

First Movers Compensation

An Instrument for Protecting Emissions Reductions After the EU ETS Reform – A Paper on Behalf of KlimaUnion

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List of abbreviations

BECCS	Bioenergy with carbon capture and storage
CAPEX	Capital expenditure
CCfD	Carbon Contract for Difference
CEEAG	Climate, Energy and Environmental Aid Guidelines
CfD	Contract for Difference
CO_2	Carbon dioxide
ECT	Energy Charter Treaty
EHB	European Hydrogen Bank
EMAS	Eco-Management and Audit Scheme
EU	European Union
EU ETS	European Union Emissions Trading System
EUA	European Union Allowance
FID	Final investment decision
FIT	Feed-in tariff
IPCEI	Important Projects of Common European Interest
MS	Member State
OPEX	Operational expenditure
RFNBO	Renewable fuel of non-biological origin
SAM	State Aid Modernisation
TRL	Technology readiness level

1 Introduction

1.1 Background

The European Union Emissions Trading System (EU ETS) is currently undergoing significant reform, with the European Commission's July 2026 proposal seeking to adjust the instrument for the remainder of its fourth phase, as well as its fifth phase starting in 2031. Key measures include a reduced linear reduction factor, extended free allocation, additional European Union Allowance (EUA) supply for the ETS investment booster, and new mechanism for the use of offset credits. Taken together, the reform would ease supply constraints on allowances in the EU ETS which will tend to reduce prices of EUAs.

While a range of factors affect the EUA price movements, including geopolitical events, trade tensions and the business cycle, both spot market prices and post-2030 price projections for EUAs have adjusted downwards since the start of the reform process. EUA futures started falling in mid-January, coinciding with uncertainty over the expected reforms. The trend reversed into recovery in mid-February after European Commission President Ursula von der Leyen's public defence of the EU ETS. The EUA price climbed further in July after the publication of the reform proposal revealed details which were less bearish than worst-case scenarios (ClearBlue Markets 2026). The December 2026 EUA future now stands at 81 EUR, down from 92 EUR in January but up from 69 EUR in February this year (ICE Index 2026). Estimates for 2030 and beyond have generally been adjusted downwards as well: ABN AMRO revised its 2030 baseline from 145 to 138 EUR per tonne and 2035 baseline from 200 to 191 EUR; MATERIA now puts the 2030 price at 120 EUR per tonne in their probability-weighed scenario and at 103 EUR if the reform passes (ABN AMRO 2026; MATERIA 2026). ClearBlue Markets estimates the Commission's July 2026 proposal, if enacted as written, would lower 2030 prices by 22% (ClearBlue Markets 2026).

A lower EUA price can both erode the business case for low-carbon production and impair the value of already committed investments in low-carbon production assets. A lower production volume of low-carbon products would result in lower emissions reductions compared to the baseline case. By reducing the incentives for low-carbon production, Europe's industry might also miss the opportunity to establish itself as a leader in low-carbon production. Further, sustained revenue loss from reduced production could turn investments into stranded assets, negatively affecting the first movers' prospects at a time when Europe's industry already faces severe challenges, and delay its transformation towards net-zero.

1.2 Objective & Scope of this Paper

This paper explores a policy instrument ("the instrument" or "compensation instrument") to protect first movers in low-carbon production from lower-than-expected EUA prices, driven by the reforms to the ETS or other external factors. The paper discusses the **definition of first movers**, **arguments for and against** such an instrument, and potential **eligibility criteria**. It then explains the instrument's **design options** and their **implications,** provides an **indicative cost estimate,** and closes with **conclusions and recommendations.**

This paper deals only with this specific instrument as such and does not provide a systematic comparison with other options such as quotas or lead markets for low-carbon products.

This paper is intended to provide an objective analysis of the above topics and to serve as the basis for further discussion. It does not imply its author taking a position for or against the planned EU ETS reform or the instrument as such.

2 Instrument Design & Implications

This section deals with the design and implications of the compensation instrument, starting with the definition of first movers and the basic character of the instrument. It continues with the precedents and the arguments for and against the instrument, and concludes with a discussion on eligibility, type of support, allocation mechanism, and the instrument's duration.

2.1 Definition of First Movers in Industrial Decarbonisation

As with any public support instrument, targeted support and well-defined eligibility are crucial. Limiting the instrument's scope to first movers can be a useful proxy. A literature review provides some considerations relevant for defining a first mover:

