Achieving Systemic Bankability of Carbon Capture and Storage in Poland

A Guide to Commercial Development Using the Systemic Bankability Framework

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August 2026

CLEAN AIR TASK FORCE

Acknowledgment

The legal and policy framework analysed in this paper reflects the state of law and publicly available policy documents as of 11th June 2026. Based on the framework presented in Greig et al. (2025), Systemic Bankability is the Key to Unlocking Energy Transition Speed and Scale.

Executive Summary

Poland's industrial sector generated roughly 60 million tonnes of CO_2 in 2024, representing nearly 20% of the country's total CO_2 emissions, and a significant share of those emissions cannot be eliminated through electrification alone. Carbon capture and storage (CCS) technologies present one of many vital opportunities to address these hard-to-abate emissions and advance competitive industrial decarbonisation in Poland. Yet the country has not deployed a single large-scale CCS facility. This report aims to understand why that is, and what it will take to change it.

Drawing on the systemic bankability framework developed by Clean Air Task Force and Princeton's Andlinger Center for Energy and the Environment, this report applies nine conditions for commercial-scale technology deployment to Poland's CCS sector. Systemic Bankability exists when technology costs have fallen, project risks are manageable, financing is available on commercial terms, and enough projects have been built that private capital can flow repeatedly and at scale. Assessed against these conditions, Polish CCS remains firmly pre-commercial, but closing the gap to systemic bankability is not primarily a technical challenge.

High-Level Overview of Poland's CCS Potential and Current Conditions

Poland has significant potential for CCS deployment due to the structure of its industrial emissions and the availability of geological formations suitable for permanent CO_2 storage. The strongest case for CCS concerns hard-to-abate sectors, including cement, chemicals, refining and other energy-intensive industries, where direct electrification or fuel switching may be technically difficult or economically demanding.

Poland also has relevant geological conditions, including onshore sedimentary basins and potential offshore storage options in the Baltic Sea, although their practical use will require further research and investment in transport infrastructure. At the same time, the institutional capacity remains in its early stages. Policy and legislative work are progressing under the planned national CCS strategy and the CCS Special Act. Poland has not yet created an integrated support system for CCS project developers.

Key Barriers to Systemic Bankability

The analysis indicates that CCS deployment in Poland is constrained by the incomplete development of the conditions required for commercially financeable projects. Industrial demand for CCS is becoming clearer, especially in sectors where process emissions cannot be addressed through electrification alone, and Poland has relevant geological potential. However, these factors do not yet translate into a mature systemic bankability system. The main barriers arise from the interaction between regulatory uncertainty, insufficient revenue visibility and the absence of enabling infrastructure. There should be clarity on CO_2 transport arrangements, permitting timelines, access rules and the allocation of long-term liabilities. Simultaneously, Poland has not yet established a dedicated support scheme to bridge the gap between project costs and expected market revenues. As a result, early projects face risks arising from the lack of an enabling framework. Moving to commercial deployment will require coordinated action across law, infrastructure planning, public funding and administrative capacity.

The report proposes a phased roadmap:

Phase 1: 2026–2027

Poland should create an enabling framework, anchored in an adopted national CCS Strategy and supported by a completed legal basis for CO_2 infrastructure and public administration capacity. During this phase, Polish government and relevant authorities should align permitting practices with NZIA requirements, establish a specialised digital one-stop shop for investors, and prepare the legal basis for CCfD-based revenue support. Its purpose is to provide early CCS projects with a credible route from feasibility and FEED to the final investment decision. The framework developed during this phase should provide project developers with certainty regarding permitting, revenues, and access to CO_2 infrastructure.

Phase 2: 2027–2030

Public policy should focus on the first integrated CCS value chains in hard-to-abate sectors. The state should coordinate capture projects with an emerging CO_2 infrastructure, launch the first CCfD support schemes for CCS projects, and build social acceptance through transparent information and dialogue. By 2030, Poland should have created the regulatory, infrastructure, and investment conditions needed for obligated oil and gas producers to deliver the required annual CO_2 injection capacity under the NZIA.

Phase 3: 2030+

Once initial CCS value chains are operational, public intervention should gradually shift from project-specific de-risking to infrastructure expansion, stable access rules, and long-term market governance. CCS should become available to a broader group of industrial users through an already tested enabling framework. At this stage, the key policy task will be to reduce reliance on exceptional support for individual projects. Success would mean that CCS can operate as part of Poland's industrial decarbonisation pathway through repeated and scalable deployment.

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SECTION 1

Introduction

To achieve climate and energy goals, Poland will require more than the scaling of technologies that are already mature and widely financeable. Hard-to-abate sectors, including cement, lime, steel and chemicals manufacturing, cannot be decarbonised at the required pace through renewable electrification alone. This is because a substantial share of their emissions is inherent to key aspects of their production processes (e.g., chemical reactions or process heat) rather than to energy use, making them difficult to deliver reliably and cost-effectively through current electrification using renewable energy sources. For example, steam cracking in the chemical industry typically operates at 800–900°C, whereas cement clinker production requires approximately 1,450°C.

Solutions for these emissions exist, but their deployment continues to face structural barriers that slow or prevent their development. This is especially clear when early deployment relies on costly infrastructure, lengthy development periods, and complex collaboration between multiple parties. To overcome this deployment gap, substantial capital will be required. Mario Draghi's report estimates that fulfilling the EU's key competitiveness and climate targets is possible. It will require a minimum additional €750–800 billion in annual investment, while the European Commission estimates that the clean energy transition alone will need around €660 billion per year in the EU through 2030.[1]

While public funding remains important, most investment in industrial decarbonisation will need to come from private entities. Yet many existing policy instruments remain only partially aligned with how markets assess and price early-stage risk, creating persistent financing shortfalls for high-risk clean technology and decarbonisation projects. Interest in public-private partnerships is therefore growing because such consortia can combine public objectives with private capabilities; however, their effectiveness is often limited when stakeholders lack a shared, standardised way to define the conditions that must be in place for projects to be consistently financeable. This paper responds to that challenge by introducing a systemic bankability framework for Polish decision-makers and investors, offering a practical method to identify and close the gaps that hinder the commercialisation of clean technologies.

What is Systemic Bankability?

Systemic bankability refers to the stage at which technology costs have declined, risks are sufficiently low, financing is available on commercial terms, and enough commercial-scale plants have been built for technologies to enable widespread deployment. The following nine conditions define the systemic circumstances under which each technology can mature and attract private investment. When these conditions are fulfilled, project financing capacity is typically available, and project-specific investment risk is limited to judgments about project configuration, the quality of feasibility studies, and the track record of the proponent.[2]

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1 Draghi, M. (2024). *The future of European competitiveness. Part A: A competitiveness strategy for Europe.* European Commission. https://commission.europa.eu/document/download/97e481fd-2dc3-412d-be4c-f152a8232961_en
European Commission. (2026). *Commission launches strategy to accelerate clean energy investment.* Directorate-General for Energy. https://energy.ec.europa.eu/news/commission-launches-strategy-accelerate-clean-energy-investment-2026-03-10_en

2 Greig, C., Spokas, K., Waltzer, K., Ulama, D., & Hobart, S. (2025). Systemic bankability is the key to unlocking energy transition speed and scale. SSRN. https://doi.org/10.2139/ssrn.5149329. For descriptions of all nine conditions, see Greig et al. (2025), Systemic Bankability Is the Key to Unlocking Energy Transition Speed and Scale.

Box 1: Why Systemic Bankability is Important to Consider

Bankability is a set of conditions that enable a project to receive low-cost capital (specifically project debt).

Systemic bankability refers to having bankability conditions that are pervasive such that low-cost capital (specifically project debt) can flow repeatedly and at scale across a whole technology or sector.

Systemic bankability is based upon the concept of project bankability, which refers to the high level of confidence that investors and banks have in a project's ability to deliver predictable returns, across a large set of projects for a technology or industry. When this confidence is sufficient, projects gain access to a mix of low-cost equity and non- or limited-recourse commercial project debt.

Table 1: Project Bankability vs Systemic Bankability

Aspect	Project Bankability	Systemic Bankability
Definition	Bankability reflects access to low-cost non- or limited-recourse project debt from institutional lenders such as commercial banks and governmental funding agencies.	Systemic bankability exists when the conditions for project bankability are pervasive and enable widescale deployment.
Key Conditions	• low technology performance risk, • low risk of construction cost overruns, • negligible revenue risks (volume and price), • regulatory certainty, • access to enabling infrastructure networks, • widespread social acceptance, • robust supply chains, • adequate delivery capacity (e.g. public administration support), • access to commercial insurance.	Project bankability conditions exist across a large number of projects for a technology or industry.
Investment Risk	Limited to project-specific factors, such as project configuration, feasibility-study quality and sponsor track record.	
Outcome / Purpose	Enables individual projects to secure financing under predictable, low-risk conditions.	Necessary to unlock speed and scale for mid-century net-zero transition.

Research by Clean Air Task Force and Princeton's Andlinger Center for Energy and the Environment indicates the systemic bankability framework enables investors, technology developers, researchers, and policymakers to identify and prioritise risks affecting the viability and business value of early-mover projects for early-stage investors. The framework assists in planning and organising efforts for clean technologies' deployment by providing an assessment of systemic conditions needed to overcome critical barriers to commercialisation.

Conditions Needed for Systemic Bankability

1. **Access to commercial insurance:** Projects are able to secure commercial insurance that covers key construction, operational, performance, and liability risks on terms aligned with project finance requirements.
2. **Low construction cost overrun risk:** The likelihood of significant increases in construction costs after the final investment decision is low and can be mitigated through effective project design, contracting structures, contingencies, and delivery experience.
3. **Low technology performance risk:** The technology and integrated project value chain are anticipated to perform according to assumptions established at the final investment decision, with minimal risk of underperformance or substantially increased operating costs.
4. **Revenue adequacy:** Projects demonstrate a credible and predictable revenue stream sufficient to cover operating costs and required returns throughout the project lifetime.
5. **Regulatory certainty:** The legal framework creates stable and transparent conditions for investment, permitting and construction, while also encompassing policy instruments that influence financial performance.
6. **Access to enabling infrastructure networks:** Projects have access to the necessary infrastructure for construction and operation, including, where applicable, CO_2 transport networks, storage sites, port terminals, electricity networks, fuel supply infrastructure, and related technical systems.
7. **Social acceptance:** Projects achieve adequate local and broader public acceptance to proceed without significant delays, litigation risk, or political opposition that could undermine investment confidence.
8. **Robust supply chains:** The equipment, materials, services, and specialised contractors necessary for project construction and operation are available.
9. **Adequate delivery system:** The market and public sectors possess the practical capacity to deliver projects, including skilled labour, engineering and construction capabilities, administrative expertise, financial processing capacity, and experienced operators.

SECTION 2

Overview of Carbon Capture and Storage Development in Poland

CCS is a proven technology with a clear role in Poland's industrial decarbonisation, and EU policy is creating the conditions for a new phase of deployment

Carbon capture and storage (CCS) is an umbrella term for a diverse range of techniques for capturing and permanently storing carbon dioxide (CO_2) emissions to prevent them from reaching the atmosphere. Certain types of CCS have already reached commercial status in applications worldwide.[3] CCS is vital to advancing clean industry in the EU by tackling process emissions in hard-to-abate sectors. In Poland, CCS presents an opportunity as a cost-competitive decarbonisation option for selected industrial processes, which currently emit 40.6 $MtCO_2$ /year.[4] Reflecting this potential, Poland's updated NECP adopted by the Council of Ministers in June 2026 outlines a clear role for CCS in the country's industrial decarbonisation, especially in the cement and lime sectors, with possible applications in the electricity system.[5]

While Poland's updated NECP signals renewed ambition for CCS, interest in the technology is not new to the country. Interest in CCS deployment in Poland has alternated between periods of increased interest and stagnation, following the country's political election cycles. Preparatory and feasibility work were carried out in previous decades, including analyses of CO_2 injection into geological structures in central Poland, linked to the Bełchatów Power Plant and Łaziska Power Plant and in Silesia. None of these projects ultimately progressed to implementation due to a low carbon price, lack of funding and administrative complexities. However, this earlier work still created a relevant base of geological, technical and permitting knowledge, which can help reduce some early-stage uncertainty for new CCS projects in Poland. These first initiatives raised expectations for the development of CCS in Poland. Their discontinuation, however, left a lasting gap in progress and contributed to scepticism regarding the feasibility of large-scale deployment of this technology in Poland.

