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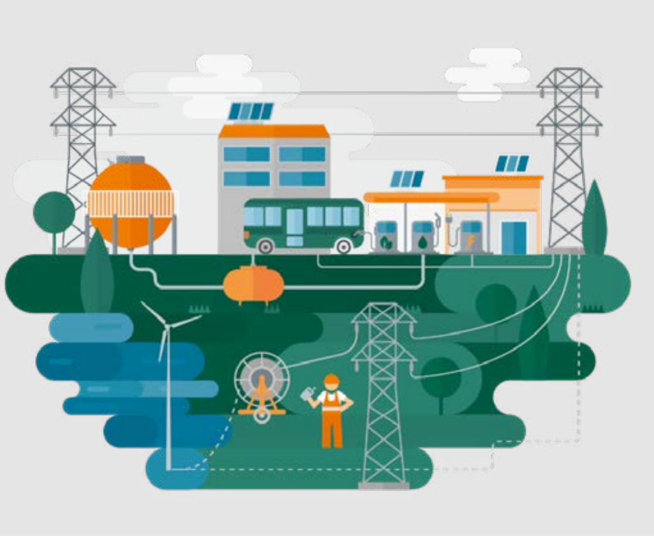

FACTSHEET

INCENTIVE SYSTEMS FOR CARBON CAPTURE UTILISATION/ STORAGE

The ramp-up of Carbon Capture, Utilisation and/or Storage (CCU/S) as a climate protection measure requires incentive systems, as the effective price on CO_2 emissions is currently generally too low to cover the costs of storage, and the market demand for CO_2 as a resource is very limited. In this context, the various incentive systems pursued in Europe are presented below, and their role in the transformation is analysed.

Why do we need incentive systems for deploying carbon capture and utilisation or storage (CCU/S)?

CO_2 emissions are a negative externality that causes harm to the environment and society. To align investment decisions and resource allocation with the goal of sustainable development, this damage needs to be factored in. Thus, policymakers should establish a **market framework aiming to ensure fair competition between polluting and green technologies** with the aim of promoting decarbonisation.

With a few exceptions (e.g., carbonated beverages or urea production), there is currently **no market demand for captured CO_2**. Scaling up CO_2 capture for utilisation or storage thus requires an appropriate market framework.

The purpose of **CO_2 storage (CCS) is solely to prevent CO_2 emissions** or remove CO_2 (carbon dioxide removal, CDR) from the atmosphere. By contrast, CO_2 utilisation (CCU) aims not only to avoid CO_2 emissions (e.g., synthetic fuels) but also to produce new products. The design of relevant incentive systems should be aligned with these objectives.

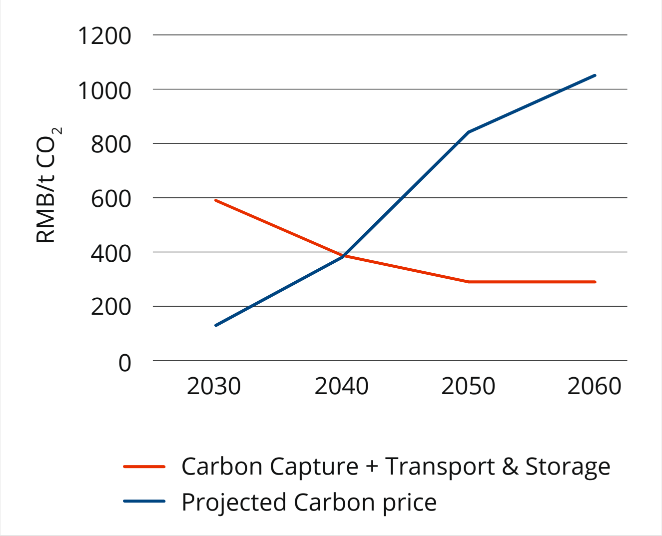

Figure 1: Comparison of abatement costs and projected carbon price. Source: Asian Development Bank (2022)

One **effective way to establish a framework incentivising emission reduction is through CO_2 pricing**. A payment for CO_2 emissions can be voluntary (as in voluntary carbon markets) or mandatory (as in compliance markets). The price can be set at a fixed rate, like a CO_2 tax, or determined through supply and demand, as in cap-and-trade systems.

The **European Union (EU)** has implemented a cap-and-trade system, the **EU Emissions Trading System (EU ETS)**, requiring businesses to buy tradable emission allowances. With allowances becoming scarcer, the CO_2 price will eventually reach levels required for the use of CCS to become cost-effective if no cheaper mitigation option exists. Currently, in both Europe and China, the **CO_2 price is lower than the cost of implementing CCS** (see figure 1[1]). Prices in the EU ETS are expected to exceed **100 EUR per ton of CO_2** by **2030**, with a further significant increase **by 2039** when the issuance of new allowances ends. Companies can therefore anticipate rising costs and begin investing in CCS today.[2, 3, 4]

However, under the EU ETS companies face some **uncertainty about future CO_2 prices**, as these depend on political decisions. Moreover, for new large industrial projects, initial projects often face significantly higher costs, making it unattractive to pioneer the technology if later adopters can benefit from lessons learned.

To encourage the early deployment of CCS, particularly in "no-regret" applications, **additional incentives are being discussed in Europe**. In general, regulatory options and incentive mechanisms for CCU/S, in addition to carbon pricing, are considered for the purposes outlined below:[5]

Compensation for higher costs of first movers

First-of-a-kind plants face higher uncertainty and significant additional costs. **Targeted support for innovative projects can help mitigate these disadvantages** and encourage investment in early projects that contribute to technology development and cost reductions.

Reducing uncertainty about CO_2 price development

The EU ETS provides a strong price signal for investments in greenhouse gas reduction. However, investment security depends on the predictability of future CO_2 prices. The development of the EU ETS (and supplementary national pricing) depends on the level of political ambition. Complementary instruments could help **reduce regulatory uncertainty around future CO_2 prices** and the profitability of climate protection measures.

Enhancing incentives when CO_2 prices are insufficient

Additional support could **ensure the economic viability of investments in case market signals from the EU ETS are not sufficient**. This is particularly important if these investments are deemed critical for achieving domestic climate goals. Industrial policy or other considerations may also provide an additional incentive beyond the CO_2 price.

