years, based on UKA futures), providing predictability for budgeting and settlement. The mechanism is therefore primarily one-directional (LCCC to emitter) during the initial ten-year period (one-way CCfD), with carbon price review provisions applying under defined circumstances and two-way payments in the potential extra-five years, in which if the ETS price surpasses the Strike price, emitter pays back the difference (two-way CCfD). The waste ICC is a two-way CCfD from year 1, but with caps on payback.

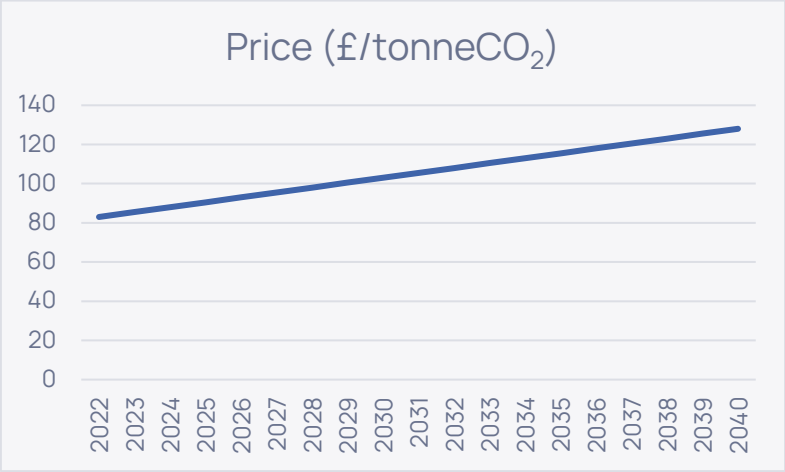

Figure 5: Defined ICC administrative carbon price path chosen (£83/tCO₂ (2022) to £128/tCO₂ (2040)) to provide predictability for budgeting and contract settlement during the initial years before shifting to the actual ETS price in the extension period. These values are predetermined when the contract is signed and do not adjust with ETS movements.

The CAPEX component has a distinct strike price within the project bid as seen in Figure 6 on the next page. For industrial projects, there is a fixed CAPEX pound per tonne CO_2 payment rate in the first five years, which can be extended for up to five additional years if it is not paid off (e.g., due to lower-than-expected quantities captured). A longer repayment period is used for waste management plants. The CAPEX component is subject to annual caps and is independent of the ETS price.

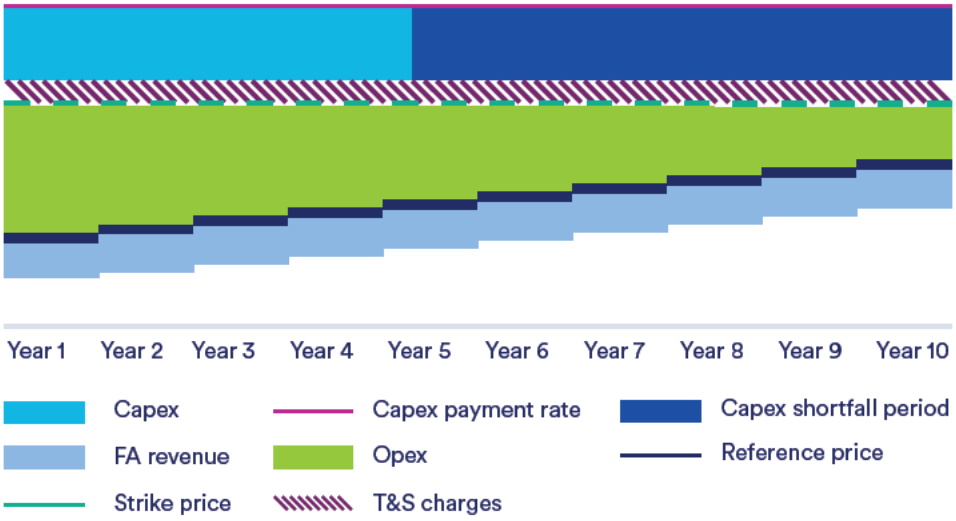

Figure 6: Structure of UK ICC Contract payment components over the first ten years © CATF. The chart shows how total per-tonne support is composed of (i) a fixed Capex Payment Rate designed to recover agreed capital expenditure and return, (ii) Opex support calculated using the negotiated Strike Price and a predefined reference carbon price trajectory, (iii) UK ETS Free Allowance (FA) interactions reflecting forfeiture and volume protection under the FA Trajectory, and (iv) reimbursed Transport & Storage (T&S) charges. Over time, the capital recovery component reduces as investment is repaid, while operating support remains the structural base of the mechanism, while also reducing due to increased CO_2 price. The structure provides predictable revenue for emitters while aligning support with verified CO_2 capture volumes and UK ETS obligations.

7. France: Grands Projets Industriels de Décarbonation (GPID)

7.1 Background

France has progressively positioned CCfDs as the part of a broader plan to decarbonise hard-to-abate sectors. The National CCUS Strategy (2023) first established that CCUS is "indispensable" for *incompressible industrial emissions* in sectors such as cement, steel, chemicals and refining. The Strategy set ambitions of 4–8 million tonnes CO_2 per year capture by 2030, 15–20 Mt by 2040, and identified industrial clusters (Dunkirk, Le Havre, Fos-sur-Mer, Saint-Nazaire) as early hubs. Between 2023–2024, the State conducted consultations and a call for interest, signalling its intent to create a CCfD-type instrument aligned with EU ETS and State-aid rules. This has recently materialised into a fully operational mechanism: the "Grands Projets Industriels de Décarbonation" (GPID 2024)—France's first competitive CCfD-style auction for CCS/CCUS and other deep decarbonisation projects. The scheme is financed under the France 2030 investment plan and was approved by the European Commission on 18 December 2024, with a EUR 3 billion envelope and 15-year support horizon[17]. The French Environment and Energy Management Agency (ADEME) acts the as operator. The launch marks the first time France implements a full CCfD-based industrial decarbonisation tender with explicit eligibility for CCS and CCU. The French approach builds upon the Netherlands' SDE++ model but focuses more narrowly on industrial CO_2 capture and permanent storage, reflecting France's later entry into large-scale CCUS deployment.

The AO GPID mechanism incorporating the CCfD-type support for CCS, CCU, and other deep decarbonisation technologies — it was officially launched on 31 December 2024, with bid submissions accepted through 15 May 2025. On 12th February 2026, the results of the first edition have been published[18]

- *7 industrial projects selected from a candidate pool of 19.*
- *Projects span high-emitting sectors such as aluminium, cement, chemicals, and specialty manufacturing. The HM plant Airvault is amongst the winners.*
- *The average subsidy intensity is 22 EUR/tonne CO_2 avoided.*

The Government launched a new consultation in June- September 2025 on the next tender design (AO GPID 2026).

7.2 Purpose and goal

The French CCfD mechanism is designed to close the cost gap between ETS carbon value and the full cost of deploying deep decarbonisation technologies, including CCS and CCU.
The mechanism objectives are similar to other EU CCfD schemes for CCUS projects:

- Derisking early investments in large industrial CCS/CCU projects where ETS price alone is insufficient for viability.
- Supporting decarbonisation of existing ETS-covered industrial sites and ensuring emissions fall below the relevant EU ETS benchmarks, delivering genuine abatement.

[17] Commission approves French State aid scheme to support decarbonisation of industrial sector
[18] Sept projets lauréats de l'appel d'offres « Grands Projets Industriels de Décarbonation »

- Accelerating the emergence of French CCS value chains, enabling T&S solutions and supporting cluster-based deployment.
- Providing long-term price certainty to improve bankability for projects at gigatonne-scale investment levels (cement, chemicals, steel, refining).
- Ensuring compatibility with ETS, avoiding over-compensation, and maintaining France's industrial competitiveness under the Fit-for-55 tightening.

7.3 Working principle

The support is a one-way CCfD implemented as annual performance-based grants **over 15 years** for avoided emissions relative to a pre-project baseline. Subsidy duration can go up to 15 years after commissioning, aligned with State-aid approval.