As a result, CCS projects remain at a pre-commercial stage in Poland, with little progress on the deployment of CO_2 infrastructure. However, in the light of the Net Zero Industry Act CO_2 injection capacity obligation, new opportunities for state funding and cross-border cooperation now provide deployment pathways that were not available during earlier phases of CCS development in Poland. Furthermore, the rising carbon price under the EU Emissions Trading System (EU ETS), has further improved the business case for CCS, especially in sectors where process emissions cannot be eliminated through electrification alone. As a result, several research projects and civil society initiatives, such as the CCUS Poland Association or CCUS.pl, are helping to create practical deployment capacity by

[3] Lockwood, T. (2024). *Carbon capture and storage: What can we learn from the project track record?* Clean Air Task Force. https://www.catf.us/resource/carbon-capture-storage-what-can-learn-from-project-track-record/

[4] Clean Air Task Force. (2024, April 26). *Carbon capture & storage in Poland: Harnessing Poland's potential for carbon capture and storage* [Fact sheet]. https://cdn.catf.us/wp-content/uploads/2024/04/26092017/ccs-poland-fact-sheet.pdf

[5] Ministerstwo Energii. (2026). *Krajowy Plan w dziedzinie Energii i Klimatu przyjęty przez Radę Ministrów. Dokument opracowało Ministerstwo Energii.* Gov.pl. https://www.gov.pl/web/energia/krajowy-plan-w-dziedzinie-energii-i-klimatu-przyjety-przez-rade-ministrow-dokument-opracowalo-ministerstwo-energii

developing technical and regulatory knowledge, bringing together emitters, infrastructure developers, and research institutions, and supporting the preparation of projects eligible for national or EU funding. Their material contribution lies in reducing early coordination gaps in the Polish CCS value chain and in creating a more structured basis for moving from feasibility analysis to investment-ready projects.

Realising the potential of CCS in Poland will require closing significant regulatory and infrastructure gaps

Deploying CCS, as with any large-scale emissions mitigation technology, involves imposing a significant financial burden both in terms of capital expenditure (CAPEX) and operating expenses (OPEX).[6] At the same time, its relatively early stage of deployment in Poland creates uncertainty regarding long-term performance and operating expenses. Key constraints to CCS deployment in Poland are primarily regulatory and financial in nature:

- Lengthy permitting process which does not reflect the Net Zero Industry Act (NZIA) requirements
- Financial support schemes have not been established yet
- The government has not adopted national CCS strategy that sets goals for the sector's development from the 2030s to 2050
- Incomplete designation of prospective onshore storage areas under the applicable legislation, with several regions excluded
- Fragmented legal framework for CO_2 infrastructure

The identified constraints contribute to the so-called "CCS paradox": companies are hesitant to invest in carbon capture facilities without clarity regarding storage areas and the transportation pathways for captured emissions.[7] This means that investment in CCS infrastructure is unlikely to proceed without a clear indication of demand from industries prepared to capture their emissions.

Recent EU legislation, such as the Industrial Carbon Management Strategy and the NZIA storage obligation, has improved regulatory clarity for Polish investors, even though the national regulatory framework is not yet entirely ready to support CCS. Under the NZIA's Article 23, Orlen S.A. has been assigned an obligation to develop a storage capacity of 4.1 $MtCO_2$/year.[8] However, ORLEN's 2035 strategy refers to approximately 4.0 $MtCO_2$/year of offshore/onshore storage capacity by 2035, alongside around 1.1 $MtCO_2$/year of capture potential from ORLEN production units and around 2.8 $MtCO_2$/year of ECO_2CEE terminal export capacity. This target falls slightly short of the company's NZIA obligation, and is set five years after the 2030 deadline.[9]

While Orlen S.A. is the main obligated actor for storage development in Poland, meeting the NZIA target will depend on whether the government can establish a national regulatory and infrastructure environment that effectively supports the take-off of CCS projects.[10] In the face of these obligations, early implementation of CCS projects and achieving final investment decisions (FID) in this decade is essential for Poland's competitiveness and industry transition.

Poland's CO_2 storage potential is substantial, and cement is the sector where CCS is needed most

With an estimated CO_2 storage potential of more than 15 Gigatons (Gt), Poland has the potential to store an equivalent of approximately 369 years of current industrial point-source emissions. This figure is likely conservative, since emissions are expected to decline as other decarbonisation options are deployed alongside CCS.[11]

6 Clean Air Task Force. (2025). Funding carbon capture and storage in Central and Eastern Europe: Strategies for cost-effective deployment. https://cdn.catf.us/wp-content/uploads/2025/09/15050506/CATF-Funding-CCS-in-CEE.pdf dostęp: 18.06.2026 r.

7 Bellona Europa, *What's Blocking the CO_2 Market? Unpacking Potential Market Failures*, 7 August 2025, https://eu.bellona.org/2025/08/07/whats-blocking-the-co%e2%82%82-market-unpacking-potential-market-failures/

8 Commission Decision (EU) 2025/1479, *OJ L 2025/1479*, 25.7.2025. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202501479

9 ORLEN S.A. (2024). *ORLEN Group strategy 2035.* https://www.orlen.pl/content/dam/internet/orlen/pl/en/about-company/strategy-2035/documents/ORLEN%20Group%20Strategy%202035.pdf

10 Given that the NZIA was finalised in the first half of 2024 and compliance will be assessed at the end of 2030, obligated companies were given more than six and a half years to deliver. The NZIA obligation is a new kind of policy driver for CCS projects in the EU and should be seen as no less an incentive to act than the subsidies on which projects have previously relied. Learn more here: Clean Air Task Force. (2026). *EU CO_2 storage by 2030: Why the NZIA target is more feasible than industry claims.* https://www.catf.us/2026/06/eu-co2-storage-2030-why-nzia-target-more-feasible-industry-claims/

11 Carbon Gap estimates Poland's theoretical geological CO_2 storage potential at approximately 209 Gt. However, a more conservative estimate of around 15 Gt is adopted here, reflecting realistic storage capacity. The Polish Geological Institute's national programme serves as the primary source and reports a range of 10–15 Gt (https://skladowanie.pgi.gov.pl/twiki/pub/CO2/WebHome/Krajowy_Program.pdf). Additional information is available from Carbon Gap (https://tracker.carbongap.org/regional-analysis/national/poland/) and CATF (https://cdn.catf.us/wp-content/uploads/2024/04/26092017/ccs-poland-fact-sheet.pdf).

More than half of Poland's industrial emissions are located in the South of the country. The region also accounts for 88% of Poland's cement and lime sector emissions, for which access to CO_2 storage is a prerequisite for complete decarbonisation.[12]

Designated onshore and offshore areas for Poland's first storage sites are identified through a government regulation. Although neither a full-scale underground CO_2 storage site nor capture facility has been realised in Poland to date, several domestic industrial players have expressed interest in pursuing CCS development, including pilot and commercial-scale projects.

The NECP indicates that CCS is most likely to be applied in the cement sector. Cement plants are key employers, taxpayers, and active contributors to local communities in Poland. Taking the supply chain into account, the sector supports over 24,000 jobs and contributes more than PLN 3 billion annually to the Polish state budget in various taxes.[13] Despite the strategic importance of the cement industry for Poland's economy and security, its competitiveness is being undermined, among other factors, by steadily increasing imports, particularly from outside the EU, where producers are not exposed to the EU ETS price. While cement production represents about 3.8% of Poland's total CO_2 emissions, its future will depend on the ability to cut CO_2 emissions, especially as free emission allowances are systematically reduced and phased out by 2034.[14]

In cement production, CCS is particularly important because emissions are not solely driven by energy use, meaning competitive decarbonisation cannot be achieved simply by switching to low-carbon energy. Roughly two thirds of cement CO_2 emissions come from the calcination of calcium carbonate (the main component of limestone).[15] This means that a large share of the emissions remains unavoidable unless CO_2 is captured and permanently stored in offshore or onshore geologic formations. Across sectoral roadmaps and modelling, CCS typically accounts for 50–70% of the total abatement required in cement production.[16]

Poland's cement industry comprises of 12 large plants located across 8 voivodships. This presents an infrastructure challenge as the location of these plants is usually determined by raw material availability rather than proximity to CO_2 transport infrastructure. Connecting these dispersed sites to CO_2 storage will require the development of wide-reaching CO_2 transport networks, including new CO_2 pipelines and non-pipeline transport such as rail.

[12] Clean Air Task Force. (2024). Carbon capture and storage in Poland: Harnessing Poland's potential for carbon capture and storage. https://cdn.catf.us/wp-content/uploads/2024/04/26092017/ccs-poland-fact-sheet.pdf

[13] Stowarzyszenie Producentów Cementu. (2026). *Spada produkcja cementu w Polsce. Jak w dobie reformy EU ETS i „szoku naftowego" ochronić konkurencyjność przemysłu oraz budownictwa, aby utrzymać falę strategicznych inwestycji?* https://www.polskicement.pl/spada-produkcja-cementu-w-polsce-jak-w-dobie-reformy-eu-ets-i-szoku-naftowego-ochronic-konkurencyjnosc-przemyslu-oraz-budownictwa-aby-utrzymac-fale-strategicznych-inwestycji/

[14] Stowarzyszenie Producentów Cementu. (2025). *Fundamentalna rola technologii CCS w zapewnieniu konkurencyjności i dalszego funkcjonowania przemysłu cementowego w Polsce*. https://orka.sejm.gov.pl/opinie10.nsf/nazwa/1048_20250305/$file/1048_20250305.pdf

[15] International Energy Agency. (2018). *Low-carbon transition in the cement industry*. IEA Technology Roadmaps. https://www.oecd.org/content/dam/oecd/en/publications/reports/2018/04/low-carbon-transition-in-the-cement-industry_g1g8d7e7/9789264300248-en.pdf

Early-stage Carbon Capture and Storage Projects in Poland

Early-stage CCS projects are emerging in Poland, indicating increasing interest among industrial emitters, infrastructure developers, and public institutions. Although the market remains in its initial phase, these developments demonstrate a transition from conceptual discussion to the actual work required to establish a domestic CO_2 value chain.