Overview of incentive approaches

There are various options for creating incentives for effective climate protection and supporting the scale-up of CCU/S. Below is an overview of approaches already pursued for CCU/S. Regulatory and support mechanisms **vary according to several factors**, including:

- Supply-side or demand-side instrument
- Monetary or non-monetary instrument
- Technology-neutral or technology-specific approach
- Target-group-specific (such as by region, industry or company size)
- Further differentiation of conditions by target group
- Degree of binding obligation

1 Asian Development Bank (2022): Road Map Update for Carbon Capture, Utilisation and Storage Demonstration and Deployment in the People's Republic of China.

2 Sandbag (2024) – Carbon Price Viewer, https://sandbag.be/carbon-price-viewer/, accessed on 04/12/24

3 Kopernikus-Projekt Ariadne Potsdam-Institut für Klimafolgenforschung (PIK) (2021) – Notwendige CO_2-Preise zum Erreichen des europäischen Klimaziels 2030, 2021_11_ariadne_hintergrund_co2-preisentwicklung_november21.pdf, accessed on 04/12/24

4 Euractiv (2024) – Experten: CO_2-Zertifikate für Industrie und Strom bis 2039 aufgebraucht, https://www.euractiv.de/section/finanzen-und-wirtschaft/news/experten-co2-zertifikate-fuer-industrie-und-strom-bis-2039-aufgebraucht/, accessed on 04/12/2024

5 The following explanations are based on information from an expert report prepared as part of the German Carbon Management Strategy.

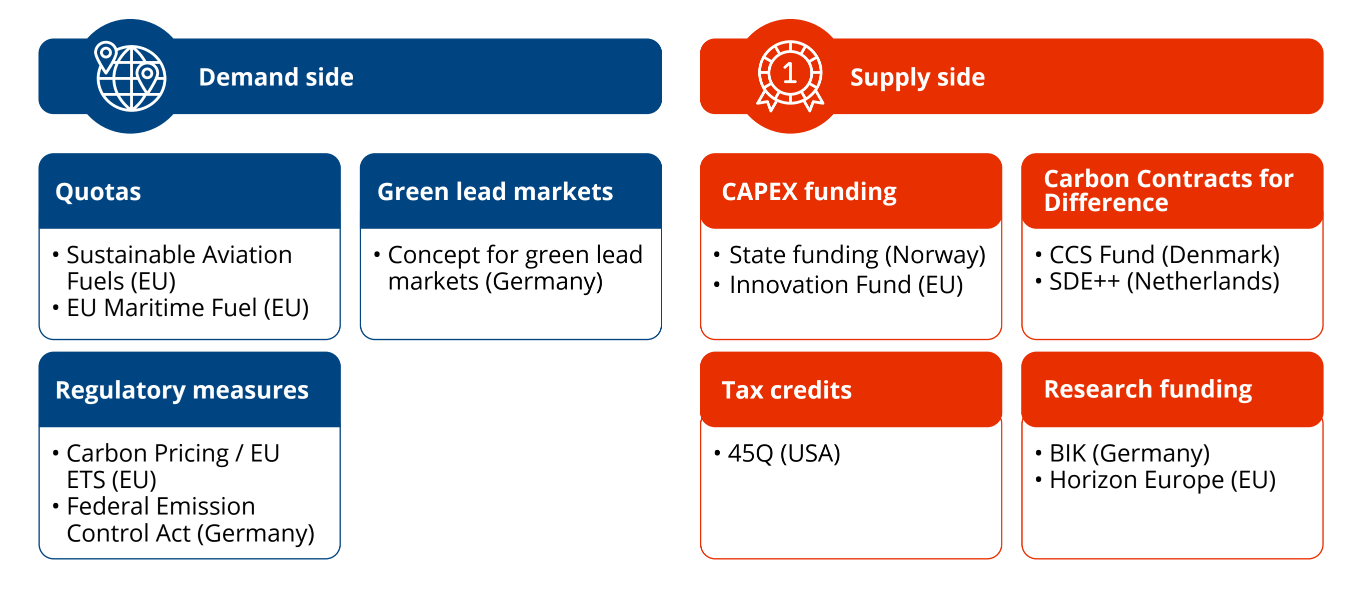

Figure 2: Overview different incentive systems for CCU/S. Source: dena

Demand side instruments

Among monetary instruments in demand-side regulatory approaches, taxes, levies and fees are the most important and frequently used instruments. Non-monetary demand-side regulatory instruments include standards, regulations and quotas, forming a classic part of regulatory law. The most important instruments for CCU/S are **quotas, green lead markets and regulatory measures**.[6,7,8] At the EU level, quotas for the use of Sustainable Aviation Fuels (SAFs) are specified, increasing from **2 percent** to **70 percent** by **2050**. SAF include non-fossil fuels produced either from biogenic sources or based on CO_2 or recycled carbon. Additionally, the EU **CCS Directive** establishes various requirements for CO_2 storage, such as the duration of liability and monitoring concepts (see figure 2).

Supply side instruments

On the supply-side support for CCU/S, a distinction can first be made between automatic support and application-based support. Additionally, the duration of support is a crucial factor. In the case of existing support instruments for CCU/S, this differentiation is relevant for investment cost funding, which is mostly provided as a one-time payment (e.g., the **Innovation Fund**).[9,10] In contrast, **Carbon Contracts for Difference (CCfD)** are granted over a longer period (typically **10 to 15 years**).[11]

Tax incentives can be offered by the state or through simplified depreciation methods. For CCU/S, this type of instrument is utilised in the **U.S.** under the **45Q programme**.[12] Companies receive a flatrate subsidy for the project depending on the size of the facility and the goal of either utilisation or storage.

Non-monetary support includes information and advisory services, public appeals and capacity building. Many of these elements are essential for the effective functioning of financial support and regulation. However, non-monetary support will not be discussed further in the following sections. The following sections will introduce and explain the most relevant instruments for CCU/S in detail.