Eligibility: Only existing EU ETS industrial sites (NACE C) are eligible; no greenfield sites. Sectoral caps: No more than one-third of total funding may go to any single industrial sector (metals, agri-food, chemicals, non-metallic minerals, petrochemicals). For CCS/CCU projects, they must: Capture CO_2 at the industrial site, demonstrate **advanced discussions** with T&S operators, store CO_2 in an EU-ETS-recognised geological facility (in the EEA) with permanent storage, or demonstrate long-term sequestration for CCU in compliance with EU rules. At least **50% of captured CO_2** must come from process emissions, biogenic energy emissions, or waste-derived fuels. Projects must **commence operations within 5 years of contract award** and delays do not extend the 15-year term.

Selection process: GPID is a competitive tender with offers **ranked primarily on EUR /tonne CO_2 avoided**. This rate is adjusted for other public aid of the project, with **cumulation being allowed**. In fact, there is a bonus scoring of +10% for projects already selected by the EU Innovation Fund (criterion N3). Furthermore, applicants can get up to +20% for ambition relative to ETS benchmark reductions (criterion N2). **No negotiation** is possible during the selection process.

Bid structure: This bid price (=strike price) fully determines the level of support the project requests during the 15-year operating period (EUR/ tonne CO_2eq avoided). However, to be valid, an offer must include much more than the bid price. The GPID requires a structured bid package consisting of mandated technical, financial, and performance components—most of which are binding once submitted.

Payment mechanism: The reference CO_2 price is a fixed *linear* price trajectory (see Figure 7 on the next page). The strike price is a constant over the contract, bid by the applicant, making the subsidy amount over the support duration not flexible but predictable. Following standard CCfD logic, aid is paid only when the strike price is higher than the fixed reference price path and is limited to verified annual tonnes of CO_2 avoided. No aid is paid when the fixed price is higher than the strike price. There is an **optional advance payment up to 50% of nominal CAPEX** (and 30% of total discounted aid), subject to strict guarantees, and must be repaid from future annual CCfD payments.

The mechanism entails performance monitoring and potential penalties for deviations. An **annual MRV** based on ETS activity levels + verified emissions reports for each sub-installation is required. For ETS covered installations this is standard practice. The operator is paid each year only for the verified CO_2 avoided, up to the committed annual volume. If actual performance falls below 90% of the committed annual decarbonisation, an additional financial penalty applies. This penalty is 10% of the monetary value of the shortfall below the 90% threshold, calculated using the contract spread (strike price minus reference CO_2 price). The penalty is capped at 9% of the committed annual aid. In practical terms, if a plant commits to 100 tonnes CO_2 and delivers only 70 tonnes CO_2, it is paid for 70 tonnes CO_2, and because it is 20 tonnes below the 90 tonnes threshold, it pays a penalty equal to 10% of the payment that would have been earned on those missing 20 tonnes. There are mechanisms for carry-forward and catch-up of over/under-performance across contract years, providing operational flexibility and risk-reduction

to project promoters. CCS volumes count only when proof of (permanent) geologic storage is provided each year, with biogenic CO_2 stored yielding negative emissions credits for performance calculations.

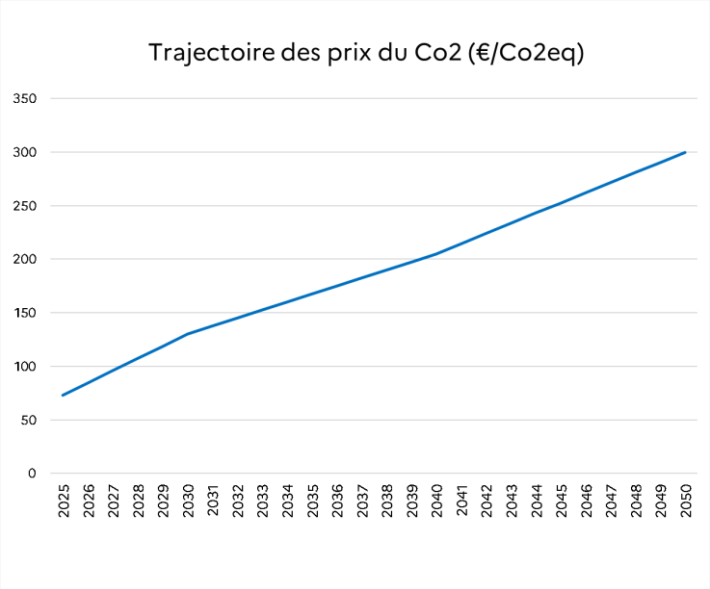

Figure 7: Fixed reference-price trajectory for CO_2 chosen by the French State for the purpose of calculating CCfD payments. It is not a market forecast and not taken from an external modelling source (Annex 4 of the call documents).

8. Overall considerations and comparison of the presented schemes

This chapter will provide overarching considerations and comparison of the presented schemes, based on the in-depth analysis of each auction scheme.

We will assess the drivers and barriers for large scale (BE)CCS projects in the cement sector, the different set-ups of the schemes (e.g. strike prices and reference prices) and provide considerations on the replicability and sustainability. Considerations on the alignment with funding authority and the timeline of implementation of the schemes is provided. Finally, an overall comparative table of the six funding scheme is included.

8.1 Drivers and barriers for large scale CCS projects in the cement sector

Large-scale CCS deployment across Europe is shaped by a common set of structural drivers and barriers, even though national schemes differ in design, scope and maturity.

Despite differences in design philosophies, all schemes show a common pattern: Large-scale CCS develops where governments provide long-term revenue certainty, credible MRV, risk-sharing, access to T&S infrastructure, and predictable interaction with carbon markets. Deployment is hindered when projects face infrastructure gaps, asymmetric risk allocation, unindexed (uncertain) support, and unrealistic operational timelines.

Sweden illustrates the benefits and limitations of an ambitious pay-for-performance model; the Netherlands offers a mature, rule-based CfD framework; Germany and France integrate CCS within industrial decarbonisation strategies but face infrastructure constraints; Denmark separates early negative-emissions support and large-scale CCS support; and the UK provides the most integrated whole-chain contracting approach through regulated clusters, requiring more T&S engagement at the time of the application.

Together, these examples demonstrate that replicable CCS support requires both strong financial design and parallel development of transport and storage systems, backed by realistic timelines and clear rules on carbon accounting, performance, and risk sharing.

8.1.1 Drivers

Long-term revenue certainty

All the schemes are designed to provide a predictable and stable long-term revenue stream through multi-year support. This is a key anchor and enabler of large-scale CCS business cases, and it is a transversal focus of the different EU CCfD schemes analysed.

- Sweden, Germany and France provide 15-year pay-for-storage contracts, which give investors confidence to pursue capital-intensive BECCS or industrial CCS projects.
- The UK's ICC model similarly uses negotiated long-term contracts to de-risk exposure to ETS price volatility and ensure capital and operating cost recovery.
- The Netherlands' SDE++ offers 12–15-year contracts, uses a fixed strike price and rule-based indexation, which all contributes to long-term revenue certainty.

- Where support horizons are shorter—such as Denmark's 8-year NECCS fund—the bankability of large projects is reduced, pushing them instead toward the longer-term CCS fund, designed for industrial emitters.

The **downside** for promoters might be the long-term commitment to operation of the CCUS facility, which may present opportunity costs in case of technological and market disruptions leading to other alternatives.

Coverage of the CCS value chain and bankability

A second common driver is the degree to which schemes cover all steps of the CCS value chain.

- Sweden stands out for supporting capture, transport and storage costs within the auction envelope, reducing fragmentation and enabling integrated mega-projects.
- Netherlands SDE++, Denmark's CCS fund and the French GPID also allow funding of transport and storage costs within defined limits.
- By contrast, Germany's CCfD model excludes transport and storage costs, covering only capture and the connection point. This leaves developers to secure and finance T&S independently, a major restraint for large-scale projects in a country with limited domestic storage and dependence on cross-border solutions.
- The UK, instead, integrates industrial emitters into regulated T&S networks, reducing interface risk and coordinating investment across the chain.