1. **ECO$_2$CEE**

   The ECO$_2$CEE, developed by a consortium of ORLEN S.A., Holcim Polska S.A., Air Liquide Polska Sp. z o.o., and ORLEN Lietuva S.A., seeks to establish a CO_2 hub at the Port of Gdańsk as a key element of CCS infrastructure for hard-to-abate sectors in Poland. The project will create an open-access, multi-modal import-export terminal for liquid CO_2 in Gdańsk, linked to industrial facilities by rail in the initial phase and, in the longer term, by dedicated CO_2 pipeline infrastructure. ECO$_2$CEE was included on the first Union PCI/PMI list in 2024 and retained on the second Union PCI/PMI list effective in 2026.[17] It is designed to connect Polish industrial emitters to the wider European CCS network, including offshore storage routes in the North Sea, by enabling CO_2 transport to Gdańsk and onward shipment to storage sites.[18]

2. **GO4ECOPLANET**

   GO4ECOPLANET aims to become the country's first comprehensive industrial CCS project by equipping the Kujawy cement plant with capture technology for permanent CO_2 storage. The Go4ECOPlanet project is funded with €228M from the EU Innovation Fund and aims to capture CO_2 emissions at 100% capture rate from clinker production at the Kujawy cement plant.[19] These emissions will then be transported in liquefied form to North Sea storage sites. The project aims to capture around 1 MtCO$_2$/year by 2030 and achieve a 100% capture rate by 2040.[20] However, high costs remain a challenge, with the project estimated to require €265 million of capital investment, a level of expenditure that would make widespread deployment in line with European climate targets challenging without funding support at this stage of development.[21]

3. **HuCCSar**

   HuCCSar, led by Górażdże Cement S.A. in partnership with Schlumberger Poland Sp. z o.o., aims to develop Poland's first onshore industrial-scale CO_2 transport and storage system by combining a domestic CO_2 hub, pipeline and underground storage. The project received €26.5 million from the Innovation Fund and is planned to start operation in September 2028. HuCCSar is a pilot with strategic relevance for domestic onshore storage, with a storage capacity of over 17,000 tonnes per year and an expected permanent storage of 51,711 tonnes of CO_2 over the project lifetime.[22] Its goal is to demonstrate a scalable and cost-efficient inland storage pathway under Poland's emerging technical framework, supported by advanced monitoring, measurement and verification technologies.

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[16] Clean Air Task Force. (2025, March 24). *The role for carbon capture and storage in decarbonising Europe's cement sector.* https://www.catf.us/resource/role-carbon-capture-storage-decarbonising-europes-cement-sector/

[17] European Commission. (2026). *Commission Delegated Regulation (EU) 2026/764 of 1 December 2025 amending Regulation (EU) 2022/869 as regards the Union list of projects of common interest and projects of mutual interest. Official Journal of the European Union.* https://eur-lex.europa.eu/eli/reg_del/2026/764/oj, *European Commission. (2024). Commission Delegated Regulation (EU) 2024/1041 of 28 November 2023 amending Regulation (EU) 2022/869 as regards the Union list of projects of common interest and projects of mutual interest. Official Journal of the European Union.* https://eur-lex.europa.eu/eli/reg_del/2024/1041/oj

[18] ORLEN S.A. (2023, December 21). *ORLEN: terminal przeładunkowy CO_2 z unijnym dofinansowaniem.* https://www.orlen.pl/pl/o-firmie/media/komunikaty-prasowe/2023/Grudzien-2023/ORLEN-terminal-przeladunkowy-CO2-z-unijnym-dofinansowaniem

[19] Go4ECOPlanet. (n.d.). *The first zero-emission cement plant.* https://www.go4ecoplanet.com/en/home

[20] Go4ECOPlanet. (n.d.). *Reducing carbon footprint thanks to Kujawy.* https://www.go4ecoplanet.com/en/about-the-project/

[21] *The €265 million figure is sourced from European Commission documentation published in 2022 and may require updating in light of subsequent revisions or more recent funding allocations.* 2022 figure. European Commission, 2022

Box 2: Systemic Bankability as a Policy Tool for Clean Technology Deployment Across CEE

The systemic bankability framework can support the deployment of CCS and other clean technologies across CEE. While the analysis is grounded in the Polish context, the framework is intended to provide a transferable policy tool that can be applied across sectors and jurisdictions.

For policymakers, its value lies in three functions:

A. Barrier Prioritisation

A structured basis for identifying and prioritising the bottlenecks that most materially constrain deployment in a given sector, by distinguishing between risks that are systemic and investment-limiting and those that are secondary or more easily managed at the project level. In practice, this allows decision-makers to focus interventions on the barriers most likely to delay commercial-scale-up, including regulatory uncertainty, infrastructure shortfalls, revenue risks, social acceptance challenges, and delivery-capacity limitations.

B. Progress Monitoring Over Time

A clear assessment structure for a systemic bankability framework can be applied at different points in time to track whether policy changes and market developments are improving the underlying conditions for technology. The framework can also enable decision-makers to assess whether specific measures are reducing key risks or whether additional action is required to sustain momentum toward commercial deployment.

C. Replicability and Scale

A systemic bankability framework can be adapted to different countries, regions, and technologies while retaining a common analytical logic for assessing barriers to deployment. This makes the framework an effective tool for CEE governments trying not only to diagnose country-specific constraints, but also to build comparable evidence, share policy learning across jurisdictions, and support scalable pathways to commercial deployment.

SECTION 3

Priority Assessment of Systemic Bankability Conditions

The nine systemic bankability conditions were applied to assess whether Poland has established a domestic enabling framework for the commercial development of CCS. Investment risk in CCS arises not from any single element of the value chain, but from the interplay among legal certainty, revenue adequacy, infrastructure availability, industrial readiness, and public administration capacity. A CCS project can progress only when these elements are integrated and present, giving investors sufficient confidence that the project can be delivered, operated, and monetised within a predictable allocation of risks and responsibilities throughout its lifetime. The nine conditions, therefore, provide a unified analytical framework for identifying the gaps that continue to prevent CCS in Poland from moving beyond early project development to repeatable commercial deployment. The table below provides a priority assessment of the systemic bankability conditions for CCS in Poland. It is intended as a concise summary of the main findings, identifying which conditions are already relatively manageable, which remain project- or context-dependent, and which currently create the most significant barriers to conventional non-recourse project finance. A detailed analysis of each condition, including the underlying risks, Poland-specific strengths and gaps, and implications for investors and public authorities, is provided in Appendix 1: Detailed Assessment of Systemic Bankability Conditions for CCS in Poland.

Once the nine conditions presented below are addressed, systemic bankability is achieved which facilitates:

1. Access to abundant low-cost commercial capital to support large scale deployment;
2. Credible asset sale options;
3. Recycling of capital, where developers have the optionality to partially sell down or exit projects shortly after operational onset and reinvest in developing new projects, helping to support scale-up.[23]

Through the conditions of the systemic bankability framework, CCS in Poland has not yet reached the commercialisation stage, as the conditions necessary for predictable, scalable and financeable deployment are still not in place. Despite its significant potential, CCS requires a more fully developed enabling environment, including clear legislation and established financing mechanisms. CCS projects currently under development are crucial first movers, but their success depends on a robust enabling framework and a capable public administration to coordinate deployment across the CCS value chain. Systemic bankability conditions in the CCS sector will evolve as the sector matures and NZIA obligations are fulfilled.

[23] Clean Air Task Force (CATF) & The Andlinger Center for Energy and the Environment. (2025). *Systemic bankability is the key to unlocking energy transition speed and scale.* Clean Air Task Force. https://www.catf.us/resource/systemic-bankability-is-the-key-to-unlocking-energy-transition-speed-and-scale/

Table 2: High-Level Priority Assessment of Systemic Bankability Conditions for CCS in Poland

Condition	CCS Sector	Responsible Entity
Low Technology Performance Risk	No operational CCS projects in Poland; national performance risks remain untested. Globally, CCS technologies have proven efficient and essential for hard-to-abate sectors such as cement.	Industry, Government, CCS Projects Developers
Low Construction Cost Overrun Risk	High project complexity involving multiple phases (capture, transport, storage) and contractors. Timing alignment is critical, as illustrated by the Kujawy–Gdańsk corridor.	Industry, CCS Projects Developers
Revenue Adequacy	No state aid support schemes for CCS projects.	Government, Public financing institutions, Lenders
Regulatory Certainty	No comprehensive legal framework for CO_2 transport and storage. The national CCS strategy and secondary legislation remain pending.	Government
Access to Enabling Infrastructure	Poland's CO_2 infrastructure remains at an early stage of development.	Government, Industry, municipalities, TSO, Regulator
Social Acceptance	Public awareness and trust are low; general lack of knowledge on CCS value chain.	Government, CCS projects developers, Academia, Civil Society
Robust Supply Chain	Supply chain with few providers.	Industry
Commercial Insurance Availability	Limited availability due to early market stage. Some coverage possible through general industrial or environmental insurance products.	Insurers
Adequate Delivery System	Relevant authorities experience capacity gaps and insufficient technical expertise in CCS, and frequently operate within procedures that are not tailored to CO_2 infrastructure.	Government, Municipalities, Academia

The condition does not prohibit access to conventional non-recourse project finance.

The condition limits access to such finance in some situations (project-specific, market-specific or structure-dependent).

The condition limits access to such finance in most situations and typically requires public support, risk-sharing instruments or policy de-risking.

Regulatory certainty and revenue adequacy are the systemic bankability conditions that must be addressed before the others. The regulatory gaps and barriers still significantly affect the technical and economic feasibility of CCS development in Poland. In these uncertain regulatory conditions, developers cannot scale up projects, and lenders cannot rely on a stable basis for long-term risk allocation. Revenue adequacy risks are still too high to enable CCS commercial take off. Existing public support is limited to preparatory activities and depends on access to European Union programmes. Under these circumstances, investors are exposed to uncertainty in EU ETS prices, high capital intensity, and financial risks associated with storage, all of which hinder access to commercial financing. The introduction of a revenue-stabilising instrument such as a CCfD is therefore a necessary precondition for CCS project deployment.

The remaining systemic bankability conditions tend to strengthen more quickly when they are anchored in a regulatory and financial framework that creates fundamentals for CCS projects' take off. The policymakers should therefore sequence tailored interventions rather than address all enumerated conditions at once.

SECTION 4

A Phased Roadmap for CCS Deployment in Poland

Poland is entering the implementation phase of CCS, with simultaneously both systemic bankability shortfalls and clear grounds for building a domestic CCS value chain: significant geological potential, a strong industrial base, qualified research centres, and growing private-sector interest. The priority assessment above shows that the immediate task is not to address all barriers at once, but to remove the constraints that prevent projects from reaching FID. The roadmap below structures this assessment into a sequenced policy pathway: first, establishing regulatory and financing foundations; then, enabling infrastructure delivery and social acceptance; and finally, supporting scale-up and market consolidation.

Roadmap-Based Prioritisation of the Systemic Bankability Conditions

The matrix orders systemic bankability conditions by the roadmap phase in which they should be prioritised and by their expected impact on moving Polish CCS projects from early FIDs to commercial-scale deployment.

Table 3: Phased Prioritisation of Systemic Bankability Conditions for CCS Deployment in Poland

Expected Impact on CCS Deployment	Phase 1: 2026–2027	Phase 2: 2027–2030	Phase 3: 2030+
Highest Near-term Impact on FID	Regulatory certainty	Access to enabling infrastructure	
Delivery Impact on First Projects	Revenue adequacy risk	Construction Cost Overrun Risk and Technology Performance	Robust supply chains
Scale-up Impact on Market Formation	Adequate delivery system	Social acceptance and access to commercial insurance	

Legend: Darker colours indicate conditions that should be prioritised earlier under the roadmap and have the strongest effect on near-term FID. Medium and lighter colours indicate conditions that become decisive during first-project delivery and that mainly shape market scale-up once the first integrated CCS chains are under development.

Roadmap logic: Phase 1 addresses the binding constraints identified in the paper: regulatory certainty, revenue adequacy and delivery capacity. Phase 2 focuses on infrastructure access, construction risk and social acceptance. Phase 3 consolidates the rest of systemic bankability conditions as the market scales.

Phase 1: 2026–2027

Establish regulatory and financing foundations to enable final investment decisions.

The initial phase should address two primary constraints in the Polish market: regulatory certainty and revenue adequacy. Poland should adopt a CCS Strategy aligned with NECP, which would provide the basis for the forthcoming Polish Energy Policy until 2050 and the Industry Strategy in relation to CO_2 infrastructure development. Concurrently, the legal framework for CO_2 transport and storage must be finalised to provide a clear and practical basis for project development. This includes addressing legal gaps in the Geological and Mining Law and related legal acts resolving uncertainties in CCS investments. Additionally, a dedicated market framework for CO_2 transport and storage should be established to define system operations and allocate responsibilities along the value chain. The Energy Law should be amended to regulate CO_2 transport, thereby facilitating network planning.