6 European Commission (2024) – REFuel EU Aviation, https://transport.ec.europa.eu/transport-modes/air/environment/refueleu-aviation_en, accessed on 04/12/2024

7 European Commission (2024) – Legislative framework, https://climate.ec.europa.eu/eu-action/industrial-carbon-management/legislative-framework_en, accessed on 04/12/24

8 BMWK (2024) – Leitmärkte für klimafreundliche Grundstoffe Konzept des Bundesministerium für Wirtschaft und Klimaschutz (BMWK), https://www.bmwk.de/Redaktion/DE/Publikationen/Klimaschutz/leitmaerkte-fuer-klimafreundliche-grundstoffe.html, accessed on 04/12/2024

9 European Commission (2024) – What is the Innovation Fund? https://climate.ec.europa.eu/eu-action/eu-funding-climate-action/innovation-fund/what-innovation-fund_en, accessed on 04/12/2024

10 European Council (2024) – Horizon Europe, https://www.consilium.europa.eu/en/policies/horizon-europe/, accessed on 04/12/2024

11 Clean Air Task Force (2024) – Designing Carbon Contracts for Difference, https://www.catf.us/resource/designing-carbon-contracts-for-difference/, accessed on 27/11/2024

12 Congressional Research Service (2023) – The Section 45Q Tax Credit for Carbon Sequestration, https://sgp.fas.org/crs/misc/IF11455.pdf, accessed on 04/12/2024

Summary for the Chinese context

The **EU ETS serves as the lead instrument for incentivising emissions reductions within the European climate protection architecture**, with CCS already integrated into the system. However, the EU ETS alone does not sufficiently promote the adoption of CCU/S.

Start-Up Phase

Experience from Europe shows that **CO_2 pricing at levels below 100 EUR/ton is currently insufficient to drive investments** in CCS projects. While investment subsidies for first movers help overcome initial costs, these funds are often insufficient, especially when projects face unforeseen obstacles leading to cost increases (e.g., **Porthos, Hafslund Celsio**)[13,14].

Norway's approach could serve as a model of how to ensure the successful implementation of initial CCS projects. Norway guarantees state coverage of approximately **80 percent** of Capital (CAPEX) and Operational Expenditures (OPEX) for **10 years**. This has led to the successful implementation of the Brevik and Northern Lights projects, despite high initial costs.

Scale-Up

CCS has not yet entered the scale-up phase, as the initial projects are still in planning or nearing operation. Europe is currently preparing incentive systems for scaling up CCS, with several initial projects still in development or approaching operation. **Germany, the Netherlands and Denmark have adopted funding based on the concept of CCfDs**. These can be tailored to CCS or applied as a crosssectoral approach, as in **Germany**, which focuses on CCS for industries with otherwise unavoidable CO_2 emissions. The goal of the **German** approach is to concentrate subsidies on strategically important applications.

CCfDs can be financed from CO_2 pricing revenues. The introduction of **end-user surcharges** on products is recommended, as it can pass costs on to consumers, thereby **shifting demand to low-carbon products and solutions while also easing the burden on public budgets**. This is particularly relevant for companies primarily generating their value domestically, such as the cement and lime industries and thermal waste treatment plants—industries where CCS will be deployed in the long term.

Mature Phase

Europe has yet to fully transition from the start-up phase to a scale up for CCS. Concepts for the transition to a mature market are currently being developed. CO_2 pricing is expected to play a crucial role in that phase, accompanied by other instruments. In **Germany**, a **concept for green lead markets has been introduced** with the aim of ensuring demand for green products and enabling longterm green business models without prolonged reliance on subsidies. Implementation is challenging due to certifying and labelling of green products being complex. In **China**, procurement requirements, particularly for state-owned enterprises, could have significant leverage for green lead market development.

Regarding CCU, the **EU** has implemented quotas for non-fossil fuels produced via CCU (Renewable Fuels of Non-Biological Origin (RFNBOs)), increasing until **2050**. These quotas apply to shipping and aviation.

This overview outlines the framework for scaling up CCU/S in Europe. For China, strategies must consider local economic conditions and political priorities to ensure successful implementation in line with the country's climate goals. For example, state-owned enterprises could be first movers due to their strong capital base. Generally speaking, the development of CCU/S not only requires funding, but also a **strategic vision, political recognition and stable conditions for operating after construction**.

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13 Carbon Herold (2024) – Rising Costs Challenge Dutch CO_2 Capture Project Porthos, https://carbonherald.com/rising-costs-challenge-dutch-co2-capture-project-porthos/, accessed on 05/12/2024

14 Gassnova (2024) – Fall 2024/Status of CO_2 Management Report to the Ministry of Foreign Affairs from Gassnova SF (Norway), https://gassnova.no/app/uploads/2024/11/Fall-2024_Status-of-CO2-Management.pdf, accessed on 05/12/2024

Capital Expenditures (CAPEX) Funding[15]

To significantly reduce industrial emissions, Carbon Capture Utilisation and/or Storage (CCU/S) technologies are needed for hard-to-abate emissions (especially cement, lime & waste-to-energy). Overcoming the financing gap requires an appropriate market framework and incentive systems.

Overview

Mechanism of action • Government-provided grants tocompanies for their investments • Grant amount can be a percentage of the total investment or based on the cost difference between new facilities and conventional equipment	*Impacts on the state* • Additional burden for government budget • Taxes or other sources for covering the costs necessary (e.g., income from emissions trading)
Role in transformation • Overcoming investment barriers • Covering of first-of-a-kind costs for early projects • Support for research & development	*Risks* • Potential double funding in case of missing coordination with other funding programmes • Limited effectiveness in case of insufficient funding volume • Windfall profits if subsidies are not required