The **downside** for promoters is that the need to include T&S requires more mature projects, potential third-party engagement and extra funding requirements at the time of applications.

Integration with carbon pricing and avoidance of double compensation

Schemes increasingly interact with the EU ETS or national carbon taxes, ensuring price indexation, risk sharing and avoiding overburden or overcompensation from either the project promoter or the tax-payer. This is especially the case when we have a two-sided CCfD, with the one-sided one being even more beneficial to the promoter.

- The Dutch SDE++ uses an ETS-correction factor, aligning subsidies with CO_2 market values and preventing overcompensation (extra Government expenses); BECCS projects could consider negative emissions possible if the biomass used meets the EU RED Directive sustainability requirements.
- Germany requires clear differentiation between process, fossil and biogenic streams and credits biogenic CO_2 as negative emissions only if stored permanently and ETS-compliant.
- The UK ICC model adjusts support through a reference-price path linked indirectly to ETS trajectories and recovers ETS free allowances, while France embeds ETS baselines and sub-installation rules directly into MRV.
- Denmark implements a dynamic adjustment mechanism through its annual settlement process. When the actual ETS price surpasses the fixed path, the reference price is raised to prevent over-compensation.
- Sweden uses no reference price, due to the scope of the auctioned good.

These mechanisms create predictable interplay between CCS support and carbon markets, a significant driver for large emitters whose decarbonisation strategy depends on carbon-price visibility.

The **downside** for promoters is the ceiling for returns in multiple (two-sided) schemes; in case the carbon prices (e.g. EU ETS) go over the reference prices of the funding mechanism.

Technology and feedstock eligibility

The design choices and eligibility criteria influence which industries or (BE)CCS configurations can scale, ultimately determining which sectors can realistically deliver the volumes of CO_2 required to meet national climate targets.

The Dutch, German, and French schemes all allow a broad range of climate mitigation technologies. However, Denmark's CCUS fund and the UK's ICC Contracts focus specifically on CCS.

- Sweden restricts support to biogenic CO_2, effectively prioritising the pulp & paper and district-heating sectors while excluding fossil-intensive emitters unless they have substantial biogenic shares. This limits the total deployable scale of CCS fossil-intensive sectors, e.g. cement.
- The Netherlands and France support both fossil and biogenic capture. SDE++ is technology neutral, encouraging competition across abatement options and including BECCS and CCU as eligible categories expanding the CO_2 reduction portfolio.
- Germany supports transformative production processes for industrial decarbonization (incl. cement sector), i.e. CCU/CCS, but applies detailed accounting to prevent over-crediting of biomass residues and zero-rated CO_2 streams.
- Denmark's NECCS fund is explicitly designed for BECCS and DACCS, whereas the CCS fund targets large industrial emitters irrespective of feedstock, covering therefore the cement sector.
- The UK ICC CCfD focuses on industrial CCS, enabling cement plants and mixed-fuel facilities to participate as long as CO_2 is permanently stored. Alternative business models (Power BECCS, GGR) tackle other CO_2 types (biogenic, atmospheric) to be captured, ensuring appropriate cost banding but limiting flexibility for hybrid projects.

The **downside** for promoters in some schemes is the restriction on eligible technologies and the different types of installations. Some schemes separate the types of installations (ICC) and others promote direct competition between all decarbonisation technologies and industries (SDE++). For cement in particular for Sweden, a challenge is clear for CCS fossil-intensive sectors if they compete against installations that capture biogenic and atmospheric carbon (negative emissions).

8.1.2 Barriers

Infrastructure dependency and cross-chain coordination

Across all countries, infrastructure readiness is a dominant barrier. Large-scale projects depend on access to T&S networks, port terminals, shipping solutions, and timely storage permits.

According to the Global CCS Institute, all the CCfD schemes include bid prerequisites around T&S. In the case of the SDE++, a formal CO_2 offtake agreement with a T&S operator is required. Similarly, Denmark awards bids based on the delivery of a full CCS value chain, ensuring a more integrated approach. In contrast, France and Germany require projects to be in advanced discussions with T&S operators or have a sufficiently secured storage solution, offering a slightly less formal requirement compared to the other schemes. Sweden and France rely on cross-border storage capacity, increasing coordination risks and elongating project timelines. Germany faces similar constraints, with no large domestic storage yet available. This makes securing foreign capacity a prerequisite, complicating bankability and auction competitiveness. The UK's requirement for engaging with regulated T&S operators reduces counterparty risk but still exposes emitters to infrastructure delivery delays.

Compliance requirements

All schemes rely on highly prescriptive verifications, but the weight of compliance varies:

- France imposes complex SEQE baselines, DNSH checks, and performance penalties—a significant operational burden, further reinforced by annual ETS-aligned MRV at sub-installation level and strict under-delivery penalties below 90% of the committed decarbonisation volume.
- Sweden and Netherlands SDE++ require extensive verification and documentation. Additionally, it links payments strictly to verified storage, increasing cash-flow pressure. SDE++ also provides limited support for (external) storage liability and long-term monitoring costs beyond project lifetime.
- The UK ICC model mandates stringent monitoring and high capture-rate guarantees, with clawback mechanisms for non-performance.
- Denmark's CCS fund has more complex compliance obligations than NECCS, without buffers or partial-performance flexibility.
- Germany projects must follow the ETS reporting rules and they must achieve at least 60% GHG emission reduction (compared to reference system) within 3 years of operation and 90% by the end of the 15 years.

The **downside** for promoters relates to the more-or-less extensive compliance requirements of each CCfD mechanism. Such obligations ensure environmental integrity but create cost and administrative barriers that disproportionately affect large, multi-asset projects, because they have more emission streams, more interdependencies, higher exposure to operational variability, and much larger financial penalties for even small deviations, making administrative and cash-flow burdens significantly heavier for large-scale deployments.

Exposure to cost inflation and asymmetric risk allocation

Another cross-cutting restraint is the limited protection against inflation or cost increases.

- Sweden and France fix support in nominal terms, offering no indexation; in Sweden, subsidy levels can be reduced if project costs fall or if new revenues arise — but they can never increase if costs rise. These rules tighten risk allocation entirely onto the project developer.
- The Netherlands follows a CfD logic but still requires developers to manage construction and operational risk.
- The UK partially adjusts costs but applies clawbacks to upside revenues.
- Denmark's NECCS includes indexation and moderate penalties, while the CCS fund maintains stricter performance obligations.
- The German model allocates risk asymmetrically between the state and the developer. While energy price and CO_2 price volatility is shared, CAPEX and non-energy OPEX inflation, as well as performance and compliance risk is faced by the developer.

Where downside risks are not shared, large-scale CCS projects—already characterised by high CAPEX and long construction periods—may struggle to secure financing. This might be the case for promoters applying for schemes with predetermined subsidy ceilings that can lead to under compensation and no full coverage of the costs e.g. the Dutch and German scheme with floor price. It might also happen that market prices (ETS or other) are lower than the UK and France pre-fixed linear increasing reference price, thereby resulting in under compensation of promoters.

Timelines, permitting and implementation constraints

Across Europe, permitting duration, lead times for cross-border storage agreements, and construction schedules often clash with contractual deadlines.

- Sweden's original 3-year start-of-storage requirement was incompatible with the realities of large projects and extended to 4 years after stakeholder feedback.
- Denmark's NECCS originally required 2025 operation—another unrealistic timeline for scaled infrastructure—and the CCS fund now anticipates 2028–2029 operation as a realistic horizon.

These examples show that feasibility windows and implementation requirements are as important as financial support when designing scalable CCS policies.

8.2 Advantages and disadvantages of different strike price setup options

The **strike price** is a design criterion of a one or two-sided CCfD scheme. It defines the level of support a project will receive—it represents the agreed cost per tonne of CO_2 avoided or captured, covering both capital and operational expenditures over the project lifetime.