Simultaneously, Poland should develop a financing framework that enables initial projects to progress beyond feasibility studies. At the end of Phase 1, Poland should adopt the implementing regulations for a CCfD system for avoided CO_2 emissions. These regulations should define the auction design, project eligibility criteria and settlement mechanism for payments calculated against the prevailing EU ETS price. This would create the legal basis for revenue stabilisation before first CCS projects move toward FID.

Permitting and administrative procedures should be streamlined in accordance with NZIA requirements. A specialised and digitalised one-stop shop, facilitated by a SPOC, should guide investors through the permitting process, while public authorities should receive knowledge-sharing support for CCS-specific approvals. The government should establish an official Carbon Management Projects Investor Guide within the SPOC, drawing on the experience of the National Contact Point for Renewable Energy Sources. The guide should offer guidance on preparing and delivering CCS investments, covering inter alia administrative procedures and technical requirements. Its purpose is to provide investors with a transparent source of information to navigate the entire investment process. The guide should be regularly updated. The guide should also feature an interactive list of procedures for CCS investors. This tool should identify each required decision, permit, notification, or agreement, indicate the competent authority, explain required documents and technical inputs, specify the steps, and show the links between procedures for capture installations, CO_2 transport infrastructure, and storage sites.

Phase 2: 2027–2030

Transition from establishing enabling conditions to initiating pre-commercial CCS development.

Once legal and financing foundations are established, the focus should shift to delivering the first integrated CCS value chains. This phase should prioritise cluster-based deployment, with infrastructure and project sequencing organised around emitters most likely to advance, particularly in industrial regions with concentrated capture demand. The state should act as "the coordinator", aligning the experiences of emitters and CCS developers, progress in CO_2 infrastructure development, and the national vision for CCS.[24] By the end of Phase 2, Poland should organise the first CCfD auctions for CCS projects. The auction design should reflect sectoral priorities, with particular attention to capture projects in hard-to-abate sectors with process emissions. This would allow revenue support to be directed toward projects where electrification alone cannot deliver deep emissions reductions and where CCS is most relevant for industrial decarbonisation. During Phase 2, Poland should build social acceptance for CCS through a government-backed information and education programme launched from 2027 and continued in the following years. The programme should explain the purpose, safety conditions and decarbonisation benefits of CCS in accessible materials tailored to different audiences, while creating a structured dialogue with civil society organisations and municipalities in which CCS investments are expected to be located.

[24] Clean Air Task Force. (2025). *Funding carbon capture and storage in Central and Eastern Europe: Strategies for cost-effective deployment.* https://cdn.catf.us/wp-content/uploads/2025/09/15050506/CATF-Funding-CCS-in-CEE.pdf

Phase 3: 2030+

Expand infrastructure and progress toward commercial CCS deployment.

Once initial projects are operational, the objective should transition from individual project enablement to market formation and scale-up. Policy should then prioritise expanding transport and storage infrastructure, increasing access for additional emitters, and establishing a standardised market framework for CO_2 management services. The state should continue to play a significant role but gradually shift from direct de-risking of individual projects to managing network expansion, maintaining regulatory predictability, and ensuring that infrastructure development aligns with industrial demand.

Financial support mechanisms should already be in place and subsequently evaluated. Instruments initially designed to make early projects investable should be modified to facilitate broader deployment, emphasising system efficiency, open access, and cost reduction over time. As additional projects progress, other systemic bankability conditions will become critical determinants of deployment speed. At this stage, these conditions should be prioritised, as they will determine whether Poland can transition from initial projects to a fully scalable CCS market. This phase will be considered successful when CCS operates within a stable legal framework, supported by reliable transport and storage services, viable business models, and an expanding pipeline of industrial users, without reliance on exceptional project-specific interventions. By the end of the decade, Poland should have a functional domestic system capable of meeting demand resulting from the development of carbon capture installations in industry and integrated CO_2 transport infrastructure.

SECTION 5

Conclusion

Systemic bankability provides a holistic framework for assessing these constraints and sequencing the actions needed to address them. Its value lies in shifting the discussion from isolated policy measures to the interconnected conditions that must be in place for projects to become financeable across an entire sector. When applied iteratively, the framework can also support the deployment of other clean technologies and assist CEE states facing similar difficulties in moving from early projects to commercial scale. Used in this way, systemic bankability can help build an efficient, structured approach to deploying clean technologies, in which public intervention focuses on removing the constraints that prevent private capital from moving at the pace required for industrial decarbonisation and the energy transition. Even where a systemic bankability framework is adapted to different national contexts or sectoral conditions, its purpose remains the same: to support a more coherent strategy for building the conditions under which private capital can mobilise at the scale and pace required for the successful commercialisation and scalability of clean technologies.

The current policy framework in Poland does not yet support the large-scale private investment needed to make CCS commercially viable. While Poland has the geological potential, industrial base, and growing private-sector interest to develop a competitive CCS sector, analysis indicates that conditions are not yet in place for repeated, large-scale mobilisation of private capital. A holistic approach and long-term vision are crucial for Poland to establish a commercial CCS value chain and achieve its goals for a competitive, decarbonised industry.

APPENDIX 1

Detailed Assessment of Systemic Bankability Conditions for CCS in Poland

Advancing CCS to a commercially viable decarbonisation option for Poland's industry sector requires creating conditions for bankable, capital-intensive projects. Although CCS is likely to remain a relatively high-cost decarbonisation option, it can still attract private investment if revenue risks are reduced, CO_2 transport and storage infrastructure is available, and investors have sufficient confidence in future carbon prices and regulatory framework.

The following assessment applies nine systemic bankability conditions to evaluate whether Poland's CCS framework can support projects reaching FID and advancing toward commercial deployment. These conditions serve as a diagnostic tool, recognising that CCS bankability depends on technical maturity as well as on legal, financial, infrastructure, and public administration capacity to allocate risk in an acceptable manner for investors and lenders. The analysis examines how each condition influences CCS development in Poland's current market, distinguishing between risks that immediately hinder investment and those that become critical during development.

Low Technology Performance Risk

Description: The technology and integrated project value chain are anticipated to perform according to assumptions established at the final investment decision, with minimal risk of underperformance or substantially increased operating costs.

CCS cannot be considered a technical novelty. The individual technologies comprising the CCS value chain (capture, transport, and storage) have operated in various commercial contexts for decades. The capture, transport and injection of CO_2 for the purposes of enhanced oil recovery (EOR) has been carried out in the United States since the 1970s, while industries such as fertiliser production and natural gas processing routinely capture CO_2 (without storage) to ensure product purity. Since first being demonstrated in Norway in 1996, the dedicated storage of CO_2 for climate change mitigation now also takes place at a number of locations globally.[25] The storage of CO_2 is a safe technological solution, provided it is managed responsibly throughout planning and implementation, in line with international safety standards and the latest technical guidelines.[26] As of June 2025, 18 commercial dedicated geological CO_2 storage projects are currently operational globally, storing over 80 million tonnes of CO_2, demonstrating the safety, reliability, and scalability of CO_2 storage.[27]

25 Ma, J., Li, L., Wang, H., Du, Y., Ma, J., Zhang, X., & Wang, Z. (2022). Carbon capture and storage: History and the road ahead. *Engineering,* 14(7), 33–43. https://doi.org/10.1016/j.eng.2021.11.024

26 Clean Air Task Force. (2024). *New, holistic review of major carbon capture and storage projects shows the technology is working, highlights opportunities for increased climate benefit.* https://www.catf.us/2024/07/new-holistic-review-major-carbon-capture-storage-projects/

27 Hatta, A., Consoli, C., & Seyyedi, M. (2025). *The safety and permanence of CO_2 geological storage.* Global CCS Institute. https://www.globalccsinstitute.com/wp-content/uploads/2025/09/The-Safety-and-Permanence-of-CO2-Geological-Storage-Global-CCS-Institute.pdf

Various scenario-based studies, depending on storage site type, leakage pathways, and regulatory assumptions, indicate high long-term CO_2 retention.[28] One assessment of hypothetical offshore and onshore scenarios found that, even over 10,000 years, at least 98% of injected CO_2 would remain in the subsurface, while a separate North Sea assessment, based on ten leakage scenarios, concluded that 99.99% of the injected volume could be expected to remain securely underground for at least 500 years.[29]

Furthermore, in the EU, the safety of underground CO_2 storage is ensured through a harmonised multi-stage process of site selection, risk assessment and ongoing monitoring, consistent with the provisions of Directive 2009/31/EC on the geological storage of carbon dioxide. CCS projects are multi-phase undertakings involving numerous contractors and complex interfaces across components of the whole supply chain. Performance risk in CCS should be disaggregated across the value chain. For capture, risk may be relatively limited where projects rely on commercially proven vendor technologies already deployed in hydrogen, power and gas-processing applications, although public evidence is less clear that equivalent performance assurance is already standardised for less well demonstrated industrial applications such as cement and steel. Storage risk depends heavily on the geological formation and operating history; it may change depending on whether injection is to be performed in onshore/offshore formations or on the developer's level of experience in CO_2 storage projects. Beyond component-level risk, CCS projects also face integration risk, as the project's commercial performance depends on the successful alignment of the whole value chain. CCS is recognised by the IPCC and the International Energy Agency as an important climate technology for hard-to-abate sectors where alternatives are limited.. Furthermore, geological CO_2 storage draws on decades of subsurface experience from the oil and gas industry. At present, CATF's project tracker has identified 37 proposed CCS projects across Southern and Central & Eastern Europe, signalling growing regional engagement and the potential for more geographically distributed CO_2 infrastructure. CCS projects have not yet been deployed in Poland, preventing a comprehensive assessment of performance risk in the national context. Industrial emitters in Poland are in the early stages of adopting capture technologies, with no operational large-scale units to date. Globally, CO_2 capture technologies have been implemented in industry since the 1970s, and several large-scale projects have operated successfully in countries such as Canada, Norway, and the United States. Projects such as Sleipner, the Alberta Carbon Trunk Line, and Quest have consistently met high levels of technical performance.[30] Although some large-scale demonstration projects worldwide have encountered technical issues, this is not indicative of a general lack of technical readiness. First-of-a-kind plants have typically encountered – and resolved – early operational issues, including component failure and inadequate process gas treatment; however, such issues should be resolved more quickly as supply chains deepen, operational experience accumulates, and standardised solutions become more widely available.

Front-End Engineering Design (FEED) studies are a crucial step in scaling CCS projects, as they assess whether a project is technically and economically feasible and provide the information needed for FID. FEED studies require significant time and expenditure, reaching up to 5% of the total project value. Public support for feasibility and FEED studies can therefore reduce early project risk and move projects closer to FID, while also generating knowledge that can be shared with the wider CCS ecosystem. At the FEED stage, developers assess inter alia: site constraints, capture technology selection, flue gas characterisation, energy and cooling requirements, water use, waste streams,

[28] Stalker, L., Michael, K., Jenkins, C., Holland, K., Peeters, L., Myers, M., & Ross, A. (2025). *Reviewing the implications of unlikely but potential CO_2 migration to the surface or shallow subsurface* (Technical Report 2025-01). IEAGHG. https://doi.org/10.62849/2025-01,

[29] Alcalde, J., Flude, S., Wilkinson, M., Johnson, G., Edlmann, K., Bond, C. E., Scott, V., Gilfillan, S. M. V., Ogaya, X., & Haszeldine, R. S. (2018). Estimating geological CO_2 storage security to deliver on climate mitigation. Nature Communications, 9, Article 2201. https://doi.org/10.1038/s41467-018-04423-1; Daniels, S., Hardiman, L., Hunn, V., Jones, R., & Robertson, N. (2023). *Deep geological storage of CO_2 on the UK continental shelf: Containment certainty*. Prepared for the UK Department for Business, Energy & Industrial Strategy; Hoydalsvik, H., Devaux, F., Zweigel, P., Gittins, C., Tucker, O., Seldon, L., & Neele, F. (2021). CO_2 storage safety in the North Sea: Implications of the CO_2 Storage Directive. *In Proceedings of the 15th Greenhouse Gas Control Technologies Conference, 15–18 March 2021.* SSRN. https://ssrn.com/abstract=3811350.