- Bruegel notes that first movers take on distinct **disadvantages** expressed as both **risks** and **uncompensated spillovers** to late movers, related to the potential failure of technology, unproven commercial potential, not yet-identified cost-reducing measures, as well as non-existent supply chains and support ecosystem; based on this, Bruegel then argues that public support for first movers is necessary (bruegel 2021)
- Similarly, the Florence School of Regulation points out that first mover companies deploying **low-technology readiness level (TRL) solutions** are at a **disadvantage** unless necessary support measures in the financial and other domains is granted (Florence School of Regulation 2026)
- UK's 2021 Industrial Decarbonisation Strategy implies **deep decarbonisation** as a feature of first movers, as opposed to incremental savings achieved for example through energy efficiency measures (Department for Energy Security & Net Zero und Department for Business, Energy & Industrial Strategy 2021)
- E3G proposes that first movers are considering investments which would first **require de-risking** to reach a positive Final investment decision (FID) and argues in favour of EU assistance (E3G 2025)
- Clean Air Task Force (CATF) similarly implies that first movers are companies investing in decarbonised processes for which the current levels of emissions prices do **not support a business case** (Clean Air Task Force 2025)

Disadvantages, **risks** and **price gaps** which need addressing, as well as **deep decarbonisation** and **low-TRL** all feature in (partial and/or implied) definitions of first movers. In the interest of objectivity, it should be pointed out that first mover *advantage* is also an established concept covered widely in scientific articles and strategy documents. It implies that once a first mover is established in a market, other companies face entry barriers.

For the specific context of this policy instrument, further considerations are necessary. See section 2.4 for a detailed discussion of eligibility criteria.

2.2 Basic Character & Precedents

The choice between a capital expenditure (CAPEX) and operational expenditure (OPEX) focused support is fundamental for the instrument and many of its downstream design choices.

A CAPEX-based approach targets the (partially or fully) eroded value of an investment that has already been made prior to the ETS reform. It does so directly, e.g. by paying a lump sum compensation to the investor regardless of their operational decisions, including whether or not the relevant assets are indeed used for low-carbon production and intended emissions reductions materialize. The investor is the direct beneficiary of this approach, and its basic character is **compensatory** – it addresses the consequences of an eroded investment value rather than incentivising future behaviour.

An OPEX-based approach, by contrast, targets the eroded competitive advantage of the marginal unit of low-carbon production relative to its carbon-intensive incumbent. Its basic character is more akin to that of **State Aid** as defined by the European Commission, in that it must be in pursuance of a public interest objective, e.g. environmental protection, and in that it aligns with the "incentive effect" assessment principle of the Climate, Energy and Environmental Aid Guidelines (CEEAG)

(European Commission 2022).[1] The advantage of this approach is that it can easily be tied to output and therefore to emissions reductions. Furthermore, by protecting the production volume and the profit margins, it indirectly protects the value of the investment and with it, the investor itself.

Precedents are established for both approaches and are useful for exemplifying the basic design of the instrument and for examining the arguments for and against such an instrument.

Many cases exist of settlements between the state and the investor. A prominent recent example of CAPEX-based compensation is that of the Germany and RWE & LEAG in the context of the German coal phase-out. A negotiated loss-of-profit compensation worth about 4.4 billion EUR was reached, conditional on both companies waiving Energy Charter Treaty (ECT) arbitration rights. This compensation was not tied to output and aimed squarely at compensating the eroded value of beneficiaries' assets due to changes in policy.

An example of a mixed, CAPEX- and OPEX-based approach is the compensation scheme introduced after Spanish government's retroactive cuts to renewable feed-in tariffs (FIT) following the financial crisis of 2008, justifying the move as fiscal necessity. With no ex-ante protection in place, domestic investors had limited legal recourse while foreign investors pursued ECT arbitration which Spain repeatedly lost. The government ultimately agreed to a compensation in the form of guaranteed returns for both domestic and foreign investors, in part to avoid further litigation.

The OPEX-based approach has many precedents across EU Member States (MS). Germany's Climate Protection Contracts *(Klimaschutzverträge)* programme is one of the more prominent. Aid is allocated per tonne of CO_2-eq. avoided. Austria's Industry Transformation programme *(Transformation der Industrie)* follows a similar logic, supporting the operational cost differential of low-carbon production processes in energy-intensive industry. Sweden's Bioenergy with carbon capture and storage (BECCS) reverse auction scheme awards 15-year contracts to companies that capture and store biogenic CO_2 at the lowest cost per tonne.

Given the distinct advantage of the OPEX-based approach of protecting emissions reductions, this is the preferable choice and the only option discussed in the remainder of this paper.

2.3 Arguments for & against the Instrument

Based on the precedence cases and further considerations, the following arguments for and against such compensation instrument can be outlined. The former include:

- **Uncertainty around EUA prices for already made investments:** The current EU ETS reform amplifies regulatory uncertainty around future EUA prices, potentially weakening the business cases of low-carbon products from already made investments, thus endangering emissions reductions
- **Mitigating uncertainty decreases costs for future investments**: Mitigating regulatory uncertainty lowers the risk premium on future decarbonisation investments, ultimately decreasing the cost of the green transition
- **Many industrial companies are already under stress:** EU industrial decarbonisation investments are being made against a backdrop of simultaneous competitive shocks – US tariffs, Chinese production overcapacity, and high compliance and energy costs – reducing the wiggle room companies have to absorb additional regulatory risk
- **The instrument would not shield the companies against all types of risk:** This compensation instrument would not shield investors from market, interest rate, technology and other risks; it specifically addresses carbon pricing risk
- **It is first and foremost a risk protection instrument, not an additional subsidy:** Especially if a two-way instrument is selected, it is inherently symmetric