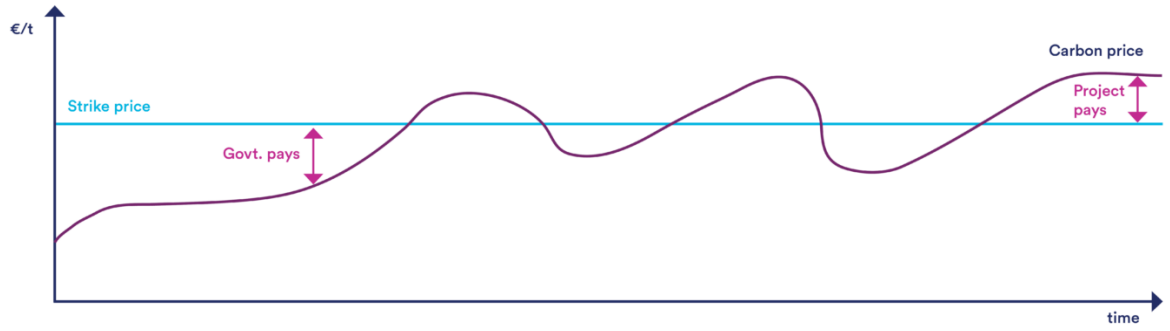

Figure 8: Illustrative payment flows in a carbon contract for difference. Implemented policies often exclude payment from the project to the government (asymmetric payment) © Clean Air Task Force

Across the analysed European schemes, two main approaches exist, according to the Global CCS Institute: fixed strike prices and dynamic strike prices. The advantages and disadvantages of each strike price type are described in the following chapters. The information summarises findings of the previous sections and are reflecting also the findings of the Global CCS Institute.[19]

8.2.1 Fixed strike prices

Most countries, including the UK, France, Denmark, and the Netherlands, establish a maximum strike price. Denmark uses offered rates and settlement baselines. The Netherlands uses phase ceilings (subsidy intensity caps). In France and the UK, there is a pre-agreed linear increase over the years. In several of these schemes, a maximum allowable strike price is defined during the auction or application process, based on prior market analysis or technology benchmarks. Advantages and disadvantages of this set up from the government and applicant/promoter point of view (POV) are given in the table below.

[19] Global CCS Institute (2025), CCS 101 – Carbon Contracts for Differences (CCfDs) in Europe: https://www.globalccsinstitute.com/ccs-101-carbon-contracts-for-differences-ccfds-in-europe/

Table 2: Advantages and disadvantages of fixed strike prices

Fixed strike price	Advantages	Disadvantages
Government POV	Provides budget predictability: once the strike price is set, total subsidy exposure can be estimated over the contract duration. Encourages cost discipline among bidders, fostering competition and efficiency. Simplifies administration and reduces verification burdens.	If real project costs rise sharply (e.g., due to inflation or energy price spikes), projects may become financially unviable, risking under-delivery or non-implementation. Overly conservative price caps may deter participation, reducing the number of bids and slowing decarbonization.
Applicant POV	Offers investment certainty—revenues from the CCfD are predictable. Simplifies financial planning and investor communication.	Projects face cost overrun risks, since no upward indexation or compensation for inflation is usually allowed. In volatile markets (as seen in recent years), fixed strike prices can lead to financial losses if operational costs exceed expectations.

8.2.2 Dynamic strike prices

Germany is currently the only country that incorporates a dynamic component into its strike price mechanism. The German scheme allows for strike price adjustments reflecting changes in key market parameters such as energy prices or CO_2 T&S costs. Advantages and disadvantages of this set up from government and applicant/promoter POV are given in the table below.

Table 3:Advantages and disadvantages of dynamic strike prices

Dynamic strike prices	Advantages	Disadvantages
Government POV	Increases the likelihood that projects remain viable through market fluctuations, ensuring continuity of delivery. Reduces the risk of project failure or the need for costly renegotiations.	Creates budgetary uncertainty as total payouts depend on variable factors. Increases the complexity of monitoring and adjustment procedures.
Applicant POV	Provides flexibility and financial resilience in volatile markets. Ensures fairer compensation when input prices (e.g., energy, materials) deviate significantly from initial assumptions.	Requires more complex reporting and compliance mechanisms. Adjustments may be asymmetrical or capped, limiting full compensation for unforeseen costs.

8.3 Advantages and disadvantages of different reference price set up options

The reference price represents the benchmark against which the strike price is compared to determine payments. In CCfDs, the government compensates the difference when the reference price (e.g., the EU ETS price) is lower than the strike price and, in some schemes that are two-sided, it receives repayments when it is higher.

Four main approaches across European schemes, identified by the Global CCS Institute, are highlighted in the image below.

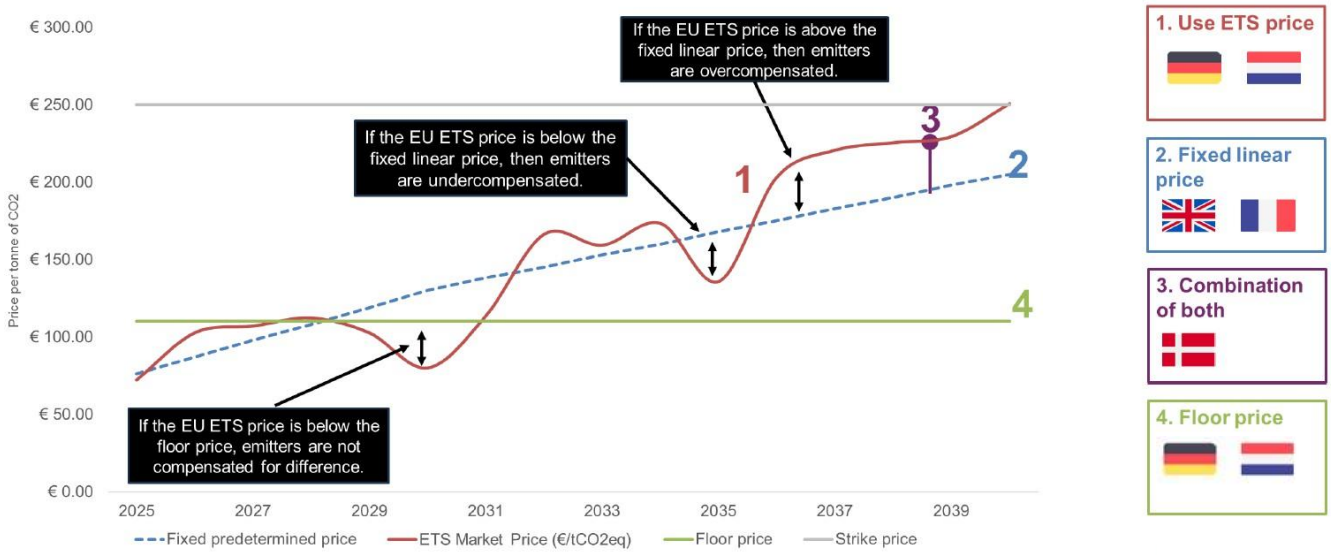

Figure 9: Illustration of the functioning of the different reference price set ups. © Global CCS Institute – modified to add German floor price

Governments face a trade-off between budget predictability and market responsiveness, while applicants must balance revenue certainty against exposure to cost or price volatility.

- Fixed systems (UK, France) prioritize fiscal discipline and administrative simplicity.
- Dynamic or market-linked systems (Netherlands, Germany) favour fairness and resilience to changing conditions but at the expense of budget stability and of administrative load.
- Hybrid systems (Denmark) attempt to balance both but may create asymmetric risks.
- Systems with a floor price offer developers revenue certainty and protect government budgets from excessive payouts, but they also create a risk of under-compensation when real carbon prices fall below the floor.

The best design varies by country, depending on fiscal flexibility, market maturity, type of projects and policy goals—whether to speed up deployment with dynamic methods or ensure budget control with fixed or floor systems.

The information in this chapter summarises findings of the previous sections and are reflecting also the findings of the Global CCS Institute.[19]

8.3.1 Real carbon market reference price (EU ETS spot price)

In the Netherlands and Germany, the reference price is linked directly to the actual EU ETS allowance price. Payments are linked to real carbon market conditions, ensuring accurate compensation for emission abatement. Advantages and disadvantages of this set up from government and applicant/promoter POV are given in the table below.

