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Can a minimum price on carbon accelerate the adoption of clean technologies?

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Context

The EU Emissions Trading Scheme (EU-ETS) is one of the world's largest carbon markets, covering 40% of greenhouse gas emissions in the European Union (EU). [1] Established in 2003, the EU-ETS is a 'cap and trade' scheme that sets a limit on the amount of CO2 emissions, within which companies can trade emission allowances. The supply and demand for these allowances results in a carbon price which can fluctuate due to changing market dynamics and extraneous factors, in a way that can create uncertainty for long-term investments.

The EU-ETS market opened at approximately €84/tCO2 price at the beginning of 2022, with the price going up to €97/tCO2 on February 7, 2022, before crashing to €58/tCO2 on March 7, 2022 in the aftermath of Russia's second invasion of Ukraine on February 24, 2022.[2] At the time of writing this paper in June 2022, the price is back to around €80/tCO2. [3] These fluctuations have once more indicated that political events and other exogenous shocks change expectations of the future price of carbon, resulting in price instability. Similar price shocks can be observed in the aftermath of the 2008 financial crisis, [4] and in the first half of 2020 due to measures taken in response to the COVID pandemic [5]. After the 2008 financial crisis, it took almost a decade for prices to recover to previous levels. [6]

This instability has an effect on the decarbonisation of sectors covered by the EU-ETS, since investors are unable to rely on a predictable price to base decisions on. In this context, a minimum price or a price floor in the EU-ETS could provide the stability necessary to accelerate investments, especially those in breakthrough clean technologies needed for this transition. Although the EU-ETS currently does not envisage a price floor, the idea has been pushed recently by Germany, which has advocated for a price floor of €60/tCO2. [7]

In this paper, we make the case that the EU should implement such a carbon price floor to provide a clear and reliable price signal that can boost investment in clean technologies and accelerate the decarbonisation of ETS sectors.

01

Price certainty and technological innovations for decarbonisation

To achieve climate neutrality by 2050, many of the breakthrough innovations needed in sectors such as steel, cement or chemicals will require a carbon price estimated within the range of €100-170/tCO2. [8] So far, the EU-ETS has mostly been beneficial to incremental innovation, [9] but free allowances and relatively low and volatile price levels have failed to trigger the investments required for breakthrough innovations.[10]

Investing in innovative clean technologies bears high technological and market risks. Clean technologies are often capital-intensive and need significant support to scale up. To date, EU venture and growth capital investors have not accounted for a carbon price in their investments in clean technologies. This is because up till now, the free allowances regime has shielded industries from the cost of their emissions, and thus failed to reduce the price difference between certain existing technologies and clean alternatives. [11] With the EU-ETS reform and the phase-out of free allocations imminent, carbon pricing is starting to play a prominent role in investor decisions on whether to invest in emerging technologies. The carbon price floor creates a "much clearer short-term signal about the commitment of regulators to actually implement the announced long-term cap", [12] thereby providing greater regulatory certainty for investment decisions for decarbonisation.
For carbon pricing to play a decisive role in incentivising investments into clean technologies, the predictability of that price is key. Investors must be able to rely on a predictable price when evaluating the commercial viability of a new technology. An investor interviewed for the purpose of this paper provided the following insight:

"Having a price on carbon is one very important thing. Being able to rely on a minimum carbon price five to ten years ahead is what would really speed up investment decisions." [13]

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The importance of a floor price with a built-in ratchet mechanism can be demonstrated with the example of green steel-making using hydrogen as direct reduced iron. The current marginal CO2 abatement cost using green hydrogen for steel-making has been estimated at $368/tCO2 (€325/tO2) in a study from the Columbia SIPA Center on Global Energy Policy. [14] A scenario developed by Cleantech for Europe highlights the value of a carbon price floor in this sector:

"Consider a rising floor price, say of €30 in 2022, €70 in 2025 and €120 in 2030. To be cost-competitive with CO2-intensive steel in 2030, the technology would need to go down the cost curve from €325/ton today to €120/ton in 2030. At that level, it would be competitive with conventional steel, which would pay a real carbon price of €120/t CO2. Should the investor believe a cost reduction from €325/CO2to €120/CO2to be possible by 2030, the floor price will provide the necessary certainty to invest in this new technology." [15]

The chart below shows estimates of the marginal abatement costs for a select number of breakthrough clean technologies. While some of them should already be cost-competitive with incumbent processes based on the current carbon price in the EU-ETS, the free allowances regime prevents this cost-parity from effectuating.