[30] Lockwood, T. (2024). *Carbon capture and storage: What can we learn from the project track record?* Clean Air Task Force. https://www.catf.us/resource/carbon-capture-storage-what-can-learn-from-project-track-record/, Gładysz, P., & Kupiec, B. (2025). *Capturing public trust: Social acceptance of CCS in Poland.* Clean Air Task Force. https://www.catf.us/resource/capturing-public-trust-social-acceptance-of-ccs-in-poland/

secondary emissions, CO_2 transportation and storage assumptions, and execution risks. Alberta Carbon Capture Kickstart experience shows that FEED studies can provide a common basis for estimating the levelised cost of capture, testing the emissions-reduction potential, and identifying design choices that affect cost, performance, and integration risk before capital is committed.[31]

Public grants are a common financing mechanism used by many CCS projects to fund FEED studies.[32] Public funding for FEED studies should be recognised by the Polish government as part of a broader public support framework for bringing CCS projects to investment readiness, filling the gap between early-stage feasibility work and full-scale infrastructure support. In the United Kingdom, public support for FEED was channelled through instruments that distinguished between early project development and later capital deployment. The Industrial Energy Transformation Fund provided funding for feasibility and FEED studies for clean energy technologies, and awarded more than GBP 13.7 million grant funding to CCUS projects by October 2025.[33] The Industrial Decarbonisation Challenge funded feasibility and FEED studies for industrial clusters between 2019 and 2024, providing more than GBP 210 million to six large industrial clusters.[34]

The Challenge was delivered in two stages via three workstreams:

- **Deployment:** projects have designed the infrastructure required for CCS and hydrogen production at full commercial scale;
- **Cluster plans:** projects produced plans to reach net zero in each of the industrial cluster regions;
- **Industrial Decarbonisation Research and Innovation Centre (IDRIC):** a dedicated research centre that brought together academia, industry and government to support technology development for the transition to net zero

Technology performance risk can be further reduced via vendor guarantees. CCS technology vendors typically provide performance guarantees for the capture phase of the value chain. As a result, a portion of the technology performance risk is likely to be contractually managed through the supplier package rather than being borne solely by the project developer. The Global CCS Institute notes that vendors such as Honeywell have offered extensive warranty and performance guarantees.[35] In contrast, while insurance coverage for CO_2 storage projects is emerging around the globe, comparable standardised vendor guarantees appear less prevalent in the CCS storage phase, since the bankability of geological storage is shaped by project- and jurisdiction-specific liability arrangements and by the conditions of the geological formations rather than by equipment-performance risk that can be readily allocated to a technology vendor through standard warranty packages.[36]

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31 International CCS Knowledge Centre. (2024). *11 industrial CCS FEED studies: Lessons learned from Emissions Reduction Alberta's Carbon Capture Kickstart Program.* https://ccsknowledge.com/wp-content/uploads/2024/10/era-lessons-learned-web_2024-10-17-1.pdf

32 OECD, *CCUS Policies and Business Models: Building a Commercial Market*, OECD Publishing, Paris 2023, https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/11/ccus-policies-and-business-models_e56bdde5/6ef05538-en.pdf

33 Department for Energy Security and Net Zero. (2026). *Industrial Energy Transformation Fund (IETF) Benefits Report.* https://assets.publishing.service.gov.uk/media/6972cd0ad8adeaf266040584/ietf-benefits-report.pdf

34 UK Research and Innovation. (n.d.). *Industrial decarbonisation.* https://www.ukri.org/what-we-do/browse-our-areas-of-investment-and-support/industrial-decarbonisation/

35 Global CCS Institute. (2025). *State of the art: CCS technologies 2025.* https://www.globalccsinstitute.com/wp-content/uploads/2025/08/State-of-the-Art-CCS-Technologies-2025-Global-CCS-Institute.pdf

36 IEAGHG. (2024). *Insurance coverage for CO_2 storage projects* (2024-TR04). https://doi.org/10.62849/2024-TR04. Smith, B. (2025). *Insurance for carbon capture and storage: State of the market.* Global CCS Institute. https://www.globalccsinstitute.com/publications/insurance-for-carbon-capture-and-storage-state-of-the-market. Spencer, T. C., McCaughey, J. W., Bresch, D., & Steffen, B. (2026). Facilitating permanent carbon storage through risk transfers? Analyzing the insurability of the carbon leakage liability. *Energy Research & Social Science*, 136, 104746. https://doi.org/10.1016/j.erss.2026.104746

Low Construction Cost Overrun Risk

Description: The likelihood of significant increases in construction costs after the final investment decision is low and can be mitigated through effective project design, contracting structures, contingencies, and delivery experience.

In the case of early CCS deployment in Poland, the key source of risk lies primarily in the ability of developers, EPC contractors, and technology providers to manage large, technically complex investments of a type for which they have limited direct delivery experience. In that respect, construction risk is driven less by the regulatory regime and financing options themselves than by the experience and coordination capacity of the companies involved. A distinct challenge arises in enabling network development. For instance, the Kujawy–Gdańsk CO_2 transport corridor illustrates this broader coordination problem, as capture installations, transport infrastructure, and storage solutions must be developed in parallel and aligned in terms of timing, capacity and technical specifications. Where one part of the value chain lags the others, the result may be delays, underutilised assets, or additional costs, even if the individual project components have well-understood costs.

Revenue Adequacy

Description: Projects and enabling framework demonstrate a credible and predictable revenue stream sufficient to cover operating costs, debt service, and required returns throughout the project lifetime.

In Poland and the rest of Central Eastern Europe, the crux of the economic challenge for CCS lies in the significant funding gap between the high deployment costs and the relatively low market price of CO_2.[37] The total cost of CCS projects comprises two primary factors: the capture cost and the cost of transporting and permanently storing CO_2 underground. The cost of CO_2 capture varies considerably across industrial sectors, primarily due to differences in the physicochemical properties of flue gas streams and production process characteristics across hard-to-abate sectors. Additional variation arises from the scale of capture installations and the specific technological configurations applied in the project. The cost of CO_2 transport depends mainly on the distance between the emission source and the storage site, the selected transport method, and the volume of CO_2 transported. Location and type of storage site, as well as reservoir capacity and quality, are the main determinants of CO_2 storage costs. Furthermore, financial security costs constitute a major factor in developing CCS.[38] The provisions of the Regulation of the Minister of the Environment of 30 October 2015 on financial security and the provision of funds related to the underground storage of carbon dioxide mandate that site operators secure funds to cover potential liabilities, monitoring of possible CO_2 leakage during the operational phase, and decommissioning costs of CO_2 storage sites until responsibility for the closed underground CO_2 storage site is transferred to the National Administrator of Underground CO_2 Storage Sites. This substantially increases the project's required costs. The regulations also stipulate separate calculations for corrective action costs and EU ETS settlement costs during both the operational phase and decommissioning stage.

The EU ETS price is a key driver of CCS's economic feasibility. Since CO_2 price evolution is market-driven and inherently uncertain, investors face significant financial risk, leading to hesitancy to commit capital to CCS projects. For CO_2 transport and storage infrastructure, this risk is further increased by the business case's dependence on future CO_2 volumes being delivered to the system and on users paying tariffs sufficient to ensure an adequate return on investment. This creates a wide range of possible cost outcomes, depending on the future EU ETS price, local geological conditions, and sector-specific factors, which complicates the development of reliable financial models, especially for early-stage projects. Consequently, project developers may delay FIDs or make them conditional on the availability of support instruments or dedicated EU and national funding programmes, which can provide greater certainty of future revenue. This, in turn, constrains the market's ability to scale up CCS infrastructure at the pace required for competitive industrial transition.

37 Clean Air Task Force. (2025, September 16). *Funding carbon capture and storage in Central and Eastern Europe: Strategies for cost-effective deployment.* https://cdn.catf.us/wp-content/uploads/2025/09/15050506/CATF-Funding-CCS-in-CEE.pdf

38 Regulation of the Minister of the Environment of 30 October 2015 on financial security and the securing of funds related to the underground storage of carbon dioxide (Journal of Laws, item 2144).

The investment financing environment for CCS remains underdeveloped, which significantly limits the capacity of public authorities and industry to advance early-stage projects. Existing domestic support schemes primarily target broader innovation, research and development, or industrial modernisation. These schemes, such as those provided by the National Centre for Research and Development in Poland, do not specifically address the de-risking of CO_2 infrastructure or the business case for commercial-scale projects. Consequently, project developers depend largely on European Union mechanisms, including the Innovation Fund, while national co-financing remains limited.[39] As a lower-income EU member state, Poland qualifies for support from the EU Modernisation Fund, although it is not currently supporting CCS projects in the country.[40]

The Polish government has not yet created a dedicated financial mechanism that would provide attractive incentives for CCS developers. The emerging policy instrument for this purpose in Europe is the 'carbon contract for difference' (CCfD), which effectively covers the difference between the EU ETS price and the actual carbon abatement cost for decarbonisation projects over a contracted time period.[41] Projects typically bid a 'strike price' which reflects the carbon price they require, and available funds are allocated to the most competitive projects – often taking other criteria into account. CCfDs can be designed in a variety of ways, which can fundamentally affect the balance of cost and risk between the funding state and the project developer. Key design criteria include selection criteria (such as cost, project maturity, or overall abatement), performance criteria (capture rate requirements, improving performance over time), payment structure and choice of reference price. In theory, a CCfD requires the project to pay back to the government counterparty should the EU ETS price go over the strike price (symmetric payment); however, CCfDs implemented in the Netherlands and for some UK projects exclude this provision (asymmetric payments). For CCS projects in particular, design choices may need to account for the complexity of the project value chain, which relies on the robustness of the whole supply chain. As CCS projects reduce a plant's emissions intensity, they are also able to generate a revenue stream from the increased share of freely allocated ETS allowances which remain unused and can be sold to other emitters. This may help hedge against fluctuations in carbon allowance prices, which are among the main determinants of CCS investment viability.[42] CCfDs mostly assume that bidding projects have factored this free allowance revenue into their bid prices; however, the UK model has provided some volume and price assurance for free allowance revenue for its first industrial CCS project.[43]

It is worth acknowledging that the CATF analysis from 2025 indicated that if the Polish government and its CEE counterparts invest now in expanding CO_2 transport and storage capacity, CCS deployment costs could fall below the projected EU ETS price by 2030. At this point, no further payments would be required under an asymmetric CCfD; once CCS becomes cheaper than the ETS, the subsidy phases out automatically.