Table 4: Advantages and disadvantages of real carbon market reference prices

Real carbon market reference price	Advantages	Disadvantages
Government POV	Reflects real climate value; aligns public support with market signals. Promotes cost-effectiveness and market consistency with EU climate policy.	Creates budget uncertainty: government outlays fluctuate with ETS volatility. Difficult to forecast total expenditure across multiple years.
Applicant POV	Ensures accurate and fair compensation in line with real market dynamics. Avoids the risk of long-term under-compensation.	Increases revenue uncertainty, complicating project financing. Developers must manage exposure to carbon price volatility.

8.3.2 Fixed predetermined reference price (linear)

Used in the UK and France, where governments set a fixed, linear reference price path at the start of the contract (e.g., a gradual increase per year). This provides certainty to both parties about the expected level of compensation. Advantages and disadvantages of this set up from government and applicant/promoter POV are given in the table below.

Table 5: Advantages and disadvantages of fixed predetermined reference prices

Fixed linear reference prices	Advantages	Disadvantages
Government POV	Enables precise budget control—total subsidy payments can be predicted in advance. Simplifies contract administration and reduces volatility risk.	May lead to misalignment with real market trends, causing over- or under-compensation. Weakens the price signal linkage to the EU ETS.
Applicant POV	Offers predictable revenue streams, simplifying financing and investment decisions. Reduces market risk exposure.	Risk of under-compensation if real ETS prices fall below the fixed path. Could result in lost opportunity if market prices exceed expectations and overcompensation rules apply.

8.3.3 Hybrid reference price (dynamic cap)

The Danish model applies a dynamic adjustment mechanism (via the annual settlement mechanism). If the real ETS price exceeds the fixed path, the reference price is increased—avoiding over-compensation. However, if the ETS

price drops below the fixed path, no downward correction occurs. Advantages and disadvantages of this set up from government and applicant point of view (POV) are given in the table below.

Table 6: Advantages and disadvantages of hybrid reference prices

Hybrid reference prices	Advantages	Disadvantages
Government POV	Controls excessive subsidy payments. Maintains partial predictability of expenditure.	Still bears some exposure to ETS volatility on the upside. Creates an asymmetry that may be contested by industry as unfair.
Applicant POV	Avoids being overpaid relative to market conditions, maintaining scheme credibility. Maintains partial protection from sharp price rises.	Exposed to under-compensation risk when ETS prices are low, as no downward correction is made.

8.3.4 Reference price floor

The Netherlands and Germany set a minimum "floor" for the reference price, ensuring that the subsidy never exceeds a predefined ceiling, even if ETS prices collapse. Advantages and disadvantages of this set up from government and applicant/promoter POV are given in the table below.

Table 7: Advantages and disadvantages of reference floor prices

Reference price floor	Advantages	Disadvantages
Government POV	Ensures maximum payout predictability; limits fiscal exposure. Protects public funds against sustained low ETS prices.	May result in under-compensation if ETS prices fall significantly, risking project underperformance or delays.
Applicant POV	Certainty of maximum subsidy level guaranteed by the government, independently from ETS price volatility.	Risk of under-compensation if the real ETS price stays below the floor for extended periods. May complicate long-term financial modelling.

9. Conclusions

This chapter presents a synthesis of learnings and strategic insights regarding the competitive bidding mechanisms of Carbon Contracts for Difference and auction schemes for CCS across Europe. Drawing on examples and schemes from countries including the UK, France, Germany, the Netherlands, Denmark and Sweden, the chapter examines the implications of different design choices for both governments and applicants. It explores the trade-offs between fiscal predictability, market responsiveness and practical implementation, highlighting how local context—such as industrial structure, regulatory frameworks and infrastructure readiness—influences both sustainability and replicability. The following sections outline best practices, risks and considerations for long-term policy effectiveness, offering conclusions that serve as guidance for future CCfD programme design and deployment across diverse national settings.

9.1 Sustainability and replicability considerations

The rapid emergence of CCfDs and related auction-based instruments across Europe reflects a broader shift from ad-hoc grants and fragmented support to toward competitive, rule-based, technology-neutral mechanisms capable of delivering large-scale industrial decarbonisation. While each national scheme has unique institutional, legal, and market conditions, clear patterns are emerging that define what makes such mechanisms sustainable in the long term and replicable in other jurisdictions.

The sustainability and replicability of CCfDs depend on robust legal frameworks, fiscal discipline, infrastructure readiness, integration with carbon pricing, and alignment with national industrial strategies. While each country adapts the model to its context, emerging best practices point to a value-chain approach that ensures effectiveness from project inception through long-term operation and policy impact.

Institutional and legal foundations

A foundational requirement for sustainability is legal certainty, both for investors and for public authorities. In order to be sustainable and replicable a CCfD scheme should have an alignment with EU State aid rules and a dedicated implementing agency with expertise in carbon pricing, state aid, and industrial technologies. For example, The Dutch SDE++ provides a strong example of rule-based, transparent alignment with EU State Aid rules, demonstrating that a technology-neutral cost-per-tonne-CO_2 approach can remain fully compliant while still enabling competition across sectors. Germany, Sweden, France and Denmark reinforce this principle: they all embed their CCfD schemes into the CEEAG framework and operate through specialised implementing bodies — BMWK/PtJ in Germany, Swedish energy Agency in Sweden, ADEME in France, the DEA in Denmark, and DESNZ and LCCC in the UK — ensuring administrative competence and consistency.

Fiscal design and long-term budget discipline

Long-term decarbonisation contracts require clear fiscal planning. Sustainable financing requires multi-annual budget commitments aligned with project lifetimes, transparent cost-control instruments (caps, correction factors, dynamic references). For example, SDE++ employs strict annual budget ceilings and a uniform EUR/tonne CO_2-avoided metric, enabling expansion or contraction according to fiscal capacity while preserving competitive neutrality. Germany combines 15-year support contracts with a double-volume budget design (base + additional funding volume) and introduces surplus payment mechanisms for high carbon-price environments—ensuring the public budget is not over-exposed.

Infrastructure readiness and value-chain coordination

Effective CCfDs rely on the real-world availability of capture, transport, and storage infrastructure. Sustainability requires that funding schemes be paired with enabling T&S regulation, clear cross-border CO_2 transport frameworks (e.g. alignment with the London Protocol amendments) and realistic timelines based on infrastructure availability. For example, Denmark mandates single-operator full-chain responsibility, simplifying oversight and reducing integration risks in early markets. The SDE++ requires binding T&S agreements prior to operation, ensuring whole-chain coordination even without mandating a single integrated operator. In the UK, only regulated T&S operators are allowed to associate to the project. Without these complementary policies, supported capture projects risk delays or abandoned assets. In Sweden, for example, lessons from the first auction show that insufficient value-chain readiness can limit participation and raise the risk of stranded capture investments. CCfDs are most effective in countries with significant emission-intensive industry clusters (steel, cement, chemicals).

Integration with carbon pricing

A defining characteristic of Europe's new CCfD landscape is the strong linkage to carbon pricing systems, especially the EU ETS (as seen in Netherlands, Germany and Denmark; France has no linkage). The UK mechanism links the reference price to the UK ETS only for the 5-years operational extension. Direct linkage to the EU ETS (and UK ETS) prevents over-compensation, keeps public spending aligned with market signals and makes it suitable for integration with other carbon-pricing regimes. For jurisdictions lacking an ETS, a synthetic, transparent reference price (fixed or indexed) can substitute—but must remain predictable to maintain investor confidence.

Industrial strategy

Germany and the UK illustrate how CCfDs complement hydrogen strategies, renewable power expansion, and industrial transition roadmaps. The Netherlands, France and Denmark integrate schemes within broader carbon management and renewable-energy frameworks. Replicability therefore depends on an industrial base suitable for abatement as well as the coherence with energy market design. Countries with more dispersed industrial emissions may need simplified or sector-specific CCfD models to remain administratively feasible.