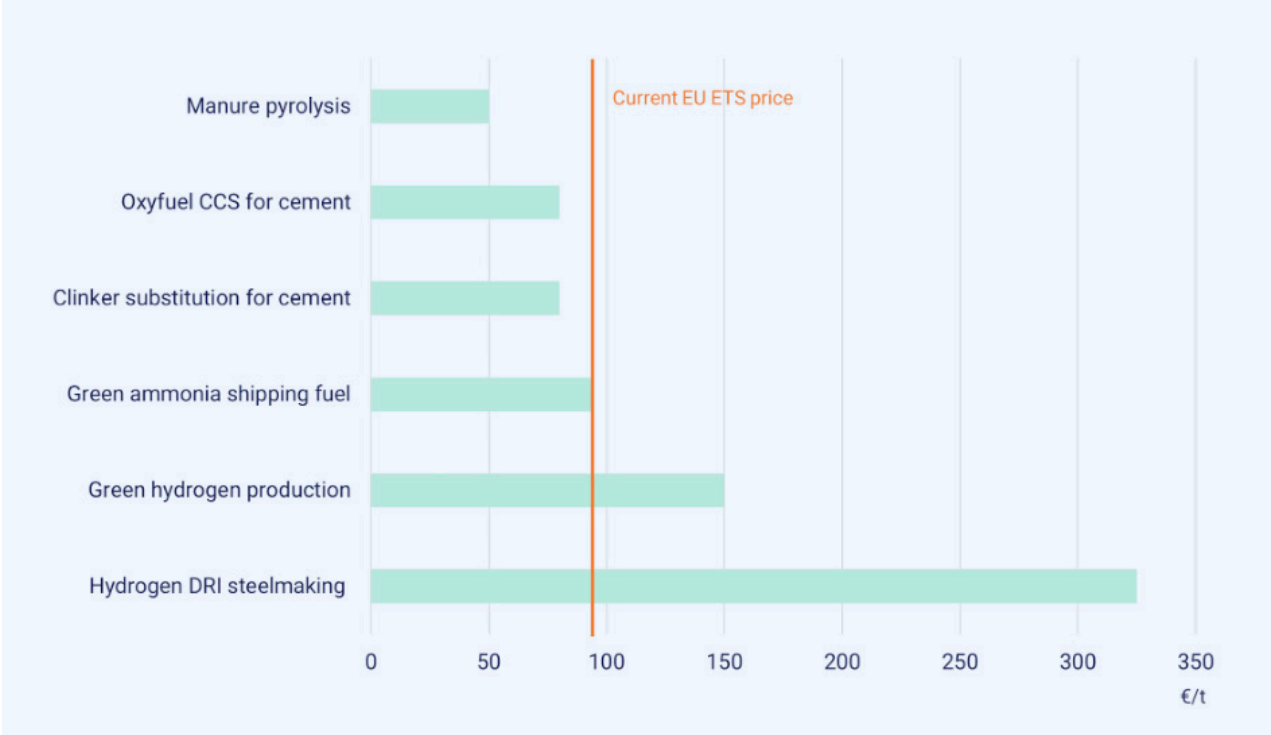


Figure 1: Marginal Carbon Abatement Cost of Selected Clean Technologies

Sources: Columbia SIPA Center on Global Energy Policy (Hydrogen DRI steelmaking), Agora Energiewende (Oxyfuel CCS for cement), Cleantech for Europe interviews (green ammonia shipping fuel, clinker substitution for cement, manure pyrolysis)

In addition to providing predictability, a carbon price floor would also result in lower financial costs for such breakthrough investments. Indeed, carbon price certainty allows for the use of more debt and less equity to finance the investment costs, lowering the total costs as debt is considerably cheaper than equity. [16] The implementation of a carbon price floor would consequently lower the carbon price required to realise breakthrough projects. [17] It must be noted, however, that this would materialise only if free allocations are phased out, or

if the free allocation benchmarks are revised to include low-carbon, breakthrough technologies. [18] The implementation of a carbon price floor, the phase-out of free allocations, and the appropriate revision of benchmarks for free allocations are complementary measures that will strengthen the carbon price signal.

Moreover, a carbon price floor could also be advantageous for governments in the context of their budgetary planning. The auctioning of EU-ETS allowances is a growing source of revenues for Member States, and many countries earmark such revenues for national spending programmes. [19] With the proposal of the European Commission to earmark 100% of these revenues for climate purposes, [20] and the European Parliament considering introducing an amendment that would require Member States to adopt ex-ante plans on how they intend to use revenue to ensure compliance and public scrutiny, [21] having more certainty about future revenue streams could considerably ease this exercise.

