Carbon price forecast under the EU ETS

Executive Brief – November 2023

Is the current design of the EU ETS suited for post-2030 deep decarbonisation?

The European Union (EU) has set ambitious decarbonisation targets for 2030 and 2050, supported by a range of policy instruments to foster various actors to cut their emissions. One of these instruments is the EU Emission Trading System (EU ETS): a market on which electricity producers and industrial companies pay for their greenhouse gas emissions, therefore generating revenues to finance the EU's green transition.

The aim of this article is to present how the current structure of the market with the Market Stability Reserve (MSR) works and how it will behave in the future with its current design, by using our POLES-Enerdata modelling tool. The results raise some questions about the value of projected carbon prices in the future and the durability of the current design of the EU ETS.

1. THE EUROPEAN EMISSION TRADING SYSTEM (EU ETS)

1.1. System Overview

The EU ETS operates in all EU Member states plus Iceland, Liechtenstein, and Norway (EEA-EFTA states) since 2005. It covers emissions from around 10,000 installations in the energy sector and manufacturing industry, as well as aircraft operators flying within the EU and departing to Switzerland and the United Kingdom, that represent around 40% of the EU's emissions.

The EU ETS operates in successive trading phases. The first phases allowed to launch the system and progressively establish its policy framework: obtaining a carbon price, setting emissions caps that are more and more constrained, trading permits across the EU, monitoring CO_2 emissions for emitters, opening the perimeter to cover additional emissions in the EU. Over the years, it has undergone several revisions aligning the system with the strengthened EU climate targets (see e.g. the COPEC research programmes for an ex-ante assessments of those legislation proposals). Since 2005, the EU ETS has helped bring down emissions from power and industry plants by 37%. Recently aligned with the *Fit for 55* package, the cap on emissions has been tightened to -62% by 2030 compared to 2005 levels impulsing additional pressure on emissions.

The EU ETS works on a 'cap and trade' principle. A cap is a limit set on the total amount of greenhouse gases that can be emitted by the installations and aircraft operators covered. Every year, emissions must be covered by the same amount of permits. Since the volume of permits is due to decrease over time, emissions will have to be reduced ensuring the emitters to be compliant. At the beginning of the Phase 3 in 2013, a global cap was set with on the basis of the average total quantity of allowances issued annually under Phase 2 (2008-2012). This amount decreased annually by the linear reduction factor of -1.74 % in Phase 3 (2013-2020). The system is now in its fourth trading phase (2021-2030), with a 2021 cap set at 1,572 Mt for stationary installations and an LRF strengthened to -2.2% that means the cap decreases by 43 Mt each year. With the Fit for 55, the LRF will be -4,3% (i.e. -84 Mt/year) from 2024 to 2027 and -4,4% (i.e. -86 Mt/year) from 2028 to 2030. Additionally, two "rebasing" (punctual adjustments) are also scheduled in 2024 (-90 Mt) and 2026 (-27 Mt). The cap in 2030 will thus be 774 Mt.

1.2. The Market Stability Reserve (MSR)

The Market Stability Reserve is a market mechanism whose aim is to provide stability to the EU ETS market. The reserve was decided at the end of 2015 and implemented in 2019 to address the large excess of emission allowances that has been accumulated in the system since its creation, driving down the price of carbon and thus being a weaker incentive to reduce emissions. The general function of the MSR is to help ensuring a satisfactory adequation between the supply and the demand of quotas.

This mechanism is used each year to calculate the number of allowances present in the system. If this number exceeds a *ceiling* value, the auction volume for the following year is adjusted downwards. Conversely, if it is below a *floor* value, some permits are reinjected from the reserve. In practice, the upper limit is set at 833 $MtCO_2$, and 24% of the previous year's surplus (12% after 2030) is absorbed by the MSR. From 2024 onwards, a "buffer" means that if the previous year's surplus is lower than 1096 Mt and higher than 833 Mt, the difference between the surplus and 833 Mt will be absorbed (instead of 24 %). The lower limit is set at 400 $MtCO_2$, and the MSR releases 100 $MtCO_2$ of allowances, within the limit of what is available in the reserve. Between those two values, there is no action of the MSR.

In addition, a total of 900 million allowances have been backloaded in 2014-2016 into the MSR. In other words, the auction volume reduced by 400 million allowances in 2014, 300 million in 2015 and 200 million in 2016 has been transferred into the reserve rather than auctioned in 2019-2020.