Main arguments *against* such compensation instrument can be summarised as follows:

- **Risk around future EUA prices had been known in advance:** Investors carried out the investments being aware of the uncertainties around the future carbon price; compensating them ex-post socialises losses that were explicitly accepted as private risk at the time of the final investment decision (FID)

[1] General criteria for any EU public support mechanism can be found in the political framing of the 2012 State Aid Modernisation (SAM) Communication. It provides the basis for the so-called compatibility checklist for state aid programmes as part of the 2022 Guidelines on State aid for climate, environmental protection and energy (CEEAG)

- **Difficulty in defining the entitled beneficiaries:** Establishing a compensation precedent for one class of decarbonisation investment creates pressure to extend it to adjacent sectors and technologies
- **Risk of moral hazard:** Guaranteed protection reduces future investors' incentive to conduct rigorous due diligence or hedge against foreseeable risks
- **Limited fiscal space:** At MS level, there are constraints regarding public expenditure; at EU level, the Clean Industrial Deal suggests aggregate capacity exists, however its distribution across MS and competing objectives present challenges
- **Reduced commitment to stable regulatory environment:** By providing the state a means of addressing ex-post the negative effects of policy reversal, such compensation mechanism may reduce the political commitment to maintaining stable decarbonisation policy in the long run
- **Cannot be confined to carbon-price risk:** Even if the difference in carbon price could be compensated exactly for each project, beneficiaries' operational decisions would still be based on a project's total economic viability which generally includes other factors as well (see above); compensating the carbon price difference therefore does not mean that each *individual* investment which would have been (un)viable without the EU ETS reform will remain so
- **Not only a risk-protection instrument:** When the probability-weighted expected outcome is a net transfer from the granting authority to the beneficiary – as is the case here, given that potential beneficiaries will only enter contracts with terms they consider favourable – the instrument takes on the character of an additional support mechanism

2.4 Eligibility, Type of Support, & Allocation Mechanism

Before considering the different design choices, the **criteria** for assessing them should be laid out. These are the following:

- **Effectiveness**, i.e. does the instrument contribute to achieving its stated goal(s);
- **Efficiency**, i.e. does the instrument achieve the goals in a way which minimises effort and costs and avoids or minimises windfall effects (i.e. benefits accruing to recipients beyond what would have been necessary to achieve the intended outcome); avoids or minimises unintended market distortions and externalities; and avoids or minimizes gaming opportunities and sophistication margin enjoyed by some participants over others (e.g. by large companies with dedicated in-house trading departments or able to afford specialised consulting services);
- **Ability to be operationalised**, e.g. can the instrument be implemented relying only on data which is readily available or can be collected with reasonable effort; be administratively manageable with reasonable effort for both the administrator and the beneficiary; have a robust budget estimate; and have rules which are publicly transparent and unambiguous in their application;
- **Legal implications,** i.e. does the instrument comply with relevant regulations and pass the relevant approval process (e.g. EU's State Aid Regulation). This paper acknowledges that legal implications need to be assessed without conducting such assessment.

Additionally, the design should be evaluated based on how it addresses the arguments against such an instrument, where relevant.

Following, the most relevant design features are presented and discussed. A central design choice is who is **eligible** as beneficiary of support via this instrument. Apart from the general criteria discussed in section 2.1, at least the following aspects should be considered:

- **Timing of commitment** – in the interest of avoiding windfall effects, only those projects should be eligible for support which were committed to before the intended EU ETS reforms became public knowledge. The projects committed to later can base their decisions on currently available information, including with regard to the ETS reform. This requirement can be operationalised by setting a hard deadline by which a respective project's FID must have taken place, e.g. via a proxy such as placing a binding procurement contract.
- **EUA price vulnerability** – based on their processes and cost structures, only those projects should be eligible which are at risk of their products becoming uncompetitive relative to the incumbents in the case of lower EUA prices (see section 2.2). This is not the case where the project has already received support which explicitly de-risks it against EUA price movement, such as carbon contracts for difference (CCfD) in the context of *Klimaschutzverträge*; where the low-carbon product has lower production costs

compared to the incumbent regardless of the EUA price, e.g. where investments in energy efficiency reduce the specific energy consumption and costs (in contrast to other low-carbon products such as direct-reduced iron or RFNBO-based fertiliser, which have higher production costs); where the producer cannot easily switch between low-carbon and conventional production; and where low-carbon products enjoy guaranteed demand, i.e. via quotas or lead markets. One possibility to operationalise this criterion is via a positive list at product or project level.