02

Approaches to designing a carbon price floor

The idea of a minimum price in an emissions trading system is not new. Indeed, in several emission trading schemes around the world, a minimum carbon price is already in place. One example is the United Kingdom (UK), which introduced a carbon price floor in 2013 with a price that would gradually increase from £16/tCO2 in 2013 to £30/tCO2 in 2020 and £70/tCO2 in 2030. [22] However, the price was frozen at £18/tCO2 to **"limit the competitive disadvantage faced by business and reduce energy bills for consumers"**. [23] Following the initial freeze in the spring 2015 budget, the freeze was extended in the 2016 until 2021. [24] On January 1, 2021, the UK Emissions Trading Scheme (UK ETS) replaced the EU-ETS following Brexit. [25] The UK-ETS auction regulations currently stipulate a minimum price of £22 for bids. [26]

Another example is the emissions trading scheme in California and Québec, which provides for an **'Auction Reserve Price',** which is the minimum price at which an allowance can be sold in an auction, which is determined using the Auction Exchange Rate.[27]

Canada also set a general national minimum price on carbon pollution, starting at -C$20/tCO2 in 2019, and increasing by C$10/tCO2 per tonne to C$50/tCO2 in 2022, and which will increase annually by C$15/tCO2 from 2023 to 2030. [28] The Regional Greenhouse Gas Initiative (RGGI) in the United States set a minimum reserve price of $2.38/tCO2 in 2021, increasing by 2.5% each year, and is currently reviewing this price and methodology. [29]

A price floor can also form part of a price corridor or price collar, consisting of a price floor price and a price ceiling. [30] In the aftermath of the price fluctuations in the EU-ETS triggered by Russia's second invasion of Ukraine and the European energy crisis, it has been suggested that the implementation of a price collar can play the role

of a “safety valve” for the EU-ETS. [31]In the context of a price collar, the rationale for a role of a floor price that is adequately high to begin with, and is gradually increased, is to create a **“strong and credible signal in favour of investing in low-carbon technologies”.** [32]

Another option is a moderate price floor, but with a steeper rise.[33]

The implementation of a carbon price floor can also play an important role in complementing other climate policy instruments.
Carbon Contracts for Difference (CCfDs) are one example of a targeted policy instrument for decarbonisation which could benefit from a carbon price floor. CCfDs have emerged in the last few years to incentivise investments in innovative low-carbon industrial technologies. CCfDs have two main goals: overcoming the investment risk related to uncertain carbon price developments and bridging the gap between the expected carbon price and the carbon price required to achieve cost-parity between a low-carbon and incumbent technology. [34] Through a CCfD, a government or institution can agree on a fixed carbon price (the ‘strike price’) with a project developer over a defined time period. If the market price in the EU-ETS is below that strike price, the government would pay the difference while, if the carbon price is higher, the project developer would return the additional revenues to the government.[35]

Several Member States such as Germany[36], France[37] and the Netherlands[38], as well as the EU[39] are exploring the possibility of utilising CCfDs to support the decarbonisation of their industries, or to incentivise the production of renewable hydrogen. While providing a similar function, a carbon price floor price could also complement CCfDs in several ways, including through reducing the investment risk linked to fluctuating carbon prices, increasing the debt ratio for projects, [40] and providing budgetary certainty for governments entering into CCfDs.