State funding to overcome first-of-a-kind costs

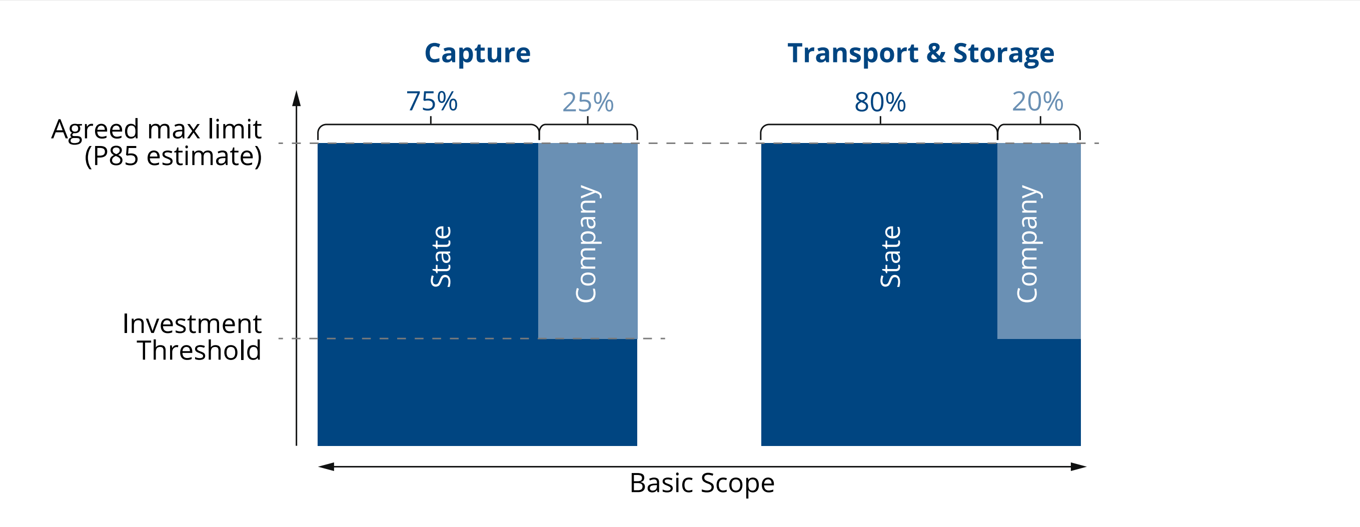

Figure 3: Overview of the functioning of the Norwegian CAPEX sharing mechanism. Source: Rosjorde & Carpenter

15 BDI (2021) – Klimapfade 2.0, https://bdi.eu/themenfelder/energie-und-klima/klimapfade, checked on 27/11/24
dena (2024) – Facilitating China's Industrial Transformation with CCU/S, https://www.dena.de/fileadmin/dena/Dokumente/Themen_und_Projekte/Energiesysteme/Entrans/240301_Report_CCS_final.pdf, checked on 28/11/24

CASE STUDY: FUNDING IN NORWAY[16]

In **Norway**, the government provides funding for the entire CO_2 process chain. For the **Northern Lights project**, the state covers **80 percent** of the capital expenditures (CAPEX) in the first phase of the project, ensuring the project's viability (see figure). The funding scheme has a similar sharing mechanism for the operational expenditures (OPEX). State support is granted for the first 10 years of operation. The **additional costs will be funded privately**. Following the first phase of funding, further funding should be exclusively private.

For the projects **Brevik** (cement) and **Hafslund** Celsio (waste-to-energy), the funding approach is very similar. For the three projects, the total CAPEX was calculated to be **1.860 million USD**, with OPEX of around **4 to 5 percent**. The goal of this funding approach is to **lower uncertainties** and **reduce high initial costs for first-of-a-kind projects** through government grants.

CASE STUDY: "BIK" IN GERMANY[17]

The new **German** funding programme **"Federal Funding for Industry and Climate Protection" (BIK)** supports Carbon Capture Utilisation and/or Storage (CCU/S) technologies. As of **2024**, CCU/S projects **targeting hard-to-avoid emissions**, such as those in the cement and lime industries and thermal waste treatment, are eligible for support.

The funding provides grants in the following ways:

- **Financial support for companies to implement CCU/S technologies:** Costs related to CO_2 transport (except for dedicated infrastructure) and storage are not eligible for funding. Funding per project amounts up to **25 million EUR** for dedicated infrastructure, and up to **30 million EUR** for other investment projects, with up to **30 percent** of eligible costs covered.
- **Financial support for research and development on innovative approaches:** Funding of up to **25 percent** for experimental development and up to **50 percent** for industrial research and feasibility studies. Up to **35 million EUR** per project.

It is uncertain to what extent the funding amounts are sufficient to support CCU/S projects. For smaller projects and research, the funding is considered adequate. However, for larger projects, additional support, e.g. through climate protection contracts (CCfD), will be necessary. An additional issue in Germany is that there are **no sufficient funding programmes available for thermal waste treatment**, as it is not eligible for support through climate protection contracts.

16 KEI (2024) – Leitfaden zum Förderprogramm "Dekarbonisierung in der Industrie", https://www.klimaschutz-industrie.de/foerderung/dekarbonisierung-in-der-industrie/, checked on 27/11
Rosjorde & Carpenter (n.y.) – The Norwegian full-scale CCS project, https://netl.doe.gov/sites/default/files/netl-file/20CCUS_Carpenter.pdf, checked on 27/11/24

17 see previous footnote

Carbon Contracts for Difference (CCfDs)[18]

Carbon Capture Utilisation and/or Storage (CCU/S) technologies are needed to avoid hard-to-abate industrial emissions (especially cement, lime & waste-to-energy). Overcoming the financing gap requires an appropriate market framework and incentive systems.

Overview

Mechanism of action	*Impacts on the state*
• Subsidy covering the difference between the CO_2 price and the cost of CO_2 abatement • Contract duration of 10 years or more • Can apply to the final product or the energy carrier	• Greater effort compared to traditionalfunding through the design of individualised funding contracts • Regular monitoring of the projects must be conducted, and the funding amounts must be continuously adjusted
Role in transformation • Overcoming investment barriers by providing business case for early adapters • Increasing planning certainty to scale up after demonstration project • Enable transition to green lead markets	*Risks* • Potential market distortion due to privileging individual projects • Risk of overfunding due to non-transparent cost structures