1.3. Banking and hedging behaviours

Additional strategic aspects are considered in the EU ETS design. First, the possibility for some actors of banking allowances: in a cap-and-trade system, actors have the ability to bank permits for future use, before the end of the compliance period. Banking constitutes an additional demand for CO_2 allowances beyond firms' need to cover the emissions by the end of the current year. Firms have an incentive to bank, in other words to hold CO_2

allowances from one year to the other if they expect future carbon prices to increase. Therefore, banking allows that expectations on future market scarcity are priced into carbon prices.

Further, some actors may also show hedging behaviours. In the EU ETS, power generators hold CO_2 allowances to hedge for future power sales. They buy CO_2 quotas beyond their need to cover their annual emissions and use these allowances to hedge the carbon prices for power they sell several years forward, while expecting higher constraint in the future. CO_2 hedging demand has gradually increased since 2008 because power firms in Western Europe no longer receive free CO_2 allowances as of 2013.

1.4. The Innovation Fund

The Innovation Fund focuses on highly innovative technologies and flagship projects within Europe that can bring significant greenhouse gas emission reductions.

The EU ETS provides the revenues for the Innovation Fund from the monetisation of 530 million allowances. In practice, the Innovation Fund allowances from the EU ETS are being auctioned based on the agreed schedule and the revenues perceived are later used to provide support to innovative projects.

2. METHODOLOGY

The approach used in this Executive Brief builds upon the POLES-Enerdata model, a partial equilibrium model of the global energy system. It covers the entire energy sector, from production to trade, transformation, and final use for a wide range of fuels and sectors. The model's scope is global, with an explicit representation of 66 geographical entities. POLES-Enerdata runs in annual time steps, with the model's outlooks typically extending from 2000 to 2050.

In POLES-Enerdata, a carbon value is set to encourage actors to cut their emissions through such additional, environmental costs making carbon-emitting fuels and technologies less competitive.

The EU ETS and the related MSR, as described above, are modelled using this proxy parameter. It allows to quantify through a carbon price the additional effort, compared to a baseline scenario, to reach the emissions cap objective at the EU ETS perimeter.

The MSR is represented with a rolling budget approach. Hence, a kind of actors' myopia is considered, with a rolling compliance only over 5 years that corresponds to what is currently found in the literature, and not over the whole period until 2050. In other words, the cumulative EU ETS emissions from year *N* to *N+5* cannot be higher than the carbon budget seen in year *N*.

Table 1 gathers all the elements considered in the current POLES-Enerdata modelling set-up.

Table 1: MSR design considered

Annual cap	Phase 4: EU ETS + aviation + maritime in 2024	
Carbon budget with a 5-year rolling compliance	Actors consider available carbon (allowances + surplus + MSR) with a 5-year anticipation	
Banking	Surplus can be transferred after each phase and simulation period	
Cap trajectory	Decrease over the year to represent the strengthen of climate ambition and CO_2 emissions objectives	
MSR	Allowances backloaded	2014-2016 period backloading is transferred in the MSR reserve + 300 $MtCO_2$ in 2019 + 600 $MtCO_2$ in 2020
	Upper limit	833 $MtCO_2$
	Storage ratio	24% from 2019 to 2030 (included) then 12%
	Lower limit	400 $MtCO_2$
	Reinjection quantity	100 $MtCO_2$
	Reserve volume	After 2024, maximum 400 $MtCO_2$
	Innovation fund	3.9 $MtCO_2$ between 2024 and 2030 added to the cap
Hedging	Hedging ratios	N+1 = 80% N+2 = 50% N+3 = 10%
	Emissions projections	Emissions from year N used for N+1 to N+3