- **Commitment:** In a production-tied payout setup, participants that are allocated support but do not deliver, e.g. because their participation was speculative, strand the budget and reduce the total amount of emissions reductions over a given period. A binding delivery commitment would be most effective in alleviating this problem, but it comes with its own downsides, e.g. the projects can on balance be expected to require higher safety margins for participating, thus lowering the instrument's overall financial efficiency. Considering already committed projects only – either post-FID or already operational – can be expected to partly alleviate this issue.
- **Project size**: In the interest of reducing the administrative burden, a threshold for project size can be considered, e.g. referring to the investment volume or emissions reductions. Projects and measures falling in categories such as energy efficiency and cross-cutting technologies often exhibit lower emissions reductions per measure. These types of measure also tend to represent marginal emissions abatement, as opposed to deep decarbonisation sometimes associated with first movers.

The next key choice is the **type of support**. Two aspects have major implications, for both this choice and that of the allocation mechanism. The first is a pronounced information asymmetry between potential beneficiaries and the granting authority – only the former have detailed knowledge of their cost structures and EUA price expectations, while the latter cannot reliably determine the costs of novel industrial projects. The second is the high heterogeneity of the eligible projects' cost structures across sectors and technologies, so that any single administratively set level of support would inevitably be too high for some and too low for others.

A range of options exists for the type of support. Three basic types, discussed below, can be used to demonstrate the trade-offs: a two-way CCfD, a one-way CCfD, and a fixed premium per tonne of emissions savings. A one-way CCfD pays out only if the actual EUA price is below the strike price while the beneficiary keeps the upside.[2] Under a two-way CCfD, the beneficiary is paid the difference between actual EUA price and strike price if the EUA price is below the strike price, and the beneficiary pays back the difference if the EUA price is above the strike price. A fixed premium is paid independently of the actual EUA price.

For all these support types, the fundamental trade-off is between the level of the expected payout and the price risk remaining with the beneficiary. Because the potential beneficiaries are generally risk-averse, the more risk the granting authority absorbs, the lower the acceptable strike price can be. A **one-way CCfD** does not escape this trade-off. The beneficiary keeping the upside is not entirely compensated for via a lower strike price, i.e. weaker downside protection for the recipient, leading to higher expected payouts.

The **two-way CCfD** is the preferable choice because it fixes the effective carbon price that the beneficiary's business case requires. The capped upside also deters participation of projects viable without support, reducing windfall effects and crowding out. Its disadvantages include less predictable annual fiscal exposure since the net payment can flow in either direction depending on the EUA price; the counterparty risk in case of paybacks; the political economy of collecting paybacks; and a muted carbon market signal. Mandatory settlement of all relevant production is a necessary safeguard (see below). The EU's Climate, Energy and Environmental Aid Guidelines (European Commission 2022) explicitly name CCfDs as one of the allowed support types in the relevant policy areas.

A fixed premium fails the instrument's main purpose as it provides no hedging – the beneficiary's revenue continues to move one-to-one with the EUA price, albeit at a higher level. Its advantages such as simple administration and predictable per-tonne payouts cannot be viewed to compensate for this failure.

[2] Strike price is the pre-agreed price level at which a one- or two-way contract for difference (CfD) is settled. If the market price falls below it, the granting authority pays the difference to the beneficiary; if it exceeds it, the beneficiary pays the difference back.

Regardless of allocation mechanism (see below), the following features should be considered for a CCfD-type support instrument:

- **Budget as the constraining value**: For administrative purposes, the total payout must be estimated in advance; it depends on the total volume of contracts (expressed as expected emissions reductions) and the payout per contract.
- **Voluntary participation:** Since a CCfD obligates the beneficiary to payback if the EUA price exceeds the strike price, it represents a financial risk to the potential beneficiaries which only they can properly assess. Obligating them to participate is therefore incompatible with an administratively determined strike price, as well as strike prices determined in an auction in case a price ceiling is in place.
- **Mandatory settlement for all relevant production:** In case the CCfD is out of the money for the beneficiary, the beneficiary should not be able to produce without settling. This safeguard prevents a two-way CCfD contract from effectively turning into a free one-sided CCfD, which would not enforce self-discipline among potential beneficiaries or work against crowding out. (Mandatory settlement should not be confused with binding delivery commitment; the former still lets the beneficiary decide freely whether to produce or not, while the latter obligates the beneficiary to deliver the full volume to which support is allocated.)
- **Managing the stranding of support**: If the beneficiary decides against low-carbon production despite having been allocated support, a part of the total budget remains unused, lowering the emissions reductions. A binding delivery commitment would obligate the beneficiary to produce the agreed volume by imposing a penalty for non-production. While this can be expected to increase the production *among the beneficiaries*, it represents additional risk for all potential participants, which must be expected to reduce the number of participants and/or drive up the strike price. Alternative options exist for preventing the stranding of support, such as a contract lapse: In case of non-delivery by a specified deadline, the contract is voided and the budget reallocated. It is worth pointing out that stranding can happen in both auctions and an administrative setup. In the latter, speculative and serious beneficiaries can ultimately fail to deliver for a variety of reasons; without them, the posted strike price could have been higher, protecting a higher volume of emissions reductions.
- **Segmenting the potential recipients:** Both a technology-neutral allocation and segmenting of potential recipients – e.g. by product – have their advantages. The former enhances competition and reduces the scope for strategic bidding and coordination when auctions are used, while also reducing administrative burden. The latter is more complex and suffers more from information asymmetry but can improve the allocation efficiency if done correctly.