Stakeholder engagement and scheme adaptability

Long-term public support is politically essential. To ensure sustainability the schemes should include transparent communication of costs and impact, integrate local development benefits, and address employment and community considerations in high-emitting regions. For example, Germany's inclusion of site-retention and workforce agreements reflects an emerging trend of linking CCfDs to just transition objectives. Denmark and the Netherlands rely on strong public communication about cost-benefit outcomes, while the UK emphasises regional economic development within industrial clusters. France links its CCfD scheme to territorial industrial strategy, emphasising regional employment retention and the revitalisation of industrial basins, while requiring transparent communication on public spending and alignment with national decarbonisation planning to maintain social and political support.

9.2 Consultative processes

The national funding authorities have all implemented some form of consultation to gather feedback and inputs on their CCfD instrument. The collected stakeholder input is used to further develop their instruments, resulting in visible annual changes and improvements. For the SDE++ , more fundamental changes take more time to be incorporated due to its rule-based, state-aid-aligned structure. The German scheme follows a similarly rigid framework. The consultation in the UK situation goes beyond a single instrument and is focussed on reaching specific targets with a portfolio of support mechanisms.

The diversity in consultation processes, implementation timelines, and opportunities for stakeholder engagement across national CCfD schemes is further illustrated in Table 8. This table provides a comparative overview of the key milestones for each scheme, including the number of rounds completed, political announcements, public consultations, state-aid approvals, call openings and closings, and contract awards. By mapping these timelines, Table 8 highlights both the procedural differences and the pace at which each country has advanced its respective support mechanisms. This context is essential for understanding the degree of flexibility and responsiveness available to applicants and stakeholders in each jurisdiction.

Table 8: Overview of implementation timelines for existing schemes.

Scheme	Nr. funding rounds already concluded	Political announcement	Public consultation	EU state-aid approval	Call opening	Call closing	Contract awarded
Sweden – Bio-CCS	1	2020-21	n.a.	Jul 2024[20]	Aug 2024	Nov 2024	Jan 2025
The Netherlands – SDE++ *	5	2023 (annual since 2020)	Feb 2025 Out 2025 (Prolongation up to 2029)	Jul 2025[21]	October 2025	November 2025	Ongoing
Germany – KSV	1	Mar 2022	Jun-Jul 2022 (final guidelines summer only 2023)	Feb 2024[22]	Mar 2024	Jul 2024	Oct 2024
Denmark CCUS Fund	1	June 2020	Q1 2022	Jan 2023**	May 2022	n.a.	May 2023
Denmark NECCS Fund	1	Dec 2021	Q1 2023	Jan 2023**	Aug 2023	Jan 2024	Apr 2024
Denmark CCS Fund	1	Sep 2023	Apr – Aug 2024	Jan 2023**	Oct 2024	Dec 2025	Apr 2026
UK – ICC	n.a.	Oct 2021	Apr-Jun 2022	N.A.	2023 (bilateral negotiations)	2024 (bilateral negotiations)	Dec 2024
France - GPID	1	2023	Jun-Sep 2024	Dec 2024	Dec 2024	May 2025	Ongoing

*Timeline for 2025 call
**Most likely the three Danish schemes fall all under the same state-aid approval

In addition to the potential to support the development of the instrument it is important to understand the level of interaction possible with the funding agency when applying. For most CCfD instruments it is clear that there is a structured way of handing the bids that are closed and non-negotiable during the auction process. There is a strict evaluation procedure in place that selects the most competitive bids, further negotiation is not possible. This makes the SDE++, the *CO_2 Differenzverträge* and the French GDIP to a certain extend rigid in terms of optimising the instrument during implementation. Sweden's Bio-CCS auction maintains this non-negotiable bid structure, even if pre-submission dialogue and post-round learning offer more flexibility than the other rule-based schemes.

Denmark stands apart. It uses a negotiated procedure that is not only aimed at the offers but also on aspects of the tender and its documents itself. In fact, apart from a set of minimum requirements, all other requirements are

[20] https://ec.europa.eu/competition/state_aid/cases1/202451/SA_107009_141.pdf; https://ec.europa.eu/commission/presscorner/detail/lt/ip_24_3583
[21] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C_202503602
[22] https://ec.europa.eu/commission/presscorner/detail/en/ip_24_845

subject to negotiation and thereby potential optimisation. This opens up the possibility to tailor the project/initiative and make it suits for purpose to the requested service.

A completely different approach is used in the UK instead. ICC contracts are awarded through a bilateral negotiation process following the CCUS Cluster Sequencing selection. Considering previous cluster inclusion, the scheme is more flexible and allows significant interaction between developers and DESNZ/LCCC, including project-specific negotiation of key commercial and technical parameters.

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Annex 1: Comparative table

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
Governmental agency	Energimyndigheten	RVO (Netherlands Enterprise Agency)	German Federal Ministry for Economic Affairs and Climate Action (BMWK)/ German Federal Ministry for Economic Affairs and Energy (BMWE)	Danish Energy Agency	Department for Energy Security and Net Zero (DESNZ) Low Carbon Contracts Company (LCCC)	French Environment and Energy Management Agency (ADEME)
Legal construct	National Ordinance (SFS 2024:626) and STEMFS 2024:1	Approval of State Aid prolongation and Amendment	Förderrichtlinie Klimaschutzverträge - Entwurf 24.03.2025	CCUS fund: Subsidy and economy scheme (appendix 6) NECCS fund: Subsidy and economy (appendix 5) CCS fund: Subsidy and economy (appendix 5 V2)	Energy Act 2023	Agreement of 16 March 2022 between the State, ADEME
Budget	SEK 36 billion (≈ EUR 3 billion) maximum scheme envelope, disbursed 2026–2046. current certified budget is SEK 30.7 billion (≈ EUR 2.82 billion)	EUR 8 billion	EUR 50 billion over 15 years; 2nd round approx. EUR 6 billion	NECCS Total DKK 2.56 billion (2023 prices; ≈EUR 343 million); annual cap of DKK 319.9 million from 2025–2032 CCS: Total fund budget: DKK 28.7 billion (incl. VAT and potential derived tax losses; ≈EUR 3.85 million) covering 2029–2044.	£21.7 billion funding for CCS up to 2050 (commitment from the Government) £8.35 billion ICC + Waste ICC 6th allocation round 2024 stemming from first cluster group (track-1), updated ICC documents for subsidy support in 2025.	Multi-year tenders. EC state-aid approval for EUR 3 billion. No per-call ceiling defined in GPID.
Support duration	Up to 15 years from first geological storage	12-15 years	15 years	NECCS: up to 8 years (2025–2032)	10 + 5 (potential) years	Up to 15 years

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
				CCS: up to 16 years (2029–2044)		
Entry into Operation requirements	≤ 4 years from grant decision	5 years for CCUS	≤ 4 years from grant decision +1 years (justified case)	NECCS: by 2026 (~1 years from award CCS: by 2029 (~3 years after award)	In Track-1 projects, DESNZ indicated that FID is expected within 2024–2025 depending on cluster readiness; Track-1 Expansion guidance explicitly refers to an expectation of FID within 12–18 months post-award.	Commissioning 5 years after the date of notification of the funding agreement
Status	First call opened in August 2024, second call is open.	Open October 2025 – November 2025	2nd round conditions approved by EU on 24 Mar 2025; preparatory (2nd) procedure for 2nd round open until 1. Dec 2025. Expected auction launch mid 2026	NECCS: Active – tender closed Jan 2024; award and contract signing in Q1 2024 CCS: ongoing; Best and Final Offers (BAFO): due December 2025; Contract award: expected April 2026	Closed for applications, next round for second cluster projects track-2 under development	One round concluded in May 2025, projects still under evaluation. Second round in preparation.
Frequency	At least 2 calls	1 call per year (5 stages)	2 calls per year (expected) 1 call per year (realized)	one-off round	Bilateral negotiations with Track-1 and track 2 projects	Multi-year competitive calls for projects (tenders); First one was in the first half of 2025.
Type of support – Payment direction	Reversed auction, Subsidy per tonne of stored biogenic CO_2; ex-post payments	CCfD (one-sided) variable funding based on cost-gap	CCfD (two-sided) variable funding during operation/exploitation	CCfD (one-sided) variable funding during operation/exploitation	One-sided CCfD, with a linear fixed reference price increase in the first 10 years and UK ETS (futures) as	One-sided CCfD (pay-for-performance): State pays the difference when EU ETS