39 GreenHorizon CEE Project. (2026). *Synthesis report on capacity gaps in carbon management in Central and Eastern Europe.* European Climate Initiative (EUKI). https://greenhorizon-cee.eu/wp-content/uploads/2026/02/EUKI-GreenHorizon-CEE-Synthesis-Report-on-Capacity-Gaps.pdf

40 CCSA Europe. (2026). *De-risking CCUS: A one-stop shop to bankable projects*. https://cms.ccsassociation.org/wp-content/uploads/2026/02/CCSA_EU_Market_Study_Jan_2026_single_pgs_digital-1.pdf

41 Clean Air Task Force. (2024). *Designing carbon contracts for difference: A comparison of incentives for carbon capture and storage in Europe.* https://www.catf.us/resource/designing-carbon-contracts-for-difference/

42 Giers, M. (2024). *Finansowanie rozwoju technologii CCUS w Polsce.* WiseEuropa. https://ccus.pl/uthistag/2024/11/Finansowanie-rozwoju-technologii-CCUS-w-Polsce.pdf

43 Department for Energy Security and Net Zero, *Carbon Capture, Usage and Storage: Industrial Carbon Capture Business Models.* Update, October 2023, https://assets.publishing.service.gov.uk/media/652eb3b56b6fbf000db75852/ccus-iccc-business-models-update-october-2023.pdf

Lessons from the Netherlands and the UK[44]

The Dutch SDE++ scheme treats CCS as one option within a wider, technology-neutral decarbonisation framework and allocates support based on relative cost-efficiency. CCS projects apply based on the support required per tonne of CO_2 stored and compete with other low-carbon technologies for funding. This approach is more workable in a context where emitters are concentrated in industrial clusters and where shared transport and storage infrastructure is already being developed, as this reduces coordination challenges and gives bidding CCS projects greater certainty on costs and timeline. The Netherlands provides bidding projects with a benchmarked cost for transport and storage, based on the Porthos infrastructure for initial projects and the (much larger) Aramis project for later projects. However, this approach has also faced challenges as projected costs for Aramis have risen over time – requiring previously successful projects to rebid with revised costs.

The UK model operates on a different premise. Industrial Carbon Capture Contracts and other CCS business models (such as the Dispatchable Power Agreement for power plants) are tailored to different CCS applications and integrated with the cluster sequencing model, which ensures that projects can access regional transport and storage networks. Revenue support is thus linked to both carbon abatement and the coordinated delivery of the entire CCS chain. Payments are determined by the tonnes of CO_2 captured and stored, with performance requirements embedded in the contracts. The model also addresses cross-chain risk by maintaining a portion of the payment stream when transport and storage infrastructure is delayed or unavailable.

Regulatory Certainty

Description: The legal framework creates stable and transparent conditions for investment, permitting and construction, while also encompassing policy instruments that influence financial performance.

Regulatory certainty is a key factor for the large-scale deployment of CCS and other clean technologies. Despite the EU's regulatory push, the Polish government has still not adopted the CCS strategy. Regulations regarding CO_2 transport remain fragmented. The relevant provisions are dispersed across several legal acts rather than being consolidated within a single CCS legal framework. This dispersion is partly inevitable because CO_2 transport intersects with energy regulation, geological and mining law, environmental permitting, spatial planning, construction procedures, safety requirements, and rules governing access to infrastructure. Nevertheless, the current Polish framework is more complex than typical legislative frameworks. The proliferation of legal acts and secondary regulations has resulted in regulatory complexity, requiring investors to reconstruct the applicable regime from multiple legal sources, many of which were not specifically designed for CCS development. This situation undermines the regulatory certainty necessary for early CCS projects to reach FID. This issue is especially evident in the legal treatment of CO_2 transport. The Energy Law defines CO_2 transmission by linking it to underground storage as regulated by the Geological and Mining Law, thereby restricting the dedicated regulatory framework to pipeline-based transport to storage sites. Consequently, Polish law currently allows CO_2 transport to storage sites only

[44] Toby Lockwood, *Designing Carbon Contract for Difference Incentives to Drive the Deployment of Carbon Capture and Storage in Europe* (2025), available at SSRN: https://ssrn.com/abstract=5686803

through a pipeline-based transport network.[45] The absence of a clear legal basis for non-pipeline CO_2 transport within the CCS chain creates a regulatory gap for early CCS deployment in Poland, where initial projects may need to use multimodal transport before a national CO_2 pipeline network is established. Furthermore, the Construction Law lacks a complete conceptual framework for CCS infrastructure; it does not yet define a CO_2 capture installation or a CO_2 transmission network, which means that regulatory uncertainty arises already at the level of legal classification under the construction-permitting regime.[46]

In 2023, amendments to the Geological and Mining Law enabled onshore underground storage of carbon dioxide, lifting the previous prohibition on CO_2 storage and establishing general rules for commercial-scale CCS activity. However, significant challenges persist, particularly regarding the regulatory boundaries between CO_2 transport networks and storage sites. Previous provisions of localisation ordinance permitted CO_2 storage in depleted hydrocarbon fields located in the Cambrian reservoir area within Poland's Exclusive Economic Zone in the Baltic Sea, but excluded onshore storage, thereby limiting the potential for CCS in Poland for many years.[47] However, the recently amended regulation expands the catalogue of areas where underground CO_2 storage complexes may be located by designating 18 additional onshore areas and offshore areas within Poland's exclusive economic zone.[48] The designated locations concern selected deep geological structures at depths greater than 900 metres below ground level, including hydrocarbon reservoirs and highly mineralised groundwater horizons, commonly referred to as saline aquifers. The regulation will also apply to enhanced hydrocarbon recovery operations combined with underground CO_2 storage.

The areas were selected based on geological, hydrogeological, geophysical, and environmental data. The selected structures meet key safety criteria and may provide suitable geological conditions for the permanent and secure storage of CO_2. The signing of the regulation does not determine the location of underground CO_2 storage sites. It only designates the areas within which the prospecting, exploration and documentation of underground CO_2 storage complexes will be permitted. Even after the amended provisions enter into force, much more time will elapse before it is possible to confirm whether the relevant conditions for potential future CO_2 storage are met.

The main legal barrier to the development of CO_2 offshore storage in Poland stems from the prevailing interpretation of Article 11 of the Helsinki Convention, which prohibits CO_2 dumping in Baltic Sea, except for dredged material, which in each case requires a prior special permit. This has a significant impact on the shape of the Polish CCS model; If offshore storage in the Baltic is excluded, projects must rely either on future onshore storage or on the export of captured CO_2 to North Sea storage sites. That substantially alters the economics and risk profile of the value chain. There are divergent interpretations of Article 11 of the Helsinki Convention in the context of offshore CCS. The divergence concerns whether CO_2 injected into deep geological formations beneath the Baltic seabed should be treated as "dumping" in the Baltic Sea Area, or whether it should be distinguished from disposal into the sea or onto the seabed.[49] The latter interpretation is persuasive from a functional and environmental perspective, because geological storage of CO_2 does not involve the release of material into the marine environment, but the injection of CO_2 into sealed geological formations for permanent containment. It also better reflects the

45 Mikusek, P. (2022). Regulacje prawne sekwestracji dwutlenku węgla jako bariera do dekarbonizacji krajowej gospodarki gazowej. *internetowy Kwartalnik Antymonopolowy i Regulacyjny (internet Quarterly on Antitrust and Regulation)*, 11(2), 11-31. https://doi.org/10.7172/2299-5749.IKAR.2.11.1

46 Most of these regulatory gaps are expected to be addressed by the forthcoming CCUS Special Act, which will amend relevant provisions in other legal acts, such as the Energy Law and the Geological and Mining Law. This special normative act is intended to cover, inter alia, coordination of access to CO_2 storage services, third-party access to CO_2 transport and storage infrastructure, non-pipeline CO_2 transport, and NZIA-based permitting simplifications. However, at the time this report was finalised, the draft CCUS Special Act had not yet been officially entered into the Minister of Climate and Environment's legislative works registry, so its final scope remained uncertain.

47 Rozporządzenie Ministra Środowiska z dnia 3 września 2014 r. w sprawie obszarów, na których dopuszcza się lokalizowanie kompleksu podziemnego składowania dwutlenku węgla, Dz.U. 2014 poz. 1272. https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20140001272

48 Regulation of the Minister of Climate and Environment of 8 June 2026 amending the Regulation on the areas where an underground carbon dioxide storage complex may be located (Journal of Laws, item 761).

49 ORLEN S.A. (2024). ORLEN S.A. – *implementing CCS through ECO2CEE Project* [PowerPoint presentation]. Baltic Carbon Forum, Vilnius. https://bcforum.net/forum_presentations2024/Day%201/Session%201/00.01.pdf

purpose of CCS, which is to prevent emissions from entering the atmosphere rather than to dispose of waste in the Baltic Sea. There are also significant differences in the interpretation of the wording of "seabed" and "subsoil" in the Convention, which is crucial in order to have a common understanding of the scope of the Convention.[50] To remove these legal uncertainties, the Contracting Parties should either amend Article 11 of the Helsinki Convention or adopt a resolution confirming an interpretation that allows the storage of CO_2 in sub-seabed geological formations, subject to appropriate environmental safeguards and monitoring requirements.[51] An amendment would provide the strongest legal certainty,[52] while an interpretative resolution could offer a faster route to clarifying that sub-seabed geological storage of CO_2 should not be treated as prohibited dumping under the Convention. Furthermore, Poland has not ratified the 2009 amendment to Article 6 of the London Protocol, which was intended to enable the export of CO_2 for sub-seabed storage.

Additional ambiguity arises from the automatic transfer of property rights to the State upon licence expiry, which raises concerns regarding property protection rights. The procedural architecture of the regime, requiring a series of administrative decisions, regulated in various legal acts, prior to the grant of a storage licence, creates cumulative administrative complexity and a high risk of prolonged proceedings.[53] Uncertainty also surrounds how CCS will be integrated into upcoming national strategies. As a consequence, investors lack clarity on long-term government targets regarding this technology.

CCS investors continue to face complex administrative procedures. In general, CO_2 transport infrastructure in Poland is not sufficiently reflected in national infrastructure planning or spatial planning documents. Consequently, developing CO_2 pipelines requires multiple administrative approvals, which delays project preparation and increases the risk of conflicts with land-use plans and administrative procedures. Uncertainty regarding operational obligations and future liabilities hinders investors' ability to accurately assess and allocate capital to CCS projects.[54] This uncertainty should also be assessed in light of ongoing work to implement the Net Zero Industry Act, which supports the early identification and planning of areas suitable for net-zero technology projects, including CCS infrastructure. In the Polish context, the designation of underground CO_2 storage complexes should be better integrated with spatial planning and infrastructure-permitting rules, so that storage sites, CO_2 transport routes and capture projects can be planned as one coherent CCS value chain. This would reduce the risk that projects with identified geological potential are later delayed by fragmented land-use, environmental and construction procedures.

Establishing predictable and stable regulations is essential to reduce perceived investment risk. As the NZIA accelerates carbon management obligations, anchoring CCS in stable national law and integrating it into all relevant national strategies (CCS Strategy, Hydrogen Strategy, Polish Energy Policy until 2050, Industry Strategy, Long-term Climate Strategy until 2050) will be key to enabling commercialisation of these technologies.

Access to Enabling Infrastructure

Definition: Projects can access the necessary infrastructure (such as CO_2 pipelines, storage sites, port terminals and related infrastructure) for its operations and performance.

Effective deployment of CCS at scale is directly dependent on the availability of transport infrastructure and suitable geological storage sites. The proximity of emitters to storage, the availability of onshore or offshore reservoirs, the need for shipping or pipeline transport, and the spatial concentration of industrial sources all alter the pathway of deployment. A project with access to nearby onshore storage can operate within a fundamentally different cost envelope than one that depends on long-distance transport to

50 HELCOM. (n.d.). *Document attached to HELCOM meeting record.* https://meetings.helcom.fi/_entity/annotation/8dff1a65-b80e-ef11-9f89-000d3a6879aa

51 For further discussion of the importance of environmentally sound geological CO_2 storage in the Baltic Sea region and the legal barriers arising under the Helsinki Convention, see: *Call to Enable CO_2 Storage in the Baltic Sea Region under the Helsinki Convention, open letter to the Contracting Parties to the Helsinki Convention and the HELCOM Secretariat*, 15 July 2026, https://www.catf.us/wp-content/uploads/2026/07/Open-letter-on-the-Helsinki-Convention.pdf

52 To amend Article 11, all the Contracting Parties need to accept the amendment as The Helsinki Convention requires consensus among all Baltic Sea states for activities that could impact marine environments.