Another key design choice is the allocation mechanism. Two options are considered in this paper: allocation via auctions, and administrative allocation where the granting authority posts the CCfD strike price and eligible recipients decide whether to enter the contract or not.

The case for auctions rests on the information asymmetry and cost structure heterogeneity. An **auction-based allocation** is superior at inducing the potential beneficiaries to reveal the level of support they actually need, reducing windfall profits. Assuming both allocation mechanisms have the same, fixed budget, a competitive process with a pay-as-bid strike price can reach the projects that a uniform, administratively set price cannot. Another advantage is a more straightforward budget planning enabled by cutting off higher-priced bids once the pre-determined budget has been exhausted. On the other hand, competitive allocation comes with its own challenges and disadvantages. It requires a sufficient number of bidders for the auction to be competitive, which is a risk where the pool of eligible beneficiaries is small. It also entails higher complexity, more elaborate rules, and a design burden relating to bid components, potentially leading to a longer lead time.

Administrative allocation reverses this profile. Its principal weakness is that it requires the granting authority to set a uniform price, exposing this setup to overpaying by granting the most efficient projects the highest windfalls. At a fixed budget, these inframarginal payouts lead to a lower volume of total emissions reductions. Information asymmetry also makes ex-ante budget estimation more difficult, as the level of the strike price is the only direct lever available to the granting authority for adjusting the incentive level. The advantages of an administratively determined strike price are higher predictability for the potential beneficiaries, lower complexity and lower transaction costs. A posted strike can be implemented quickly, is transparent,

and imposes a lighter analytical burden on smaller or less sophisticated beneficiaries, narrowing the sophistication margin. This allocation mechanism also does not depend on competition. While determining the strike price reliably is difficult ion practice, matching the posted strike price to the EUA price expected by the beneficiaries when committing to their respective investments can, on average across the pool of eligible recipients[3], compensate the EUA price difference only while not compensating for other factors which might have eroded the business case. This outcome is not guaranteed in the auction setup. However, where other factors did additionally erode the business case, this approach can be expected to offer insufficient level of support and lead to a lower overall volume of protected emissions reductions.

On the criteria set out above, the auction is the stronger choice on efficiency wherever adequate competition can be expected. The administrative model is preferable on operationalisation and becomes the more defensible choice as the eligible population shrinks and competition dwindles. Both options generally avoid distorting the competition, as recipients with stronger business cases (e.g. due to higher efficiency, a higher level of innovation, or better process integration) have a better chance of securing the strike price their business case needs. The two options are not mutually exclusive: a hybrid – e.g. a posted strike corridor within an auction, or an auction reverting to a posted price if bidder numbers fall below a threshold – can capture part of both, at the cost of added complexity.

2.5 Duration

The instrument's total lifetime should ideally reflect the length of the projects it addresses; relevant existing funding programmes typically have a duration of 10 (e.g. European Hydrogen Bank) or 15 years (e.g. *Klimaschutzverträge*).

However, it must be assumed that the bids (in case of allocation in auctions) or participation decisions (in case of administratively set strike price) will reflect the total risks associated with the viability of the business case (see section 2.3), beyond just the EUA price. These are exceedingly hard to assess reliably with longer time horizons, driving participants towards higher risk premia and decreasing the instrument's efficiency. This builds a strong case for splitting the instrument's lifetime into several phases with a shorter contract duration, after which the necessary level of support is determined anew. A duration of five years could be a reasonable balance between minimising risk premia and giving the beneficiaries a sufficient level of planning security. In case market or policy conditions change in the future so that support via this instrument is not required anymore, subsequent phases can be forgone. Smaller interim allocation rounds can be considered for redistributing the stranded budget. To further reduce the risk premium, an additional tool that can be considered is indexation to inflation.

A gradual phaseout of the instrument is worth considering. It should preferably take the form of lower total budgets in subsequent phases, rather than reducing the initially agreed support levels for individual projects, as this would risk projects forgoing low-carbon production once support drops below what their business cases require.