3. CASE STUDY AND RESULTS

3.1. Scenario assumptions and set-up

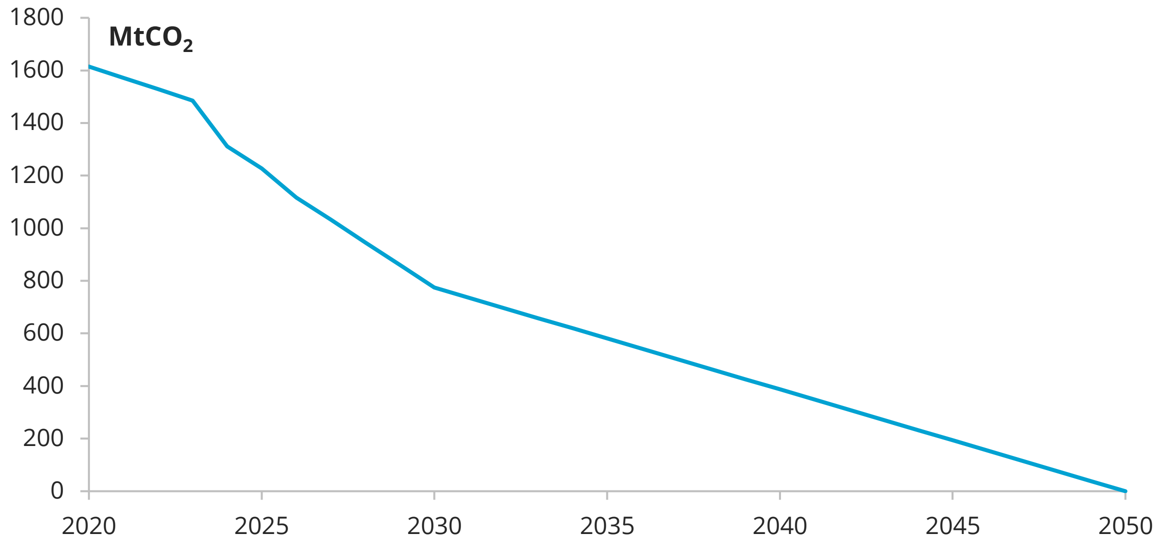
In this Executive Brief, EnerBlue[1] is considered as the reference scenario. It is worth noticing that this scenario is defined by the achievement of new NDCs submitted up to end of 2022, which leads to a global temperature increase of around 2.5°C. Hence, this scenario already embeds a certain level of climate ambition, in particular at the EU level.

On top of the parameters already set in part 2, an ambitious emissions cap is considered, reaching 0 in 2050 (see figure 1). This assumption is however not as ambitious as a cap

[1] See EnerFuture service: https://www.enerdata.net/research/forecast-enerfuture.html

decreasing linearly to 0 after 2030, which would lead to net zero emissions in the EU ETS around 2040, as envisaged in some scenarios.

Figure 1: Assumption for the EU ETS cap



Source: Enerdata, POLES model

3.2. Scenario results

Under the scenario configuration described above and using the POLES-Enerdata methodology discussed in section 2, a carbon price trajectory is calculated as a model result, which is commented in the following.

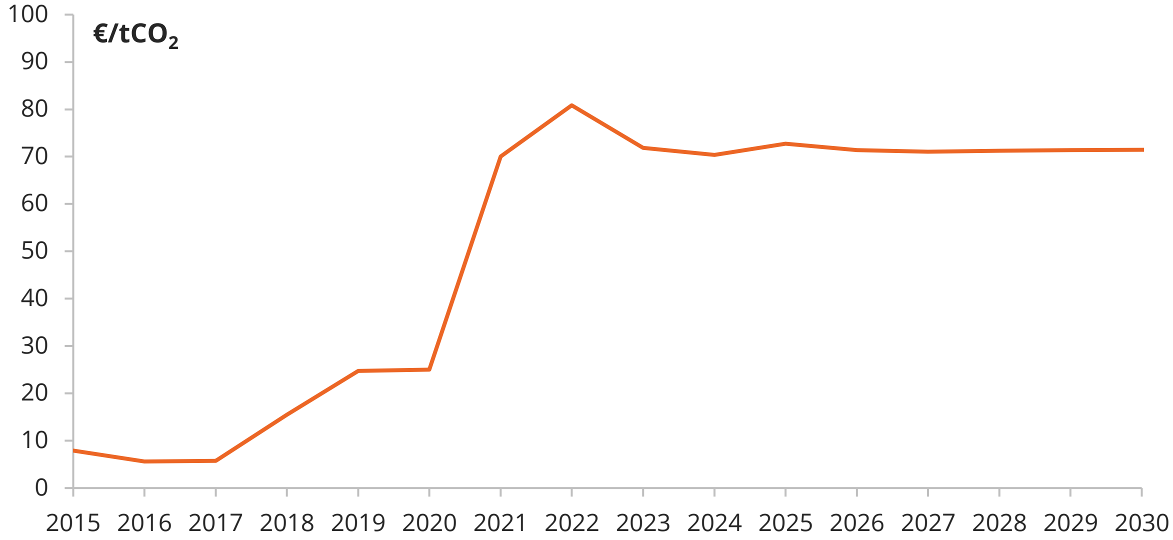
Price stabilisation by 2030

In the 2020s, the carbon price in the EU ETS remains relatively stable at around €70-75/tCO_2. This trajectory is coherent with the most recent literature on the topic, although in the lower range of the available benchmarks.