53 A.Lpiński (2025). Prawna regulacja podziemnego składowania dwutlenku węgla. Przegląd Geologiczny. 73. 626-630. 10.7306/2025.67.

54 GreenHorizon CEE Project. (2026). *Synthesis report on capacity gaps in carbon management in Central and Eastern Europe.* European Climate Initiative (EUKI). https://greenhorizon-cee.eu/wp-content/uploads/2026/02/EUKI-GreenHorizon-CEE-Synthesis-Report-on-Capacity-Gaps.pdf

offshore reservoirs. For pipeline transport to operate efficiently, CO_2 is usually compressed to dense-phase conditions, while ship transport requires CO_2 cooling and liquefaction; both of which need considerable energy input and dedicated equipment. Safe handling of pressurised CO_2 across the value chain is essential, as even infrequent incidents can shape public perceptions and intensify opposition to new infrastructure.

The geographic and sectoral profile of hard-to-abate industry is a key factor in the development of CO_2 storage and transport infrastructure in Poland. Southern Poland accounts for more than half of the country's industrial emissions and, critically, for 88% of emissions from the cement and lime sector, where access to CO_2 storage is a prerequisite for full decarbonisation.[55] At the same time, the most suitable geological formations for CO_2 storage are located in other regions, including northern and western Poland and offshore areas. Enabling storage in those regions will therefore require the development of a CO_2 transport system connecting emitters with suitable storage sites, through onshore pipelines, maritime transport to offshore storage sites, or a combination of both. Cross-border cooperation may also be necessary if the domestic storage base proves insufficient or if available sites do not meet all relevant safety and technical criteria. Physical infrastructure for CCS across Poland is still at a formative stage. At present, Poland has no dedicated CO_2 pipeline network and no specialised export terminals capable of handling large volumes of CO_2 by sea (as is broadly the case across Europe). Currently, the development of CO_2 hubs (an integrated infrastructure enabling the reception, aggregation, transport and further management of carbon dioxide from multiple emission sources, comprising transmission and/or transhipment infrastructure components as well as CO_2 utilisation or storage facilities) is also envisaged, integrating various transport options into a single system for delivering CO_2 to storage sites.[56] Poland currently lacks permitted CO_2 storage sites and is yet to issue any exploration licences to develop CO_2 storage. Based on available geological information, only a preliminary screening of potential storage areas had been conducted, identifying areas that may be suitable for further geological investigation before any licence for underground CO_2 storage can be obtained.

Uncertainty regarding the availability and construction timing of CO_2 infrastructure limits the bankability of early projects. According to CATF's CCS cost tool, Poland's industries will be able to access CCS at lower cost if the country achieves widespread availability of both CO_2 transport and storage infrastructure. In a scenario with widespread development of onshore storage and CO_2 pipelines, Polish emitters will have to pay between €23 and €49/t to transport and store their CO_2; without its development, the transport and storage costs could rise to €93-€100/t. The potential repurposing of Poland's gas network for CO_2 transport remains unclear as Polish strategic documents foresee a significant increase in natural gas consumption, which means that the CO_2 transport network will largely have to rely on new infrastructure.

The development of the transport system will require establishing a comprehensive pipeline management and operations model. The immediate policy priority is not only to designate a transport system operator but also to establish a credible access regime that reduces uncertainty prior to the finalisation of the EU-level CO_2 market package. Although the Energy Law introduced a general principle of non-discriminatory access to networks, the implementing regulation envisaged under Article 11r, concerning detailed connection rules and technical requirements, has not yet been adopted. The Polish government must still make an early policy decision regarding the third-party access (TPA) framework for CO_2 transport infrastructure. CCS Directive does not specify whether Member States should implement negotiated third-party access (negotiated TPA) or regulated third-party access (regulated TPA.[57] Consequently, different Member States have adopted various approaches in regulating this issue.

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55 Clean Air Task Force. (2024). *Carbon capture and storage in Poland: Harnessing Poland's potential for carbon capture and storage.* https://cdn.catf.us/wp-content/uploads/2024/04/26092017/ccs-poland-fact-sheet.pdf

56 Gładysz, P., Nowak, W., Bukowski, M., Śniegocki, A., & Bączyk, A. (2021). Rola technologii wychwytu, transportu, utylizacji i składowania CO_2 w drodze do osiągnięcia neutralności klimatycznej. *Nowa Energia*, (3), 31–35. https://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-22bef219-18d4-4ba4-9a87-5c98348d644f

57 Negotiated TPA means that the terms of access, including fee structures and related rules, are determined through direct negotiations between the infrastructure operator and the user (the CO_2 emitter). Both parties are obliged to act in good faith. This model ensures flexibility, enabling agreements to suit the specific needs of each project. It also reduces administrative burdens in the early stages of CO_2 network development. Regulated TPA means that third-party access is granted based on standardised conditions set out in legal provisions and determined by the regulator, in particular through tariff arrangements for transmission services approved by the regulatory authority.

Table 4: A Summary of Key Provisions in Existing National Regulatory Frameworks for CO_2 Pipeline Transport[58]

Jurisdiction	TPA Framework	Description
Germany	Negotiated TPA with regulatory safeguards	Operators must grant other undertakings non-discriminatory access on terms that are appropriate and transparent, and not less favourable than those applied internally or to affiliated or associated undertakings. Access may be refused only where the operator demonstrates a lack of capacity or compelling legal reasons. The refusal must be justified in writing and sent to both the requesting party and the Bundesnetzagentur (federal regulatory authority). Where refusal is based on lack of capacity, the requesting party may require information on the concrete expansion measures and associated costs needed to enable access. Operators may also be required to carry out expansion measures where economically reasonable or where the requesting party assumes the costs, provided that safety of the system is not impaired.
Denmark	Negotiated TPA with regulatory safeguards	The network operator must grant access on objective, transparent and non-discriminatory terms. Access may be refused only on limited grounds, including incompatible technical specifications or insufficient capacity. Standard tariff ranges are published, but final tariffs are ultimately negotiated with users. Tariffs must be reasonable, transparent and based on clear principles, and may not cover repayment of investments already expected to deliver a reasonable profit.
Belgium – Wallonia / Flanders	Regulated TPA	A single network operator for each region is appointed by government. Local and regional operators must be legally distinct from emitters and must grant and open access. Access may be refused based on incompatible specifications, lack of capacity or other reasonable needs of the operator and other users. Tariffs must be objective, transparent and non-discriminatory, based on actual costs and a reasonable profit margin. Wallonia provides for a regulator-adopted pricing methodology, while Flanders requires review of whether such methodology is needed before 2028 and every five years thereafter. Network operators must also prepare long-term development plans covering future capacity requirements, national and cross-border connections and investment needs.
Netherlands	Negotiated TPA with increasing regulatory monitoring	Tariffs are negotiated between capture projects, transport operators and storage companies. The Netherlands has relied heavily on project-based arrangements, including publicly owned entities in Porthos and market-based conditions for future projects such as Aramis. However, because of the potential monopoly position of large CO_2 trunklines, high benchmark tariffs and overlap between transport and storage actors, the Dutch government has indicated that it will monitor the market more closely and investigate the risk posed by high and uncertain tariffs.

[58] For more information on negotiated and regulated third-party access approaches and broader regulatory aspects of CO_2 infrastructure, see: T. Lockwood (2025), *Building Future-Proof CO_2 Transport Infrastructure in Europe*, Clean Air Task Force, https://www.catf.us/resource/building-future-proof-co2-transport-infrastructure-europe/

Negotiated TPA is emerging as the preferred model for leading CCS projects in the EU, with varying levels of regulatory oversight either imposed or anticipated. This model may be particularly advantageous for large, integrated companies capable of managing substantial segments of the value chain independently.

In an emerging Polish market characterised by a limited number of potential storage sites and transport routes, smaller industrial emitters may face uncertainty regarding access terms. This issue is especially relevant for sectors such as cement, where individual emitters may lack the scale or bargaining power necessary to negotiate favourable bilateral agreements under negotiated TPA regime.

In the initial phase of Poland's CCS infrastructure development, the approach should involve negotiated TPA, supported by robust regulatory oversight and a dispute resolution mechanism. In the longer term, the system should transition to regulated TPA, using tariffs and standard agreements approved by the regulator. This position aligns with current EU law, as the CCS directive allows flexibility through TPA, provided it ensures fair and open access to the infrastructure. It also reflects the similar regulation in related sectors, such as hydrogen, where a gradual move from negotiated to regulated TPA is envisioned. A regulated TPA framework appears to be more suitable for the future Polish CCS market as there is likely to be only one transmission network operator designated.[59] Regulated tariffs facilitate expansion of the infrastructure by employing approved cost-recovery mechanisms, including cost amortisation and mutualisation, to guide planning and capacity increases, as demonstrated in pipeline projects.[60] The regulatory framework should nonetheless retain adequate flexibility to support first-mover initiatives, cluster-specific solutions, and anticipated EU regulations on CO_2 transport markets. Identifying regions and industrial clusters that could support Poland's CO_2 infrastructure backbone is the first step in prioritising where pipeline infrastructure should be developed and integrated with other transport modes. A multimodal CO_2 transport network provides facilities with a wider set of options to reach storage, enabling scale economies and competition to reduce unit transport costs, enhancing network resilience and, in certain cases, allowing for the reuse and redevelopment of existing assets such as the port in Gdansk.

An instructive example is the UK's CCUS cluster sequencing process, which identified priority clusters through a competitive assessment rather than ad hoc designation: candidate clusters first had to show they could have CCUS credibly operational by 2030, and included a full-chain transport-and-storage network linked to at least two capture projects; eligible clusters were then ranked using weighted criteria covering deliverability (30%), emissions reduction potential (25%), economic benefits (20%), cost considerations (15%), and learning and innovation (10%).[61]

Social Acceptance

Description: Project achieves adequate local and broader public acceptance to proceed without significant delays, litigation risk, or political opposition that could undermine investment confidence.

Social licence for CCS projects will be a key determinant of their deployment and role in decarbonisation of the industry. The surveys in Poland conducted by WiseEuropa on behalf of CCS.pl in 2023 found that less than 46% of the respondents could identify sectors in which CCS could be deployed. Public acceptance of CCS varies considerably across Poland, reflecting both regional disparities and the unique social, economic, and historical characteristics of the affected communities.[62] The 2023 WiseEuropa study mapped support for underground CO_2 storage at the Polish

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59 At present, there is no formally designated operator of the CO_2 transport network responsible for pipeline transport of CO_2 and for the obligations connected with transporting CO_2 to storage, underground storage, utilisation or transshipment points.

60 Foglia, C., Philipp, K., & Pernot, E. (2025, September). *Designing Europe's CO_2 market and infrastructure: A framework for action.* Zero Emissions Platform. https://zeroemissionsplatform.eu/publication/designing-europes-co2-market-and-infrastructure/

61 Department for Energy Security and Net Zero, Department for Business, Energy & Industrial Strategy, *Cluster sequencing for carbon capture, usage and storage (CCUS) deployment: Phase-1*, GOV.UK, 7.05.2021, aktualizacja: 1.11.2021, https://www.gov.uk/government/publications/cluster-sequencing-for-carbon-capture-usage-and-storage-ccus-deployment-phase-1-expressions-of-interest

62 Giers, M. (2024). *Akceptacja społeczna technologii CCUS w Polsce.* WiseEuropa. https://ccus.pl/uthistag/2024/11/Akceptacja-spoleczna-technologii-CCUS-w-Polsce.pdf

voivodeship (province) level, finding support from as low as 18% in some regions to as high as 40% in others. The highest support was recorded in the southern provinces, where industry is concentrated and coal or other hydrocarbons are mined. In contrast, the lowest support for underground storage was found in the northern provinces, where there is less heavy industry. Evidence from previous CCS deployment attempts in Poland and other countries indicates that projects may fail even when technically and regulatorily prepared, if communities perceive risks, including safety and environmental impacts, as outweighing potential benefits, or if they feel excluded from decision-making processes.[63] Support for CCS is not fixed and will depend on how well authorities and project developers communicate, educate, and run transparent consultation processes. Given how sensitive these investments are for local communities, there is a real risk that future projects will trigger uncertainty or resistance if people feel excluded or insufficiently informed.