CCfDs bridge the gap

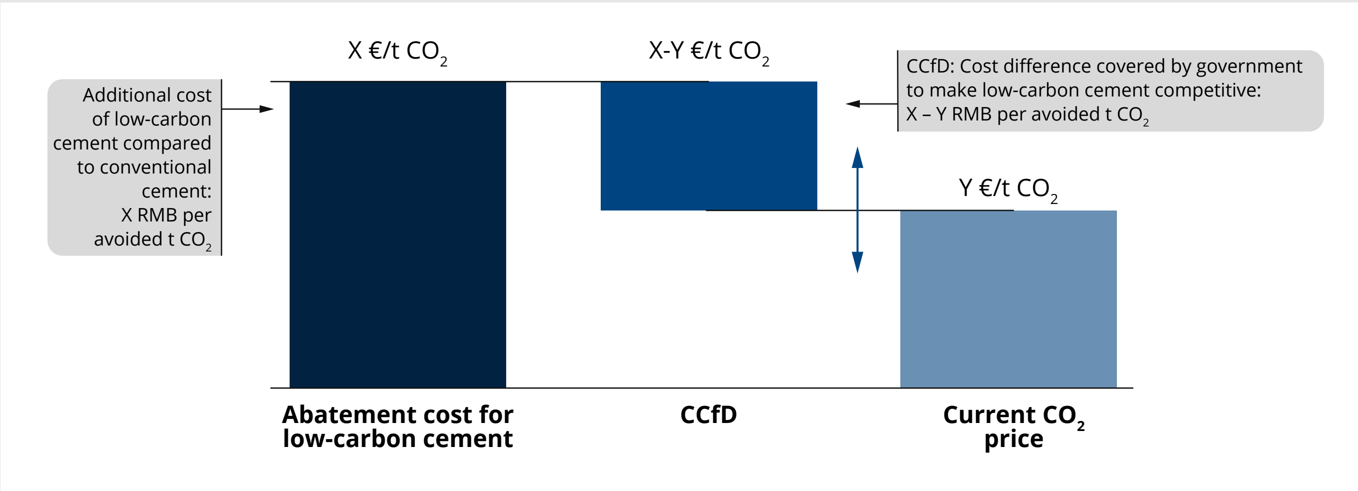

Figure 4: Overview of the functioning of carbon contracts for difference. Source: dena

18 BDI (2021) – Klimapfade 2.0, https://bdi.eu/themenfelder/energie-und-klima/klimapfade, checked on 27/11/24
BMWK (2024) – Richtlinie zur Förderung von klimaneutralen Produktionsverfahren in der Industrie durch Klimaschutzverträge
dena (2024) – Facilitating China's Industrial Transformation with CCU/S, https://www.dena.de/fileadmin/dena/Dokumente/Themen_und_Projekte/Energiesysteme/Entrans/240301_Report_CCS_final.pdf, checked on 28/11/24

CASE STUDY: "CLIMATE PROTECTION CONTRACTS" IN GERMANY[19]

In **2023**, the **German government** introduced climate protection contracts ("Klimaschutzverträge"), a form of CCfDs. These allow emission-intensive industries that are subject to the European Emissions Trading System **(EU ETS)** to participate in an auction system. In this system, they can submit a bid indicating the level of government support (strike price) they require per ton of CO_2 avoided. If the strike price is **higher than the CO_2 price, the government subsidises the company by covering the difference**. If the CO_2 price exceeds the strike price, the company pays back its additional revenues to the government. The contract price will be adjusted annually according to energy price developments.

In principle, all technologies that can reduce emissions are eligible for funding. **CCU/S is only eligible for facilities with "otherwise unavoidable process emissions".** Climate protection contracts are to be concluded for **15 years** with those bidders who have indicated the lowest funding requirement per ton of CO_2 avoided. In the **first funding round**, projects from **15 companies** were supported with a total amount of approximately **2.8 billion EUR**.

The projects must meet the following minimum requirements:

- Starting from **the third full year** of the climate protection contract's duration, the relative greenhouse gas (GHG) emission reduction compared to the reference system must be **at least 60 percent**.
- A relative GHG emission reduction of at least **90 percent** compared to the reference system must be technically achievable within the contract's duration and achieved in the **last 12 months** of the contract period.

CASE STUDY: FUNDING IN DENMARK[20]

In **2023**, the European Commission approved a CCS support programme in **Denmark** with a carbon contract for difference design. Funding is provided through **a tender, open to facilities in all industrial sectors, including energy and waste**. Due to limited funding, the programme benefits only one recipient or a consortium of recipients who win the tender.

The **winning bidder is responsible for the entire CCS value chain**, i.e. capture, transport and permanent storage of CO_2. This includes agreements with relevant subcontractors such as transport companies and storage operators. The **20-year** contract covers the capture, transport and storage of **at least 0.4 million tons of CO_2 per year** starting in **2026**.

In the **Danish model**, the **contract covers the difference between the estimated total costs of capturing and storing a ton of CO_2** over the contract duration and the bidder's expected revenues or savings from capture and storage. This includes potential savings or revenues from unused EU ETS allowances. The grant amount per ton of CO_2, intended to cover this difference, is based on the winning bid's offered value and is adjusted annually for inflation, the actual EU ETS allowance price, and savings from avoided CO_2-related taxes.

19 Clean Air Task Force (2024) – Designing Carbon Contracts for Difference, https://www.catf.us/resource/designing-carbon-contracts-for-difference/, checked on 27/11/2024

20 see previous footnote

Emissions Cap and Trade System[21]

To significantly reduce industrial emissions, Carbon Capture Utilisation and/or Storage (CCU/S) technologies are needed for hard-to-abate emissions (cement, lime & waste-to-energy). Overcoming the financing gap requires an appropriate market framework and incentive systems.

Overview

Mechanism of action • Distribution of a limited number of tradable emission allowances by the government either via auctions or free of charge • Rising prices of allowances due to decreasing cap on emissions, incentivising emission reduction	*Impacts on the state* • Revenue for the state selling emission allowances via auctions; these revenues can be earmarked for specific purposes (e.g., project funding). • Height of emissions cap is decided by the government
Role in transformation • Technology-agnostic incentive for emission reduction • Uncertainty about future prices could require additional instruments • Phase-out of new allowances supports pathway to net-zero	*Risks* • A cap that is too high for effective emission reduction • Insufficient political commitment to cap • Carbon leakage in case of lower carbon pricing in other countries