The stable trajectory for the allowance price in our scenario is explained to a certain extent by the existence of other policies fostering EU decarbonisation by 2030. The "Fit for 55" renewable and energy efficiency targets are indeed achieved in 2030, with 42% renewables in the final consumption (2 points higher than the objective), and a total final consumption of around 790 Mtoe. The EU ETS acts as one of multiple policy instruments, and the mitigation effort is therefore shared across different levers – the EU ETS price being one of them for the power sector and industry. Countries are indeed enforcing regulatory measures, as well as incentives for clean technologies (e.g. feed-in tariffs or premiums for renewable energy sources). Hence, the CO_2 price is not the only decarbonisation signal, and therefore does not necessarily need to increase by 2030 to ensure emission reductions in line with the cap.

The allowance price is however not declining below €70/tCO_2, due to two main reasons. First, a certain price level is required on the EU ETS to achieve sufficient emission reductions: the other measures in place are of course not enough alone. Second, the MSR mechanism helps to maintain the price until 2025. The action of the MSR on the market and the volumes in the reserve are shown on figure 3.

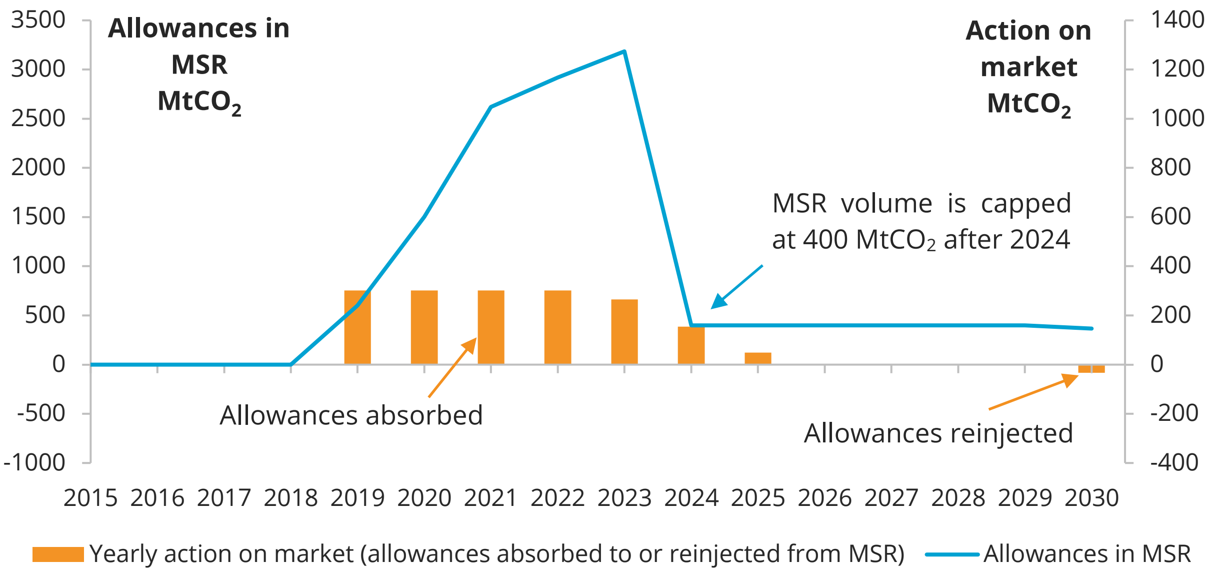
Figure 2: The EU ETS carbon price evolution until 2030



Source: Enerdata, POLES model

The MSR was filled until 2021 by the allowances backloaded from the 2010s as a surplus period for allowances. Subsequently, the reserve is expected to keep absorbing permits to maintain the EU ETS in a relatively stable price environment until 2025. This prevents an excessive supply of permits leading the price to drop, and therefore investments in clean technologies to decrease, with the associated lock-in effects and inertia. The MSR therefore correctly plays its role as a stabilising mechanism on the EU ETS.