This is why a well-designed, coordinated communication effort is essential for explaining the benefits of CCS, enabling the government or investor to engage local communities credibly, for instance, through citizen panels. At the same time, local communities need to be involved early and meaningfully in decision-making, especially where projects directly affect their surroundings. Only sustained, open engagement that takes concerns seriously can build trust and reduce the likelihood of opposition. Otherwise, even the most advanced projects may ultimately be blocked at the local level.

Robust Supply Chain

Description: The supply base required to build and operate projects is available at sufficient scale, reliability and technical quality to support repeated deployment.

CCS deployment requires coordinating several interdependent stages, whose success depends not only on the technical performance of individual technologies but also on the effective organisation and integration of the entire supply chain. A robust CCS supply chain requires coordination across multiple stakeholders (emitters, infrastructure operators), which often makes risk and liability allocation complex; the absence of a single risk bearer complicates financing and insurance.

The CCS supply chain comprises technologies for the capture, transportation and storage of CO_2. Each of these components requires specialised knowledge and equipment; collaboration among various stakeholders is essential for the success of CCS technologies. The development of CCS in Poland will be determined by the location of industrial emission sources, the availability of appropriate geological storage sites, and access to carbon dioxide transport infrastructure. Supply chains are not mature.[64] In the current market structure there are no Polish suppliers offering complete industrial CO_2 capture solutions, with end-to-end offerings typically provided by large foreign companies that nevertheless operate through Polish branches and partnerships, including firms such as Linde Group and Air Liquide.[65] However, this gap does not indicate a lack of potential in the national supply chain. The development of CCS in Poland can create new market opportunities for domestic companies, allowing them to participate as subcontractors, fabricators, and specialised service providers. Notably, Polish entities, particularly in the oil, gas, and petrochemical sectors, have already CCS-relevant experience that could support project development and operations.

Commercial Insurance Availability

Description: Project can access commercial insurance to insure its financial performance.

Assessing the insurability conditions and developing insurance solutions for emerging climate technologies, such as CCS, is complex due to the new risks involved and the lack of historical data. An essential criterion of insurability is the randomness and independence of loss occurrence; insurability is compromised if there is a systemic, foreseeable risk, such as design flaws, that is only discovered after a technology has been in operation for some time.[66]

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63 Gładysz, P., & Kupiec, B. (2025). *Capturing public trust: Social acceptance of CCS in Poland.* Clean Air Task Force. https://www.catf.us/resource/capturing-public-trust-social-acceptance-of-ccs-in-poland/

64 Giers, M. (2025). *National study on capacity gaps in carbon management: Emphasizing carbon capture and storage deployment in Poland.* WiseEuropa. https://wise-europa.eu/wp-content/uploads/2025/11/GreenHorizon-National-Study-on-Capacity-Gaps-in-Carbon-Management-POLAND.pdf

65 Giers, M., & Rubaszek, M. (2024). *Społeczno-ekonomiczne korzyści z wdrożenia CCUS w Polsce. WiseEuropa.*

66 The Geneva Association. (2024, April). *Bringing climate tech to market: The powerful role of insurance.* Author: Maryam Golnaraghi. https://www.genevaassociation.org/sites/default/files/2024-04/climate_tech_2_report_090424_web_.pdf

Insurance is a central element in the commercialisation of CCS because it helps bridge the gap between technical uncertainty and investment discipline. In early projects, the problem is not only that risk is high, but that its commercial consequences are still difficult to isolate and price with confidence. When project performance remains uncertain, financiers do not treat that uncertainty as a neutral variable. They convert it into a higher cost of capital, tighter terms, and a more cautious view of future cash flows. Insurance matters because it makes this uncertainty more acceptable to investors and lenders. It does not remove risk from the project, but it can more clearly define its financial perimeter and reduce the uncertainty that sponsors or the state must absorb. For emerging climate technologies, access to commercial insurance depends on the availability of suitable insurance products and insurers' willingness to offer adequate capacity at acceptable prices, with policy terms that do not expose the technology to significant risks that affect bankability. Insurers remain cautious when technologies transition from demonstration to commercial deployment, as they must assess substantial capital exposures, and evolving regulatory conditions. These factors complicate the modelling of loss scenarios and the pricing of risk.

In CCS, these complications are compounded by the fact that insurers are not assessing a single asset but the economic and technical feasibility of an entire supply chain. Insurers are focused not only on operational risks, such as physical damage and construction-cost overruns, but also on risks specific to CO^2 infrastructure (underperformance of capture technology, integrity risks affecting pipelines). Particular scrutiny is also directed at geological storage, because leakage exposure creates loss profiles that are more difficult to assess than those associated with commercialised technologies. Even if individual elements of the CCS value chain are technically insurable, insurers may find it difficult to quantify losses from cross-chain dependencies. The financial performance of the insured project often relies on the timely and reliable operation of other parts of the CO_2 value chain, such as capture, transport, and storage infrastructure. For that reason, insurers also look for evidence that the financial assurance obligations under permitting regimes have been understood, and that investors can demonstrate how the CCS project will be managed in practice.

These issues are especially relevant in Poland, where the scaling up of commercial insurance for CCS is constrained by the immaturity of an adequate policy environment. Poland does not yet have a mature CCS supply chain from capture through transport to storage, which means that insurers lack domestic operating history, claims experience and standardised underwriting assumptions for such projects. This is compounded by the fact that the regulatory and administrative frameworks for CO_2 infrastructure remain incomplete. Under such policy conditions, insurers are required to consider not only engineering risk but also a broader layer of policy uncertainty.

The current Regulation of the Minister of the Environment of 30 October 2015 on financial security and the securing of funds related to the underground storage of carbon dioxide together with the Geological and Mining Law, places a significant financial burden on operators involved in CO_2 transport and geological storage.[67] The existing regulatory framework does not enforce the establishment of a guarantee fund or an insurance scheme covering potential liability for CO_2 leakage from storage sites or pipeline networks.[68] Although the risk of secondary CO_2 emissions is considered low, it remains legally relevant and may generate uncertain future costs related to emission charges in the event of storage site leakage after closure. In Poland, exposure does not last indefinitely, but may continue during the post-closure period until responsibility for the closed storage site transfers to the National Administrator of Underground Carbon Dioxide Storage Sites. According to the Polish Geological and Mining Law, the operator is responsible for post-closure monitoring for at least 20 years and for addressing emissions if CO_2 leakage occurs, until all statutory conditions for transferring responsibility are met, including proof of the storage complex's long-term stability. These requirements may adversely affect the financing terms for geological CO_2 storage projects.

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67 Rozporządzenie Ministra Środowiska z dnia 30 października 2015 r. w sprawie zabezpieczenia finansowego i zabezpieczenia środków związanych z podziemnym składowaniem dwutlenku węgla, Dz.U. 2015 poz. 2144, https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20150002144/O/D20152144.pdf

68 Przybojewska, I. (2018). *Legal possibilities of carbon capture and storage in Poland.* Law and Administration in Post-Soviet Europe, 1, 18–27. https://ruj.uj.edu.pl/server/api/core/bitstreams/7cdbdde0-b611-47a5-ba86-88a9ebd246e0/content

Commercial insurance availability for CCS projects is limited due to the early stage of market development and the lack of large-scale operational facilities in Poland. An additional reason for the limited availability of commercial insurance is that the evaluation and pricing of insurance risk associated with emerging technologies is particularly challenging in the early phases of market development, as insurers are required to evaluate complex and interdependent technical and operational risks despite limited large-scale deployment evidence and a still-developing base of specialised underwriting expertise. From an insurance perspective, any leakage event must enable precise quantification of the volume of CO_2 released, as this directly influences the scale of potential claims and recoveries; in situations where exact measurement is not feasible, leakage volumes may need to be inferred, potentially expanding liability beyond the loss of credits to encompass broader environmental harm.

Adequate Delivery System

Description: Public authorities have the practical capacity to move projects to commercial deployment through financing, permitting, construction and operation.

The Polish government provides a central digital access point for administrative and permitting information through Biznes.gov.pl; the portal serves as the main online interface for business-related administrative procedures. The platform offers general information on business establishment, permitting procedures, taxation and employment law, and allows electronic submission of selected administrative applications. It also provides links to public funding instruments and national support programmes, including those administered by the National Fund for Environmental Protection and Water Management and the Polish Agency for Enterprise Development. While Poland operates a well-developed central e-government portal, a dedicated CCS digital one-stop shop has not yet been established; the Biznes.gov.pl platform does not provide an integrated overview of the permitting pathway, dispute-settlement mechanisms or funding opportunities for CCS. Poland may comply with some of the requirements of the NZIA yet still fail to create conditions that enable CCS projects to reach final investment decisions, secure funding, and progress through permitting within credible timelines. Limiting the Single Point of Contact (SPOC) to an administrative mailbox would not address the fundamental administrative challenges hindering early-stage CCS projects. Due to insufficient experience among investors and administrative bodies, as well as lengthy permitting procedures, initial CCS projects will require concurrent learning among investors, permitting, environmental, and regulatory authorities. Without stronger coordination among competent authorities, Poland may struggle to meet the NZIA permit-granting time limits for net-zero strategic CCS projects, including the 18-month limit for all permits necessary to operate a strategic CO_2 storage site and deploy the related CO_2 capture and transport projects.

The central challenge in developing an effective SPOC is not access to information but the coordinated ownership of the permitting process by public administration. Investors require an entity capable of coordinating the permitting process in a single location.

A relevant reference point already exists in Poland, where the National Contact Point for Renewable Energy Sources offers assistance and guidance during the administrative process for obtaining permits for renewables.[69] Its online portal provides investors with an investment process catalogue, a list of administrative procedures, a contact form, and an investment procedures handbook. The procedural materials outline the purpose of each procedure, applicable cases, required documentation, competent authorities, expected durations, fees, appeal options, and electronic processing. While this structure alone is insufficient for CCS, it demonstrates a constructive administrative approach.

The Single Point of Contact should expand upon this model and tailor it to the increased complexity of carbon management projects. It should publish clear permitting roadmaps for CCS initiatives, including different investment procedures for onshore and offshore storage. Additionally, it should develop standardised guidance on environmental documentation, geological activities, concession requirements, construction permits, and the interactions among these procedures. While these materials would not substitute for legally binding decisions by competent authorities, they would reduce uncertainty during the critical stage in which investors assess project maturity and funding eligibility.

69 Ministerstwo Klimatu i Środowiska. (n.d.). *Krajowy Punkt Kontaktowy ds. Odnawialnych Źródeł Energii.* Portal Gov.pl. https://www.gov.pl/web/kontaktoze

Some institutional elements relevant to CCS development nevertheless exist, though they function in a dispersed, only partially coordinated manner. Responsibility for shaping national policy in this area lies primarily with the Ministry of Climate and Environment. While the government has established a Task Force for the Development of CCUS Technologies (operating from August 2021 to July 2025) and, more recently, initiated Working Groups under a Letter of Intent (March 2025) as advisory bodies bringing together public authorities, industry, NGOs and academia, these structures function primarily as platforms for preparing the policy and regulatory framework, not for project delivery.

Overall, the existing forms of administrative support remain fragmented and insufficient to advance CCS market maturity in Poland. A more structured system of administrative facilitation is likely to emerge only once the national carbon management strategy is finalised and accompanied by a dedicated enabling regulatory framework to accelerate the development of CO_2 infrastructure.