[3] But not for each potential beneficiary individually, as they will base their respective participation decisions on whether or not the available CCfD strike price is sufficient for their business model as a whole

3 Assessment of the Instrument's Financial Needs

This section provides an indicative estimate of implementation costs for the 2027 - 2031 phase of the compensation instrument. Due to compounding uncertainties resulting from limitations in publicly available data, required assumptions and methodological simplifications, it is intended to provide an order-of-magnitude estimate rather than an exact value. The assessment logic is in line with general design considerations laid out in section 0 while remaining agnostic regarding some of the key design choices, such as choosing one of the two allocation mechanisms discussed in section 2.4. The choices were made with focus on the robustness and confidence under limitations stated above, rather than on accuracy.

3.1 Selection Of Entitled Beneficiaries & Assessment of Eligible Abatement Volume

In this simplified model, the cost of compensating first movers for EUA price vulnerability is the product of two quantities: the volume of eligible emissions reductions, and the per-tonne price differential due to the EU ETS reform and other factors.

To estimate the volume, 23 EU and national industrial decarbonisation support programmes were identified across five Member States (MS) – Germany, France, Italy, Spain and the Netherlands. Additionally, relevant EU-level instruments open to all MS were included in the scope: the Innovation Fund, four IPCEI hydrogen calls, and the European Hydrogen Bank. In most cases, programme-level assessment was chosen over project-level, since beneficiary-level data is often unavailable for national support schemes, and because the eligibility criteria in section 2.4 generally relate to instrument design rather than individual investments. Programme level assessment however misses the largest individual first movers, whose support was notified to the European Commission as individual State Aid decisions; eight such decisions, all in the steel sector, were therefore assessed individually. Freely allocated emissions certificates for the CBAM sectors are not included in the scope.

In a first step, three filters were used to scan the eligibility of different programmes and individual investments on a pass-or-fail basis. The first filter is technology-based. Only direct electrification, process and fuel switching including hydrogen-based production, and carbon capture and storage are in scope. Emissions reductions resulting from energy efficiency measures and biomass combustion without CCU/S are excluded due to their high maturity, marginal rather than deep decarbonisation, and smaller size of the typical installation. Energy efficient production generally also has a lower cost per unit of product than the incumbent. For the Innovation Fund, whose portfolio contains a broad mix of technologies, just under a half remains in scope.

The second filter is temporal. Only projects holding a confirmed grant agreement, contract signature or equivalent legal commitment by 31 December 2025 are in scope. This is used as an easy-to-operationalize proxy for committing to the investment before the EU ETS reform. For the total eligible emissions estimate, this filter proved more consequential than any other eligibility criteria, as it partly or completely eliminates eight of the 23 programmes, including the Dutch electrification contract-for-difference and the Spanish hydrogen mechanism, which were announced but not contracted before the cut-off date, and the first round of the French GPID tender whose seven beneficiaries were designated in February 2026. For the individually notified steel projects, the filter was the actual FID applied at project level, eliminating five of the eight projects.

The third filter are the four EUA-price vulnerability criteria laid out in section 0. These test whether a change in the EU ETS price affects the business case of low-carbon production. Coverage of the funded installation by the EU ETS was not a prerequisite; a producer outside the ETS competing against ETS-

covered fossil output is generally exposed, because a falling EUA price improves its competitor's position relative to its own. The French GPID doesn't hedge against price swings, and therefore falls inside the scope of the instrument. Dutch SDE++ and German *Klimaschutzverträge* hedge against the EUA price risk and contribute no eligible emissions to our estimate. Manufacturers of equipment are excluded despite potentially receiving support (e.g. electrolyzers under IPCEI), since they sit upstream from potential beneficiaries in scope of this instrument and making them eligible would lead to double counting. The vulnerability to EUA price can also vary by jurisdiction for the same technology due to differences in tax regimes, the electricity-to-gas price ratio, and other cost or revenue factors; no differentiation was used with respect to this, and a universal decision was applied across all EU MS.

Eligible emissions volumes were then estimated in a top-down manner, starting with a single figure for total abatement over the instrument's first 5-year phase from 2027 to 2031, using published programme target emissions savings as the point of departure. Each starting value is then reduced in sequence by the share of projects deemed likely to never reach realization; a commissioning factor reflecting staggered entry into operation over the 5-year period; a deduction for the share of ineligible technologies in case of programmes with multi-technology scope; and a deduction for the share of a programme whose recipients are already hedged against the EUA price. The Innovation Fund, whose four grant calls before the cut-off date are expected to provide upwards of 800 Mt CO_2-eq. of emissions reductions over its first 10 years, contributes about 48 Mt between 2027 and 2031, the largest volume among all programmes.

Because some investments stack support from different programmes, their emissions are potentially counted twice in this step. For example, the same physical electrolyser can hold an IPCEI notification, a national IPCEI grant and an EHB premium, as IPCEI participation and IF support are routinely stacked (HYDROGENERA 2025). This step reduces the total eligible emissions by about 5%.

The eligible emissions remaining at this stage of assessment amount to 79 Mt CO_2-eq. in total, or 52 Mt CO_2-eq. from EU-level instruments, 12 Mt CO_2-eq. from the national programmes, and 15 Mt CO_2-eq from the three eligible German steel decarbonisation projects supported through individual notifications.

