

MARKET MECHANISMS FOR FINANCING INDUSTRIAL DECARBONISATION: STEEL CASE STUDY

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INTRODUCTION

The steel sector is a significant contributor to the UK's greenhouse gas (GHG) emissions, responsible for 14.2% of industrial emissions and 2.4% of the UK's total GHG emissions. The UK has committed to achieving net zero GHG emissions by 2050, with an interim target of reducing industrial emissions by two thirds by 2035. Decarbonisation of the steelmaking industry is therefore imperative for the overall decarbonisation of UK industry.

OBJECTIVE

The aim of this research is to improve the affordability of industrial decarbonisation, making it an attainable and realistic goal. The use of mechanisms to manipulate the market could reduce the financial burden of decarbonisation on steel plants and prevent their closure.

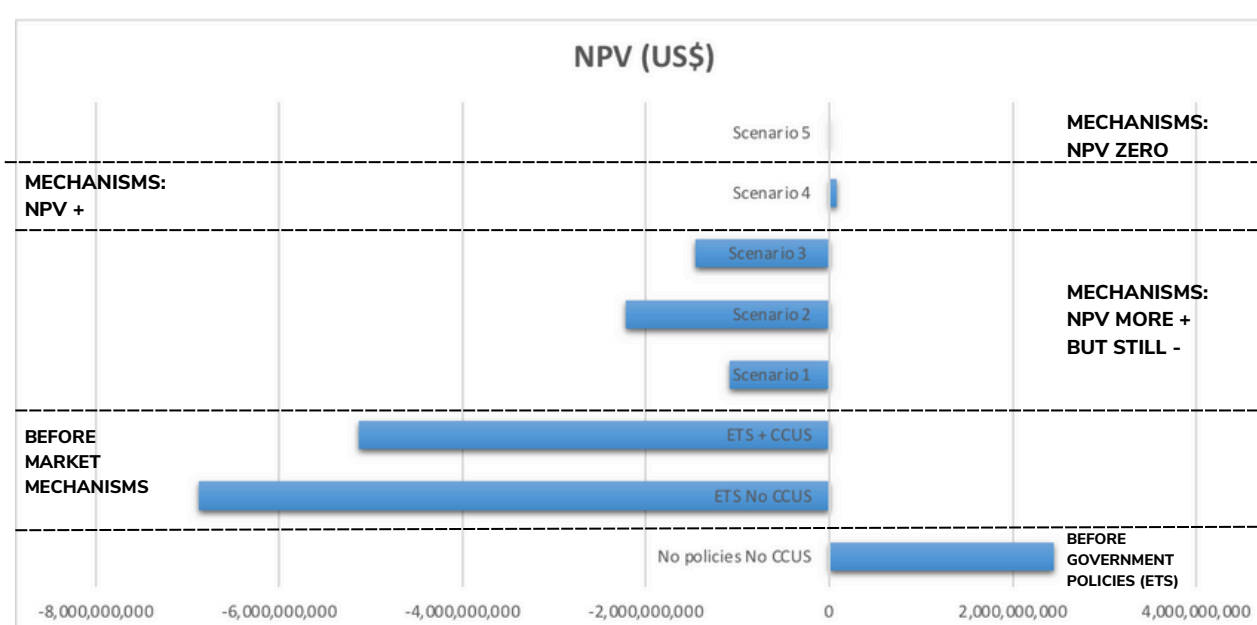
METHODOLOGY

I began my research with a literature review of the uses of market mechanisms in international government schemes and policies. Once deciding on the mechanisms I thought would influence the NPV best, I applied them to the model in different scenarios, shown below:

TERMINOLOGY

- Carbon Capture + Storage (CCUS) = Technology applied to the steel plant, which captures carbon produced. Can be sold for a profit and reduces emissions.
- Carbon Price = A cost/fine applied to a plant's greenhouse gas emissions (in US \$/tCO₂) to encourage businesses to reduce their carbon output.
- Carbon Contract for Difference (CCfD) = Guarantees investors a fixed carbon price by paying the difference when the market carbon price is lower, encouraging low-carbon industrial projects.
- Emissions Trading Scheme (ETS) = A market-based system where companies buy and sell allowances to emit a set amount of greenhouse gases.
- ETS revenues = The revenues generated by the government from the payments made by companies for their emissions. Can be recycled into other government initiatives.
- Market mechanism = Government scheme or initiative which uses economic incentives and price signals, like carbon pricing or trading, to encourage emissions reductions cost-effectively.
- Net Present Value (NPV) = The difference between the present value of a project's cash inflows and outflows, showing its overall profitability. NPV > 0 is desirable!
- Strike Price = The guaranteed carbon price (US\$/tCO₂) that ensures a project receives stable revenue if the market carbon price falls below it. Used in CCfD schemes.

RESULTS



The NPV of the steel plant is highest before government intervention and policy applications.

After this, it drops to a highly negative number. The addition of CCUS technology increases the NPV by roughly 2,000,000,000 US\$.