Emission trading as a leading instrument for transformation

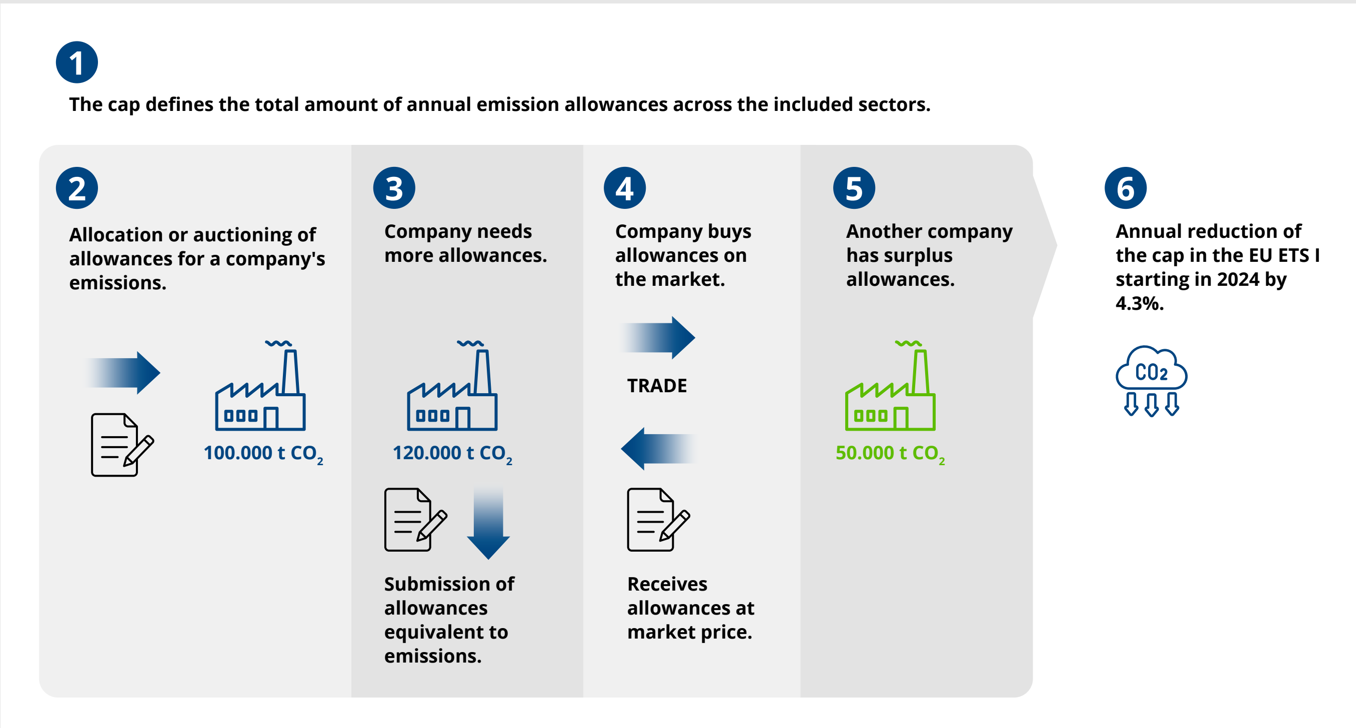

Figure 5: Overview of the functioning of the European Emissions Trading System. Source: DEHSt (2024)

21 dena (2024) - Facilitating China's Industrial Transformation with CCU/S, https://www.dena.de/fileadmin/dena/Dokumente/Themen_und_Projekte/Energiesysteme/Entrans/240301_Report_CCS_final.pdf, checked on 28/11/24
DEHSt (2024) – Informationen zum EU ETS I, https://www.dehst.de/DE/Themen/EU-ETS-1/EU-ETS-1-Informationen/eu-ets-1-informationen_node.html, checked on 27/11/24

CASE STUDY: EU ETS & CBAM[22]

The **European Emissions Trading System (EU ETS) is the leading instrument to achieve emission reduction in the EU and operates on a "cap and trade" principle**. The overall cap on emissions is gradually reduced, with the goal of phasing out the issuance of allowances entirely, thereby achieving climate neutrality in the covered sectors before **2050**.

To prevent "carbon leakage" – where companies move production to countries with lower or no carbon pricing – certain industries currently receive a portion of their allowances for free (free allocation). Currently, facilities receive **free allowances up to the emissions level of the top 10 percent of most efficient installations** in their sector.

Starting in 2026, the EU is introducing the **Carbon Border Adjustment Mechanism (CBAM)** for specific sectors (such as steel, aluminium and fertilisers) to **ensure importers pay the same carbon costs as if their goods were produced in the EU**. As CBAM is implemented, free allowances will gradually be phased out, with complete removal by **2034**.

Carbon Capture and Storage (CCS) is included in the EU ETS, meaning that no allowances need to be surrendered for CO_2 captured and permanently stored. If the **CO_2 price exceeds the cost of implementing CCS, it creates a direct financial incentive to invest in CCS technologies**. Thus, the EU ETS leverages market signals to promote private-sector investment in emissions reduction without requiring direct government subsidies or additional public spending.

22 Clean Air Task Force (2024) – Designing Carbon Contracts for Difference, https://www.catf.us/resource/designing-carbon-contracts-for-difference/, checked on 27/11/2024

End-user surcharges[23]

To significantly reduce industrial emissions, Carbon Capture Utilisation and/or Storage (CCU/S) technologies are needed for hard-to-abate emissions (cement, lime & waste-to-energy). Overcoming the financing gap requires an appropriate market framework and incentive systems.

Overview

Mechanism of action • Costs for emission reduction measures (e.g., CCU/S) in the basic materials industry are passed on to the end consumer through regulations or charges	*Impacts on the state* • Reduced need for direct subsidies or government-led decarbonisation funding • Review the instrument in terms of state aid law and introduce corresponding regulations for its implementation
Role in transformation • Market-driven incentives provided for decarbonisation by embedding carbon costs into market prices • Can be combined with Carbon Contracts for Difference (CCfDs), the Emissions Trading System (ETS) and green lead markets	*Risks* • The implementation likely faces legal and practical hurdles • Requires robust monitoring to ensure compliance and accuracy of data • Leads to increased costs for consumers, potentially leading to political opposition