Because only five MS were featured in the initial programme-level assessment, an extrapolation to the EU as a whole is carried out next for the national programmes. Individually notified projects are scaled too but only moderately, as a limited number of comparable cases outside of the five MS in this sample.

In this way, the total volume of eligible emissions for the 2027 – 2031 period is assessed to around 90 Mt CO_2-eq. Due to the approximations and simplifications undertaken in different steps of this calculation, the estimate should be viewed as indicative, with a plausible band of between 50 to 150 Mt CO_2-eq. The suspected biases run in both ways and include:

- **Innovation Fund composition (both directions):** The technology split of the fund's last and largest call could not be determined at a project level and was assessed on the basis of the previous calls.
- **Overlap (upward):** The identified overlaps are probably understated, since no beneficiary-level matching was performed and stacking is a regular occurrence (see above).
- **The extrapolation (both directions):** The five assessed MS are those with the largest industrial sectors and national decarbonisation programmes, which is why they were assessed first; linear scaling assumes the remaining MS fund decarbonisation at comparable intensity, which might be an overestimate. On the other hand, The Netherlands' industrial decarbonisation programmes tend to hedge against the EUA price, skewing the eligible emissions volume downwards for the five MS in the sample; remaining MS without national contracts-for-difference would likely fail the hedging criterion less often, so a higher share of their emissions would qualify.
- **Undercounting of abatement from hydrogen (downward):** Hydrogen emissions reductions volumes are conservative, because the ETS benchmark understates the emissions intensity of the steam methane reforming that hydrogen often displaces.
- **Public support programmes only (downward):** Projects that didn't receive public support do not feature in our sample, lowering the total amount of eligible emissions.

At the project level, 300 to 350 potential beneficiaries in total can be deduced from the analysis.

3.2 Assessment of EUA Price Differential

The second input to the cost estimate is the per-tonne gap between the EUA price first movers could reasonably have anticipated when making their investment decisions and the price they are likely to face during the 2027 – 2031 phase. This gap is the quantity a compensation instrument would need to cover.

The relevant counterfactual are the pre-reform price levels expected by the investors at the time of commitment to their projects. Since those are not publicly known, the gap is approximated by comparing forecasts published before and after the EU ETS reform. Materia, an EU carbon market intelligence service, published updated EUA price forecasts in July 2026 after reviewing the proposal (MATERIA 2026). Its status quo modelling places the 2030 EUA price at approximately 120 EUR on a probability-weighted basis which considers that the reform has not been passed yet, against approximately 103 EUR if the Commission's proposal is adopted in its current form. This constitutes a differential with the lower bound of 17 EUR. ABN AMRO revised its 2030 baseline from 145 to 138 EUR per tonne and 2035 baseline from 200 to 191 EUR, for a price differential of 7 EUR (ABN AMRO 2026).

ClearBlue Markets puts the reform's downward effect on the 2030 price at 22%, which would imply a somewhat larger gap assuming a roughly similar absolute price level (ClearBlue Markets 2026).

Energy Aspects revised its EUA forecast down from 97 EUR to 95 EUR for the 2027 – 2030 period, and from 136 EUR to 124 EUR for the 2031 – 2035 period (Energy Aspects 2026). This is the smallest gap of all, but it also refers to an earlier timeframe than the rest. It should be noted that most of the changes causing the certificate supply to relax only come into effect in 2031; the price-lowering effects over four of the five years in this instrument's first phase are therefore mostly anticipatory. On the other hand, since projects will enter service in a staggered way during the instrument's first phase, a volume-weighted payout average skews towards the end of the 2027 – 2031 period.

Given the range above forecasts, an estimate of 15 EUR per tonne of CO_2-eq. is adopted as the average price differential for the 2027–2031 period. No indexation to inflation is used in this simplified model.

An obvious source of uncertainty is the future EUA price, which is affected by factors other than any changes to the EU ETS regime. Further, the estimate includes a suspected downward bias which relates to **the timing of the reform.** Supply starts to meaningfully relax only from 2031, and the 15 EUR estimate reflects an average of a small gap for 2027 and the higher gap in 2030. But since allowances can be transferred across years, the lower 2031 price could pull down prices earlier in the period by more than just a few EUR.

3.3 Cost Estimate

From the estimated 90 Mt CO_2-eq. of emissions reductions eligible for support and the EUA price differential of 15 EUR per tonne of CO_2-eq., total expected costs in a CCfD setting are estimated at 1.35 billion EUR over the instrument's first phase between 2027 and 2031.

As already mentioned above, data availability, necessary assumptions and simplifications, uncertainties with regard to the actual future EUA price, as well as suspected biases make the above cost an order-of-magnitude estimation rather than a precise figure.