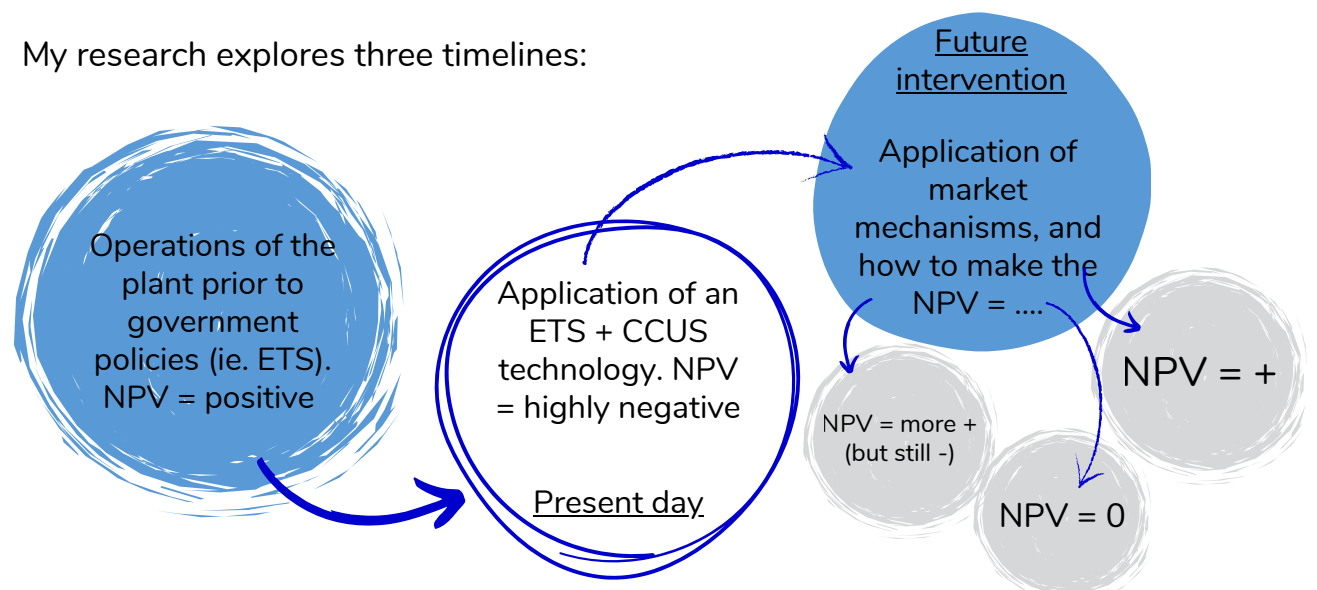
This is because of the profit generated from selling captured carbon - however the NPV remains highly negative and the operations of the plant not financially viable.

By adding market mechanisms, we can see that the NPV is increased by almost half - and most by the addition of a CCfD scheme. The combination of a CCfD scheme and ETS revenue recycling pushes the NPV to a positive number. Whilst this is desirable, it is not necessary for financial feasibility. The financial burden on the government can be lessened by setting the goal for NPV = 0. For this outcome, a single CCfD scheme with a higher strike price is preferable.

Scenario	Mechanisms
Scenario 1	ETS + CCUS + CCfD (strike = 200 US\$/t)
Scenario 2	ETS + CCUS + revenue recycling
Scenario 3	ETS + CCUS + CCfD (strike = 189 US\$/t) + revenue recycling
Scenario 4	ETS + CCUS + CCfD (strike = 200 US\$/t) + revenue recycling
Scenario 5	ETS + CCUS + CCfD (strike = 233 US\$/t)

ANALYSIS + DISCUSSION

My research explores three timelines:



It is clear from my results that government intervention is needed to finance the transition to a low-carbon steel industry. In the results section I have presented a variety of ways this can be achieved, depending on the specific desired outcome (ie. NPV result) and preferred mechanism.

My results suggest that market mechanisms can significantly improve the financial viability of decarbonised steel production in the UK. An increased NPV under ETS revenue recycling and CCfD indicates that the current financial barriers to low-carbon steelmaking can be overcome with well-designed policy support. Because of the increased NPV, private investment in CCUS-enabled steel plants could become more attractive, potentially accelerating deployment.

In proving that, through support schemes, CCUS technologies can become economically feasible, my findings can encourage continued innovation and cost reductions in capture, transport and storage systems.

This positions the UK as capable of developing a competitive, low-carbon steel industry - aligning with the government's Industrial Decarbonisation Strategy and net-zero targets. The results suggest that policy certainty and long-term schemes like CCfDs can mitigate investor risk and promote stable transitions. It also supports the case for linking the carbon market revenues to industrial decarbonisation, rather than using general government budgets.

Overall, the findings imply that a well-integrated policy framework combining market mechanisms and technology-specific support could make deep decarbonisation of UK steel both technically and financially stable.

CONCLUSION

To conclude, my findings suggest that the application of market mechanisms to a UK steel plant with CCUS technology under an ETS would cause an increase to the NPV of the plant.

This increase in NPV would make the operations of the plant financially viable and overall finance the transition to a competitive, low-carbon UK steel industry.

RELATED LITERATURE

- [Markets-Mandates-2025.pdf](https://www.blackfishengineering.com/post/the-ten-point-plan-for-a-green-industrial-revolution)
- <https://www.gov.uk/government/publications/uk-emissions-trading-scheme-uk-ets-policy-overview/uk-emissions-trading-scheme-uk-ets-a-policy-overview>
- <https://www.gov.uk/government/consultations/uk-emissions-trading-scheme-free-allocation-review>
- <https://www.gov.uk/government/collections/net-zero-innovation-portfolio>