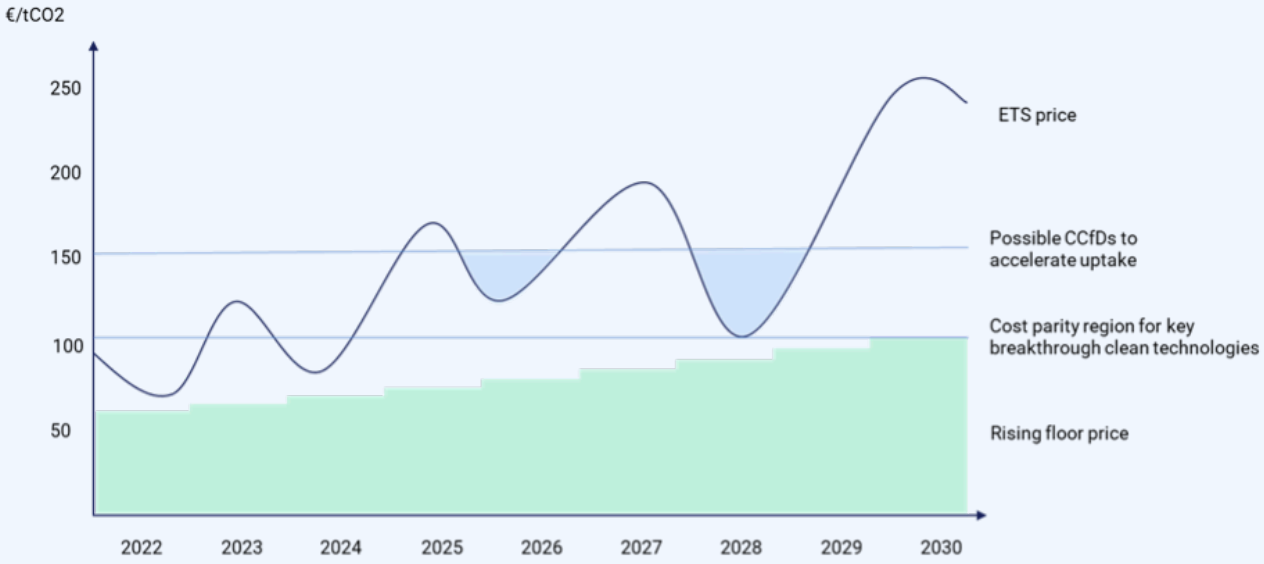


Figure 2: Example of a Rising Carbon Price Floor Combined with CCfDs

Taking a concrete example, the graph above shows how a rising price floor could be implemented and combined with other measures to accelerate investment in clean technologies such as CCfDs. In this example, we assume the establishment of a price floor of €60/tCO2 in 2022, as is currently being proposed by Germany. This floor is assumed to rise by 7% each year, adjusting for inflation and the need to gradually reduce emissions across the EU. Based on this trajectory, the price floor reaches €100/tCO2 by 2030, around which time many breakthrough technologies become cost-competitive with carbon-intensive ones. Investors would thus have a predictable price at a medium-term time horizon, to encourage their investments. In parallel, more targeted measures like CCfDs could come in at higher prices, to accelerate the uptake and cost reductions of key technologies.

03

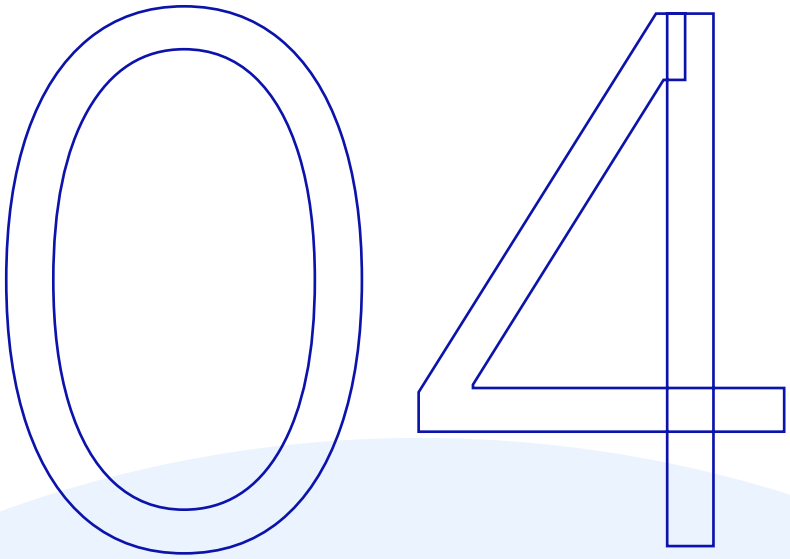
State of play in the European policy debate

Although the idea of a floor price in the EU-ETS has been discussed by some Member States on occasion, it has so far not been comprehensively deliberated or concretised at the EU level. A statement signed by eight Member States (including the UK, a Member State at the time) in December 2018 recognised the importance of **"enhanced measures...to strengthen the carbon price signal, to improve overall ambition, coverage, and predictability."**[41] It was further noted that **"[s]uch mechanisms, at each country's discretion, could include carbon price floors for electricity generation to complement the EU ETS."**[42] At that time, France, which was the initiator of this declaration, was strongly advocating a minimum carbon value as it was an election promise made by the presidential candidate Emmanuel Macron in 2017.[43]
However, the idea was not pushed recently by France despite the ongoing French presidency of the Council of the EU, and did not find a place in Macron's 2022 election program. [44]Still, the idea has not been completely abandoned by French politicians.[45]