Figure 3: The MSR reserve until 2030



Source: Enerdata, POLES model

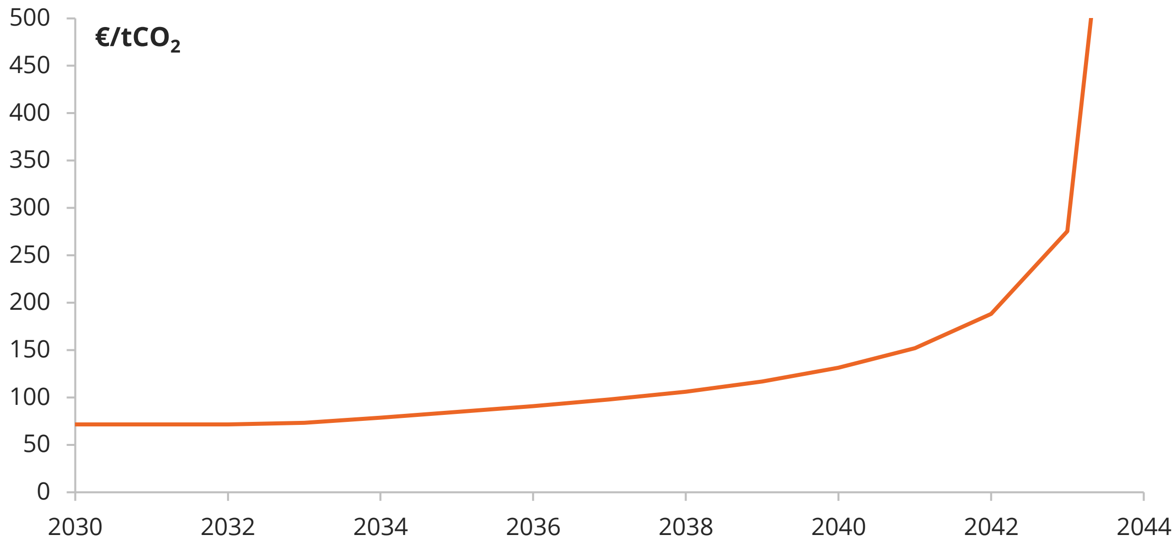
After 2025, the adequation between supply and demand of allowances leads to a stable price signal without contribution of the MSR until 2029. In 2030, the MSR starts to reinject allowances for the first time, as the market gets shorter, as is further developed in the next section.

Significant price increase after 2030

After 2030, the EU ETS price starts to progressively increase, reaching around €130/tCO_2 in 2040. After that, it quickly skyrockets and exceeds €500/tCO_2 in 2044.

Figure 4 presents the evolution of the EU ETS price after 2030.