Mobilise the potential of lower abatement costs at the end product

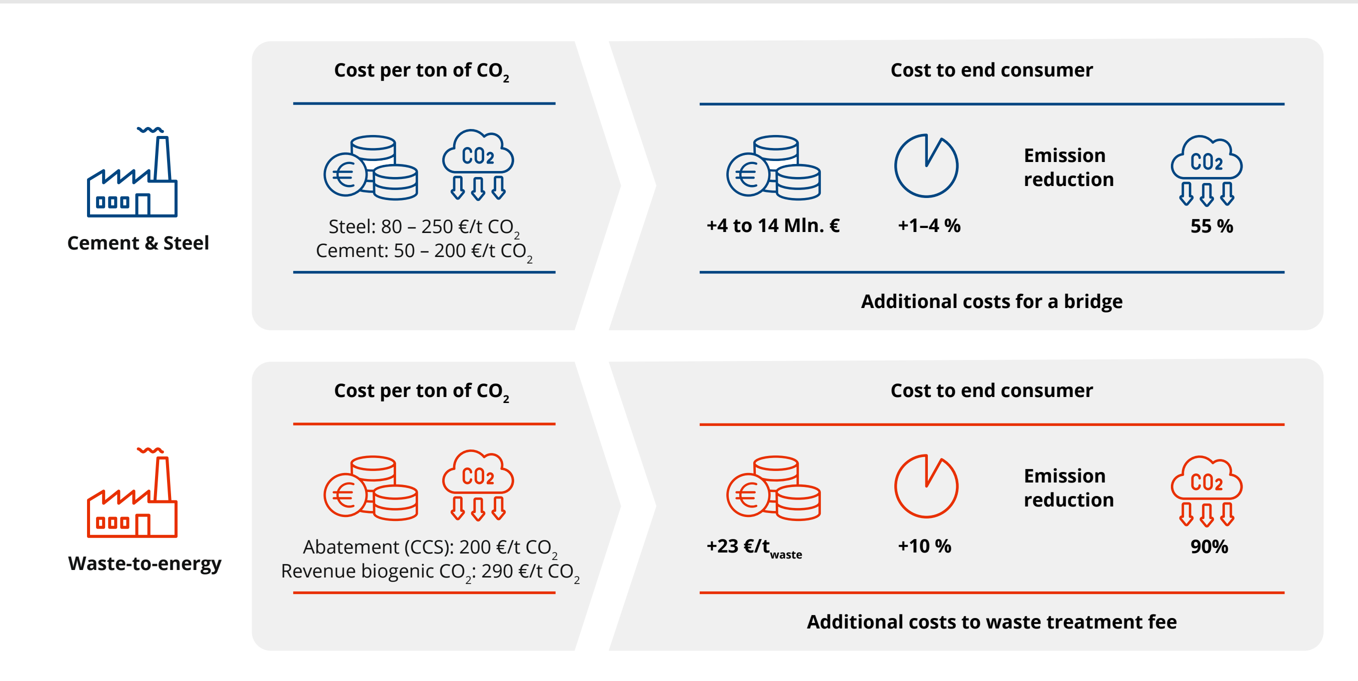

Figure 6: Comparison of the costs for the basic materials industry with the cost share of the end product, based on Roussanaly et al. (2024). Source: Roussanaly et al. (2024)

23 Roussanaly, Simon; Gundersen, Truls; Ramirez, Andrea (2024) – Putting the costs and benefits of Carbon Capture and Storage into perspective: Amulti-sector to multi-product analysis
Rootzén, Johan ; Johnsson, Filip (2016) - "Managing the costs of CO_2 abatement in the cement industry". Climate Policy pp. Page 1-20.

CASE STUDY: WASTE-TO-ENERGY SECTOR IN SWITZERLAND[24]

End-user surcharges are being discussed for the waste-to-energy sector in Switzerland for the **financing of Carbon Capture and Storage (CCS) at waste incineration facilities**. The costs for CCS would be passed on to the waste disposal fee (waste bag fee).

In the current discussion, the association of operators of waste incineration facilities would select which plants are to be retrofitted with CCS, and these would be upgraded one by one. The **costs for CCS would then be distributed nationally through the waste disposal fee**. So far, this is only a discussion.

CASE STUDY: OTHER AREAS OF APPLICATION[25]

The implementation for thermal waste treatment plants has the advantage that there is no real international competition, and thus no risk of shifting operations abroad (carbon leakage). In other industries, such as **cement, steel or chemicals, a more detailed assessment would be necessary, as there is an international market**. There are different approaches feasible to implement an end-user surcharge as a state. A possible approach is outlined below, but it still requires further review, including compliance with state aid laws.

Similar to the Carbon Contracts for Difference (CCfD) model, **companies could be compensated for the difference between the ETS price and their actual costs**. However, the funds would not be provided by the state but rather through a surcharge on the respective end products.

This surcharge could be issued via a tax, with the amount based on the cost differential between the ETS price and actual costs. To create an **effective incentive, it is essential that consumers are compensated**, for example, through a climate dividend or other mechanisms. A key challenge lies in determining which products will be subject to the surcharge and how this can be implemented with minimal bureaucracy.

24 Rootzén, Johan ; Johnsson, Filip (2016) “Paying the full price of steel – Perspectives on the cost of reducing carbon dioxide emissions from the steel industry”. Energy Policy, vol. 98 pp. 459â469

25 see previous footnote

Green lead markets[26]

To significantly reduce industrial emissions, Carbon Capture Utilisation and/or Storage (CCU/S) technologies are needed for hard-to-abate emissions (cement, lime & waste-to-energy). Overcoming the financing gap requires an appropriate market framework and incentive systems.

Overview

Mechanism of action Green markets establish demand for low-emission products by: • mandating specific emissions standards in production or procurement or • committing public procurement to follow certain sustainability standards	*Impacts on the state* • May moderately increase the cost of public procurement • Necessity for certification process for green products and raw materials • Complexity of implementation depends on the existing regulations for the end products
Role in transformation • Increased investment security for producers by ensuring stable, predictable demand • Reduced need for subsidies over time as the market becomes self-sustaining	*Risks* • Not enough green materials to meet quotas during the ramp-up; shortages could occur • Greenwashing or carbon leakage if imported materials are poorly certified or not transparent