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
		during operation/exploitation			reference price for the possible extra 5 years in operation.	price < strike price; zero-payment when ETS > strike.
Auctioned output	Sequestered biogenic CO_2eq	Renewable energy or CO_2 reduced (tonne CO_2 avoided)	Avoided CO_2eq	Sequestered and permanently stored CO_2eq (CCS) or biogenic/atmospheric CO_2eq (NECCS).	Sequestered and permanently stored CO2eq (CCS) Net-removals and /atmospheric removals of CO_2eq applicable in separate models (Power BECCS / GGR), but not for cement.	Verified and permanently stored tonne CO_2 (post-MRV). Possibility to get an earlier payment instalment conditioned on CAPEX expenditure.
Bid components	SEK/tonne CO_2eq sequestered (price & volume)	EUR/tonne CO_2eq avoided (price & volume)	EUR/tonne CO_2eq avoided (base contract price) (price & volume)	NECCS: 1. Offered Rate (DKK/tonne CO_2, 2023 prices); 2. Annual Quantity (mandatory, 2026–2032); 3. Optional 2025-Quantity (bonus evaluated); 4. Project Description & Schedule (technical and risk plan). CCS: 1. Offered Rate (DKK/t, excl. VAT); 2. Annual Quantity 2030–2044 (≥100 kt/y); 3. optional 2029-Quantity; 4. baselines	£/tonne CO_2eq captured and permanently stored (negotiated, not auctioned) (price & volume).	Required support level (EUR/tonne CO_2 avoided) + project dossier (price & volume).

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
				for taxes/EUA/carbon-credit inputs		
Eligible costs	CAPEX and OPEX costs for capturing biogenic CO_2, transporting to storage site and store.	Additional investment (CAPEX) and operating costs (OPEX) for the more climate-friendly system compared to the reference system. Operating shortfall (unprofitable top) based on basic amount & correction amount.	Additional investment (CAPEX) and operating costs (OPEX) for the more climate-friendly system compared to the reference system. Funding is provided for the transformative production share of the system. OPEX for conventional processes only possible if absolutely necessary for technological reasons.	NECCS: Operating costs across the full CCS chain (capture, transport, storage- full value-chain). No CAPEX co-funding CCS: Not cost-item reimbursement; support is per-tonne output-based across capture, transport and storage. Settlement adjusts for tax savings, EUA savings and carbon-credit income	Cost for the project (this means the design, development, construction, conversion, installation, completion, testing, commissioning, operation, maintenance and decommissioning of the facility). Not exclusively on tangible assets and connection to any relevant Transmission System (network costs) may be taken into account.	Additional CAPEX & OPEX vs reference installation (net additional cost). No DEVEX funding.
Subsidy intensity	[SEK/tonne CO_2] = [Eligible CCS costs− Other public support− 0.9×(Other financing + revenues)]/	[EUR/tonne CO_2] = (application rate [EUR/tonne CO_2] − long-term price [EUR /tonne CO_2])	[EUR/tonne CO_2] = base bid price + discounted value of other approved public funding per tonne of CO_2 avoided over the project lifetime	fixed bid price per tonne CO_2 (2023 DKK) NECCS: Inflation adjustment (by DEA) after contract awarded.	[£/tonne CO_2] = Strike Price (reflecting the OPEX and CAPEX costs of the CCUS project) − pre-fixed (reference) price resulting in to-up or pay-back payments	Bid price + discounted other public aid (EUR/tonne CO_2 avoided)

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
	(Planned stored biogenic CO_2 (t))			CCS: Settlement adjusts for tax savings, EUA savings and carbon-credit income.		
Ceiling subsidy intensity (price level)	Initially set for SEK 3,000/tonne (≈ EUR 274/tonne), but according to the latest call opening it will not be announced until after the call for entries has closed.	EUR 400/t CO_2 . The maximum intensity limit increases across phases (e.g., EUR 75, EUR 150, EUR 225, EUR 300, EUR 400 in different stages/years).	Not determined yet. likely < EUR 600/tonne CO_2 eq as in earlier rounds.	NECCS: The maximum Offered Rate × Annual Quantity must not exceed DKK 319.9 million/year (≈EUR 42.9 million) CCS: Bid cap on evaluation price (Offered Rate + evaluation-technical supplement) incl. VAT = DKK 1,750/tonne (≈EUR 234.5)	Not pre-established transversally. Bilateral negotiations per project.	No fixed cap; limited by a credible net additional cost & budget ceiling.
Minimum project size	≥ 50,000 tonnes per year biogenic CO_2	Not determined	≥ 5,000 tonnes CO_2-eq per year average baseline; Projects with subsidy need below EUR 15 million per project (can vary each call)	≥ 100,000 tonnes CO_2/year	Not pre-established transversally. Bilateral negotiations per project and overall scheme budget and GHG avoidance constraints.	Requires a minimum grant amount of EUR 20 million
Maximum project size	Limited by the call budget	Not determined. Limited only by category rules & budget	Limited by the call budget	Not determined	Not pre-established transversally. Bilateral negotiations per project and overall scheme budget and GHG avoidance constraints.	Limited by call budget and sector ceilings

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
Performance monitoring	Reporting twice per year during build and annually during operations; independent verification	Certified CO_2 reduction / storage based on actual metering and MRV.	Monitoring follows ETS reporting rules. Projects must achieve a minimum 60 % GHG emission reduction relative to the reference system within three years after operational start, and demonstrate a 90 % reduction by the end of the 15-year contract period	NECCS: Quarterly and annual reporting, ISO 27914:2017. CCS: Monthly and annual reporting, ISO 27923.	ICC Contract contains a detailed Measurement and Monitoring Plan (MMP) that the project developer must prepare, submit, and maintain. It must record, mass of CO2 captured and other operational data, including T&S operator data. Independent audit verification of the operation and savings is required.	Actual decarb performance verified annually. Under-delivery penalty < 90%. There is a Catch-up mechanism. ETS Allocation level changes (ALC) reporting mandatory.
Payments	Ex-post continuous (after verified storage); ability to bank surplus volumes year-to-year; no pre-payments foreseen.	Monthly advance payments. Every year a retrospective correction bason on the actual energy or carbon price and the certified meter readings is performed.	Annual payments for operational costs are indexed to CO_2 and energy prices. The CCfD mechanism hedges price risks — public funding is disbursed only when market prices fall below the contract price. Settlements occur annually based on verified ETS-compliant data, with quarterly advance payments possible upon provision of a financial guarantee.	NECCS: Quarterly invoicing based on verified Delivered Quantity (Appendix 5 §2.2). DEA audits annual totals and may reclaim overpayments. CCS: Monthly invoices = Delivered Quantity × Subsidy Rate (+VAT); Annual Settlement (DEA calculation) may require repayment; DEA informs Subsidy Rate per month/year per Appendix 5.	Payments are made based on the metered verified tonnes of CO_2 captured and delivered to permanent storage ("ICC Output"), with LCCC issuing monthly payments.	Annual aid per year defined according to the MRV captured carbon and other potential adjustments. Optional first payment before operation. Deductions for cumulation/CEE. No aid when ETS price > bid price (strike price).