Figure 4: The EU ETS carbon price evolution after 2030

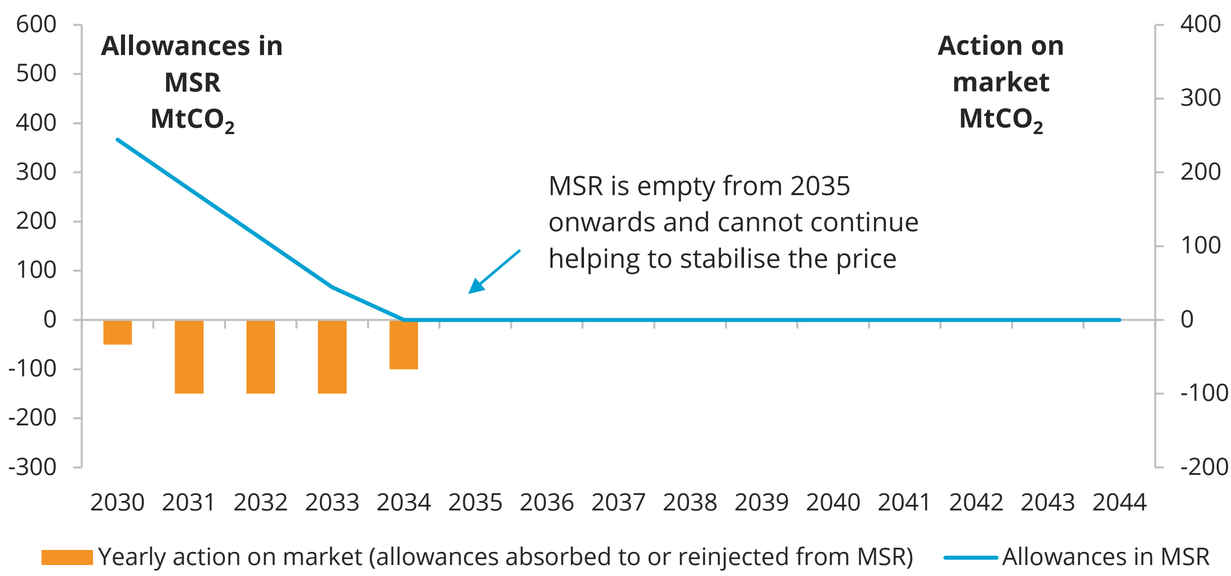


Source: Enerdata, POLES model

With the cap continuing to progressively decrease to low levels after 2030, significant decarbonisation efforts are required from power generators and industry players. With the low-hanging fruits being already implemented in the previous decade, the required abatement efforts are stronger, just as the importance of abatement costs from industry over those of the power sector. As shown on Figure 5, the MSR reinjects all of its 400 $MtCO_2$ stock in the market between 2030 and 2034, after which it cannot help to maintain the price anymore.

After 2040, the cap is getting closer to 0 and the market is getting particularly tense. The imperfect anticipation of actors has led them not to foresee the high decarbonisation challenge for this decade. If the current EU ETS market design is not updated by then, with no possible action by the MSR (empty reserve), the price is surging to over €500/tCO_2 in 2044. This illustrates the inertia of energy systems, and the anticipation required to achieve a deep decarbonisation in the considered sectors. Our results therefore show that the current system will reach its limits in the 2040 decade, and that a revision of its design should be planned – which is expected from the European Commission in the upcoming years.

Figure 5: The MSR reserve after 2030



Source: Enerdata, POLES model

Finally, a small note to keep in mind when looking at CO_2 price projections: even if a robust and reliable methodology was used to model the EU ETS in our energy-climate scenario, the carbon prices provided in this Brief should be considered while keeping in mind the high level of uncertainties surrounding the EU ETS, all the more over the long-term time horizon observed here. That being said, the current exercise allows us to confidently identify how the system would behave and provide with good orders of magnitude for the carbon price.

4. CONCLUSION

Our results show that the EU ETS price could remain relatively stable around €70/tCO_2 by 2030, due to the existing overlap with other, complementary policy instruments and thanks to the absorption of excess allowances by the MSR. Our scenarios features the achievement of renewables and efficiency targets for 2030, assuming that Member States are drivers of the ambition by themselves, not over-relying on the ETS.

The price is then expected to progressively increase to around €130/tCO_2 by 2040, with the market getting more constrained, and the MSR helping to smooth the rise by reinjecting allowances onto the market.

However, with the current design of the market and the MSR, the EU ETS price would skyrocket in the early to mid-2040s, if it were the only tool used to guarantee the equilibrium between offer and demand of allowances, in a context of high climate objectives and hence a constrained emissions cap trajectory. This surge could in fact happen even sooner, if the European Commission was to set a more stringent cap for allowances allocation than the one considered in this study, which is probable.

These results raise some concerns about the future of the EU ETS and highlight the need for updating its design so as to be compatible with a very low GHG emissions environment in the 2040-2050 decade. Among dimensioning factors, the possible inclusion of negative emission technologies in the EU ETS – which is not the case as of today – is surely one of the most impactful ones. Looking even beyond, the future role of the market, once CO_2 emissions are very close to zero, must also be anticipated. Will the market continue to exist, to ensure that emissions remain net zero, or will it be replaced by another instrument?

KEY TAKEAWAYS

- The EU ETS price is expected to remain stable at around €70-75/tCO_2 by 2030, with mitigation efforts triggered also by other measures.
- The price is then likely to increase in the 2030s, up to around €130/tCO_2 by 2040, driven by an increasing decarbonisation context.
- The MSR plays its role in maintaining a stable price signal up to 2035.
- The CO_2 price could then skyrocket in the 2040s according to our results, showing the need for a revision of the system design on the longer term.

ABOUT THE AUTHORS

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