Green lead markets as a bridge to self-sustaining markets

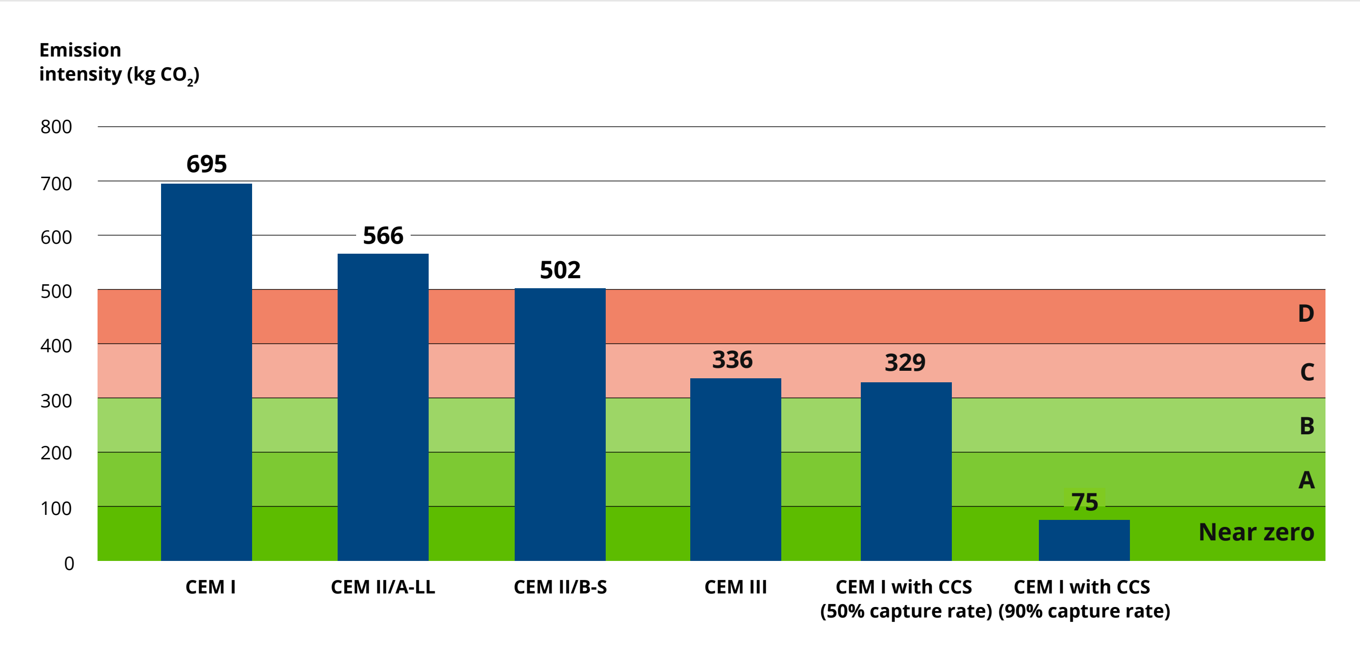

Figure 7: Proposed emission threshold values compared to current and future cement types, as well as technologies, from the background paper on the green lead market concept for Germany. Source: Guidehouse, Fraunhofer ISI, Wuppertal Institut (2024)

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26 BDI (2021) – Klimapfade 2.0, https://bdi.eu/themenfelder/energie-und-klima/klimapfade, checked on 27/11/24
BMWK (2024) – Leitmärkte für klimafreundliche Grundstoffe Konzept des Bundesministerium für Wirtschaft und Klimaschutz (BMWK), https://www.bmwk.de/Redaktion/EN/Publikationen/Klimaschutz/lead-markets-for-climate-friendly-basic-materials.html, checked on 04/12/2024

CASE STUDY: GERMAN CONCEPT OF GREEN LEAD MARKETS[27]

In **May 2024**, the Federal Ministry for Economic Affairs and Climate Action (BMWK) in **Germany** presented a concept titled **"Lead markets for climate-friendly basic materials"** (commonly referred to as "Green lead markets"). This initiative aims to **stimulate demand for climate-friendly basic materials**, such as steel, cement and chemicals, thereby encouraging investments in new industrial technologies and processes.

Currently, it is challenging for companies and consumers to determine the carbon footprint of goods along their entire value chain. To address this, **the initiative developed definitions and benchmarks in collaboration with stakeholders to establish an official government label** in accordance with DIN EN ISO 14024 standards.

These definitions **set sector-specific thresholds for emission intensity as benchmarks, including** the entire production process (cradle-to-gate). They account for direct emissions (Scope 1) as well as indirect emissions (Scope 2 and some Scope 3 emissions).

Steel – In **April 2024**, the **German Steel Federation** (WV Stahl) introduced the "Low Emission Steel Standard" (LESS) for low-emission steel. This voluntary system that all steel producers can join includes **rules for calculating and certifying emissions from hot-rolled steel**. Accounting is carried out using a mass-balance system. This approach accounts for the partial transformation of a site while avoiding double counting. Certification under the LESS framework is conducted by independent bodies such as TÜV Nord or DNV.

Cement – The potential definition of climate-friendly cement in the **German** concept for green lead markets was improved based on the **International Energy Agency's (IEA)** proposal, relying on widely accepted environmental product declarations. The framework covers emissions from energy use and production processes in making cement and its components. The **emission thresholds differentiate between five low-emission categories**, with each category separated by increments of **100 kg CO_2e per ton** (see graphic above). Cement is considered "near zero" at lower than **100 kg CO_2e per ton** and "low-emission" up to **500 kg CO_2e per ton**, with low-emission cement further classified into categories from A to D.

Chemicals – The **German** concept for green lead markets proposes emission thresholds for **climate-friendly basic chemical materials, focusing on ammonia and ethylene,** which are critical for new production methods as well as using low-emission raw materials and energy sources. For the potential classification of climate-friendly ethylene, six emission thresholds, each in increments of **700 kg CO_2e per ton**, are proposed. Ethylene is considered "near zero" up to **700 kg CO_2e per ton** and "low-emission" up to **4200 kg CO_2e per ton**, with low-emission ethylene further divided into categories from A to E.

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27 Guidehouse, Fraunhofer ISI, Wuppertal Institut (2024) – Leitmärkte für klimafreundliche Grundstoffe Wissenschaftliches Begleitdokument im Auftrag des Bundesministeriums für Wirtschaft und Klimaschutz, https://publica.fraunhofer.de/entities/publication/40e0c267-2dc1-4a54-9076-0c2136166d1a, checked on 28/11/24

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