In Germany, the current federal government expressed in its Coalition Agreement in November 2021 an intention to support a minimum EU-ETS price and, failing an agreement on the topic in the EU, potentially implementing a floor price domestically in Germany[46].
The price indicated to be the floor price in the Coalition Agreement is €60/tCO2, although no specific time-frame for its implementation has been indicated. [47] Some experts in Germany have recommended the implementation of a national minimum price in Germany latest by 2025, which could also serve as an important political signal for other Member States.[48]

The coalition agreement of the current government in the Netherlands also contained a commitment to a price floor, stating: **"[t]o create certainty, a gradually increasing price floor will be introduced for the ETS price, preferably in agreement with neighbouring countries."**[49] Denmark is also reportedly considering the introduction of a price floor mechanism. [50] These examples indicate the willingness of certain countries to implement a carbon price floor domestically without waiting for a carbon price floor in the EU-ETS. However, building consensus on an instrument like a carbon price floor in the EU-ETS would require broad-based discussion across Member States, particularly given that the EU-ETS is not favoured by certain Member States such as Poland, which has expressed its hostility to the EU-ETS on several occasions. [51]

With the ongoing revision of the EU-ETS Directive in the framework of the Fit for 55 Package released in July 2021, the idea of setting a carbon price floor returned to the realm of deliberation, [52] albeit not as one of the topics of EU-ETS reform in the Package. The public consultation on the EU-ETS saw **"only few respondents"** commenting on a carbon price floor, with **"a slight majority of those being in favour (mostly environmental NGOs and clean-energy companies)."**[53] However, till date, the European Commission has not shown any inclination to support the implementation of a price floor. Indeed, in 2019, the then European Commissioner-designate (now Vice President of the European Commission) Frans Timmermans expressed doubts on the necessity of a carbon price floor, stating that he did not **"see the merits in introducing a floor in the pricing of carbon"**, since **"the price as it is developing is going in the right direction and I'm pretty confident it will continue to do that."** [54] However, despite the EU-ETS price increasing in an anticipated manner, the wide range of fluctuation in the carbon price (between €15t/CO2 in mid- March 2020 and about 98€t/CO2 in February 2022) illustrates that the carbon price is not always predictable. A carbon price floor can contribute towards improving the overall predictability of the EU-ETS.



Recommendations

The impact of recent events, such as the Russian invasion of Ukraine, the COVID-19 pandemic, and Brexit, underlines that addressing exogenous shocks is paramount to mitigate the volatility of the carbon price and make the price signal more robust and stable.
To this end, the current revision of the EU-ETS Directive is the key opportunity to introduce a gradually increasing carbon price floor, which would help with ensuring greater predictability to companies and investors. A carbon price floor would also act as a safeguard by preventing the price from falling below a given threshold which could put at risk the pursuit of climate targets, depending on the duration of the shock.
As demonstrated in this paper, a stable carbon price can play an important role in accelerating industrial decarbonisation.

Discussions on the design of a carbon price floor in the EU-ETS should start as soon as possible, particularly in view of recent developments indicating support for a carbon price floor from several stakeholders. The German government's commitment to an EU-ETS price floor, or a national price floor as a fall-back option, as well as the intention expressed by the Netherlands and Denmark to potentially implement carbon price floors domestically send an important signal to the other EU Member States.

Although the setting of a carbon price floor has not been a focal point in the ongoing EU-ETS reform, it can play a significant role in complementing some of the other proposed reforms that strengthen the price signal. Indeed, a carbon price floor should not be seen as a silver bullet, but rather as a key component within a policy package designed to accelerate industrial decarbonisation and innovation.
In particular, with a view to creating a robust and predictable price signal, the implementation of a carbon price floor should be aligned with the phase-out of free allocation.

Furthermore, given the synergies between the carbon price floor and other carbon policy instruments such as CCfDs, which are likely to find an uptake in the near future, a carbon price floor should enter the immediate agenda for EU-ETS reform.

A carbon price floor in the EU-ETS must be carefully designed such that it starts at a sufficiently high level, and increases at a predictable and sufficiently ambitious pace, in line with the ambitious decarbonisation targets. The recent proposal for Germany for a minimum price of €60/tCO2 provides a concrete indication of a starting point for a carbon price floor in the EU-ETS. Important factors to take into consideration for the design of the carbon price floor and its future trajectory include the abatement cost curves for key industrial sectors, inflation, a clear and predictable rate of increase, and the decarbonisation goals. Figure 2 above provides an illustration of one possible option for such a well-designed EU-ETS carbon price floor.

In conclusion, we recommend adopting a credible carbon floor price for the EU-ETS, as a measure that bolsters and supports the overall effectiveness of the EU's climate policy toolbox for industrial innovation.

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