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
Cumulation	Allowed with other public support only to avoid over-compensation; other public support is added for ranking and deducted in payments.	Annual assessment of (over-) incentivization conform CEEAG (2022/C/80/01). Explicit mentioning of other support schemes that cannot cumulate with SDE++ like EIA, ISDE, SCE. Additional public support for the same eligible costs is not allowed.	Cumulation of funding is tightly restricted and may even exclude eligibility depending on the funding call. Any other public funding already approved before submission of the application must be reflected in the cost-efficiency calculation, worsening the bid's ranking. Only public funding approved after the application has been submitted is deducted from the annual grant during implementation.	No double funding for same costs allowed.	Double-funding of the same costs (without corresponding reduction of subsidy) is not allowed. Beneficiaries of the ICC CCfD can cumulate UK or EU public funding only if it is declared, does not duplicate support for the same cost items, and is reflected in a reduced ICC strike price. This is applicable for CAPEX or tax incentives, but not for additional OPEX support e.g. Innovation Fund OPEX-type support is not compatible.	Cumulation allowed but must be deducted. Overcompensation prohibited.
Eligible applicants	Companies that capture biogenic CO_2, which are also responsible for overseeing both transport and storage themselves or via dedicated subcontractors.	Companies/organisations that perform (non-)ETS industrial activities using one of the selected range of technologies, implementing projects that have not taken FID or are not operational yet.	Applicants planning to establish or convert production plants where the conventional reference system, based on capacity or rated thermal input, would fall under Annex I of Directive 2003/87/EC, and where the new configuration constitutes a transformative,	Any economic operator (public or private) or consortium capable of establishing and operating the full CCS value chain. The applicant must take the full contractual responsibility for the entire CCS value chain.	All applicants must be part of, or able to connect to, a Track-1/Track-2 CCUS cluster. ICC: UK industrial emitters that produce and capture fossil, process, or biogenic CO_2 from industrial processes (e.g., cement, lime, steel, chemicals, refining, WtE). Electricity-	ETS-covered industrial sites in France; must be an existing installation.

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
			low-emission production process Projects must have baseline emissions of at least 5 kt CO_2-eq per year and demonstrate a 60 % GHG reduction after three years and 90 % by the end of the contract.		only generators are not eligible	
Guarantees	No explicit financial guarantee instrument specified.	Include in the application a provision of a bank guarantee	0.1 % of total subsidy amount as financial prequalification security	Unconditional and irrevocable on-demand Performance and Warranty Guarantee and Parent Company Guarantee (prior to signing the contract).	UK ICC scheme does not require bank guarantees or performance bonds; instead, it relies on contractual milestones, termination rights, strict conditions precedent, and payment-only-on-performance to manage financial risk. However, Peter indicated the other awarded project presented bank guarantees. HM did not as it is using own resources (parent company guarantee).	Mandatory only if optional first payment is requested: on-demand guarantee equal to optional payment amount.
Selection criteria	Sole award criterion: cost-effectiveness (SEK/tonne biogenic CO_2 stored). Acceptance test (bid +	Competitive price in selected windows until the	Sole award criterion is cost efficiency (calculated (= base bid price + discounted value of other approved	Best price-quality ratio NECCS: consisting of best Offered Rate (60%), project	ICC projects are firstly screened through Track-1, Track-2, or Track-1 Expansion cluster pathways	N1 bid/strike price (EUR /tonne CO_2)

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
	other public support + 90% other financing/revenue ≤ costs) and feasibility via implementation plan.	budget is depleted. Feasibility assessment.	public funding per tonne of CO_2 avoided over the project lifetime) Eligibility conditions (not scored) ensure technological maturity and significant emission reductions.	maturity (20%) and offered 2025-Quantity (20%). Combined assessment of these 3 criteria results is selected offer. CCS: consisting of financial "Subsidy" 80% (via an Evaluation Amount = Offered Rate + evaluation-technical supplement derived from baseline tax savings), and Project maturity 20%;	by DESNZ according to: Deliverability & readiness, technical feasibility, emissions abatement, cost and value for money, cluster integration and subsidy control compliance. Then it is up to ministerial discretion (through DESNZ and LCCC) to negotiate ICC contracts bilaterally, with no competitive scoring or auction.	N2 decarb ambition beyond ETS bonus (up to 20% of N1 bonus) N3 Innovation Fund bonus (up to 10% of N1 bonus)
Biogenic vs fossil CO_2 treatment	Only biogenic CO_2 eligible. Mixed streams allowed, but only biogenic share counts; share determined at capture point per EU MRR; third-party verified annually.	CCS allowed for fossil, biogenic, or mixed (category-specific). No distinction between fossil or biogenic CO_2. Biogenic process emissions are counted as zero, but different values are expected in the future with new categories. Mix of fossil and biogenic can be a challenge since SDE++ only allows a single category.	Biomass allowed only if no electrification/H_2 option and must meet RED II sustainability criteria; biogenic residuals prioritized	NECCS: Only biogenic and atmospheric CO_2 eligible. CCS: fossil, biogenic and atmospheric CO_2; baselines/settlement include EUA savings for fossil fraction and possible allowances for biogenic/atmospheric if future EU rules introduce them.	ICC fully allows both fossil and biogenic CO_2 to be captured and supported under the contract. The scheme is technology- and feedstock-neutral: any CO_2 emitted from an industrial installation (process, combustion, or mixed) is eligible if permanently stored.	Only fossil CO_2 (+ emission) eligible for capture at the application stage since biogenic is already considered zero in ETS (no negative assumption for payment). During operation stage, biogenic still eligible for operational reporting and de-risks capture targets but does not lead to extra payments due to it.
	Aid covers capture, transport, storage costs;	Applicant must secure transport & storage	CCS / CCU fully eligible in the second round; project	The Operator must assume full value-chain	Projects must demonstrate a credible and defined route	Applicant must show: CCS FEED started; ≥50%

	Reversed auction for bio-CCS	Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	NECCS/CCS fund	Industrial Carbon Capture (ICC) business model	Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
T&S risk	payment only after storage means transport/storage execution risk remains with beneficiary	capacity; declaration required	must prove secured T&S connection; system boundaries include capture + connection to network but exclude transport/storage itself.	responsibility, including capture, transport, and geological storage. Storage requires EU CCS Directive permit and complies with ISO 27914:2017 (NECCS) or ISO 27923 (CCS). DEA provides no transport or storage risk coverage.	to a licensed T&S network, showing it is located or can connect to a Track-1 or Track-2 cluster, and there is an identified T&S provider with detailed proof on discussions and technical specifications (e.g. T&S readiness or connection statement). A formal contract is finalised at a later stage.	process/biogenic CO_2; advanced discussions with T&S operators; proof of storage annually.
Clawback mechanism	Clawback on other public support (100%) Clawback on revenues (incl. green premium) and new private financing (90%) If actual project costs fall by more than 20% compared to those declared in the bid: 90% of the cost savings above the 20% threshold are clawed back. No clawback in the other direction - Cost increases are not compensated	Prevents overcompensation through automatic ex-post netting rather than clawbacks: all observable revenues that reduce the unprofitable top—such as ETS benefits, avoided CO_2 costs, and certificate values are fully deducted (in the correction amount), potentially reducing the subsidy to zero. Underperformance leads to proportionally lower payments, while cost overruns are not compensated and cost	Additional public subsidies are fully (100%) deducted to avoid overcompensation. Green surplus revenues may be deducted by up to 60%, but only if the BMWK specifies this deduction mechanism in the respective funding call.	CCS fund: 100% clawback mechanisms through an annual settlement that deducts ETS allowance savings, CO_2 tax savings, and carbon-credit revenues from the subsidy to prevent overcompensation. No claw back commercial revenues such as green product premiums, nor does it include a general profit-sharing or IRR-based clawback mechanism.	Clawback mechanisms for other public support, UK ETS benefits, and carbon credit revenues. In particular, ICC beneficiaries must forfeit UK ETS Free Allowances in line with achieved emission reductions, repay 90% of any GGR credit revenues, and are prohibited from cumulating ICC support with other subsidies for the same costs. No clawbacks on product-level green premiums.	Clawback on additional public support and credit savings revenues (100%, deduction/repayment). Underperformance leads to proportional reduction of payments, with ex post penalty clawback for 90% of the material overstatement carried forward. No ex-post clawback on product-level green premiums.

	 Reversed auction for bio-CCS	 Stimulering Duurzame Energieproductie en Klimaattransitie (SDE++)	 CO_2 Differenzverträge (previously Klimaschutzverträge) (CCfD) [draft conditions 2nd round]	 NECCS/CCS fund	 Industrial Carbon Capture (ICC) business model	 Grands Projets Industriels de Décarbonation (GPDI) [2024 conditions 1st round]
		savings are retained by the project. Product-level green premiums are not clawed back (not included in the correction amount).				

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