Two further factors increase the uncertainty. As discussed in the section 2.3, the investors eligible for support will base their decision about participating in this instrument – expressed either through their bids in case of auctions, or a yes or no decision when the strike price is determined administratively – on whether or not the business case for low-carbon production exists as a whole, and this depends on factors beyond the EUA price. As the business environment for European industry has generally deteriorated in recent years due to trade disputes, China's export offensive and energy shocks, a higher compensation per tonne of CO_2 emissions might be necessary to secure the companies' participation.

The second factor potentially driving up costs of the instrument is overpaying the bidders beyond what would have been necessary to incentivise their participation, which can happen under both allocation mechanisms – auctions and an administratively determined level of support. On the other hand, lower-than-expected level of participation by the eligible parties can decrease the costs.

4 Conclusions & Recommendations

This paper discussed the design and implications of a policy instrument intended to compensate for future EUA prices that, due to the ongoing EU ETS reform, could potentially be lower than expected by first movers when they committed to investments in industrial decarbonisation. This section summarises the main findings and derives recommendations.

The first part of the paper deals with design choices and their implications. The argument is made that the instrument should only target projects which had been committed to before the information of EU ETS reform became public knowledge and whose business cases are threatened by lower EUA price, in order to concentrate the support on the projects that need it and minimize windfall effects. The instrument should be aimed at the operational level of the projects, protecting their respective business cases for low-carbon production and ensuring that the intended emissions reductions take place, rather than pay a lump-sum to the investors.

Further, this paper identifies two-way carbon contracts for difference (CCfD) as the best-suited support type due to its maximal hedge against future EUA price and the lowest expected payouts for the granting authority. For allocating the support, auctions and an administratively determined strike price were considered. In a context such as this, with sharp information asymmetry and high heterogeneity among the potential beneficiaries, auctions are generally the favoured option if sufficient competition exists. With a pool of potential participants standing at 300 or more, this condition could potentially be satisfied, especially if no segmentation takes place. Where competition is not sufficient – e.g. due to segmentation of the eligible pool of recipients – administrative allocation can become the favoured option. Another possibility are hybrid approaches.

Splitting the instrument into several shorter phases appears advisable to reduce the risk premia. A five-year interval between allocation rounds appears a reasonable choice, as it still offers beneficiaries a level of planning security. Mid-phase reallocation of unused budget is worth considering.

In the second part, an indicative assessment of the instrument's potential cost is provided, for which the eligible volume of emissions reductions and the EUA price differential were estimated. The former was placed at around 90 Mt CO_2-eq. for the first phase of the instrument. On a yearly basis, this amounts to about 4 percent of the 433 Mt emissions from industrial installations under EU ETS (European Environment Agency 2026). The low share of qualifying emissions follows from the strict application of eligibility criteria with regard to commitment date and EUA price vulnerability.

The EUA price gap was estimated at 15 EUR per tonne of CO_2-eq. during the same period. This is roughly comparable to some of the support some of the eligible emissions have already received, e.g. 22 EUR per tonne of CO_2-eq. under the French GPID, and generally stands an order of magnitude lower than the total abatement costs across relevant technologies (Direction générale des Entreprises 2026; Clean Air Task Force 2025).

The above values provide an indicative estimate of expected costs for the first phase of the instrument at 1.35 billion EUR. This tends to be comparable but lower than many of the programmes that contributed eligible emissions – which is in line with the fact that only a fraction of their respective total emissions reductions qualifies – and is roughly two orders of magnitude lower than the upcoming 100 billion EUR Industrial Decarbonisation Bank is intended to mobilise.

This estimate is subject to large uncertainty. A number of factors could drive the actual costs in either direction, among them the future EUA price trajectory, the level of participation, and overpaying the beneficiaries beyond what would have been necessary. In addition, the total cost could be driven up by the fact that participants can be expected to base their participation decisions on the total viability of the project. Even if their business cases deteriorated for reasons unrelated to the EUA price itself, they might demand a level of support that goes beyond just compensating the lower-than-expected EUA price.

In the author's assessment, this last point is the most fundamental weakness of this instrument, and one that cannot be designed away easily.

It should also be noted that the total eligible emissions reductions might be significantly higher in a potential second phase of the instrument. Firstly, projects will come online successively during the first phase, but should mostly be expected to stay operational during the entire second phase. Secondly, most of the EUA supply relaxation expected from the current reform occurs after 2031, where most available forecasts see a bigger drop in EUA prices than during the instrument's first phase. Both factors could push the costs of a potential follow-up phase higher if materialised.

In conclusion, the main finding of this analysis is that the compensation instrument discussed in this paper can be implemented in a way that is narrowly targeted, and at a cost that is subject to large uncertainties but remains modest compared to other past and present EU decarbonisation programmes. The analysis identifies considerable risks of inefficient resource allocation but also opportunities for mitigating them through appropriate design. The arguments laid out for and against this instrument point to interactions between the broader business environment and climate policy that cannot be fully designed away. Ultimately, the decision to implement it remains a political one.

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