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THE EU ETS: FROM CORNERSTONE TO CATALYST

THE ROLE OF CARBON PRICING IN DRIVING GREEN INNOVATION

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The European Commission has for a long time presented the EU Emissions Trading Scheme (ETS) as the cornerstone of EU climate policy, the policy that was, in theory, going to deliver emissions reductions in a dynamic, flexible, efficient way and incentivise clean innovation by shifting market dynamics.

Over time, as the ETS evolved, the politics surrounding EU climate policy, including a change in how stakeholders view the rate and the pace of change required, have shifted.

It is now clear that the ETS has driven certain kinds of clean innovation investments: incremental innovations that are already close to the market. It has accelerated the phaseout of some outdated technologies in the power sector, speeding-up a shift that was primarily kicked off by other instruments (direct investment support for renewables and complementary

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regulation). Yet, the ETS has so far largely failed to incentivise the development of solutions to reduce emissions in the energy-intensive industry sectors.

This paper explores the relationship between carbon pricing and innovation, setting out the key theoretical dynamics and elaborating on how these have played out in practice in the EU ETS. It concludes that, while the ETS cannot be the cornerstone of EU climate policy, it can be reformed to act as a powerful catalyst to accelerate the clean energy innovations needed to help the EU reach climate neutrality by 2050. This paper therefore ends with a set of recommendations in the context of the upcoming ETS revision:

- Strengthen the carbon price to foster close-to-market innovation
- Reduce price volatility by implementing an EU-wide carbon floor price that gradually increases over time
- Phase-out free allocations of ETS allowances by 2025 while preventing the occurrence of carbon leakage
- Increase the share of revenues from auctioning of ETS allowances dedicated to research & innovation
- Combine the ETS with ambitious regulatory policies to help pull through climate-neutral innovations

Section 1: What is the EU ETS?

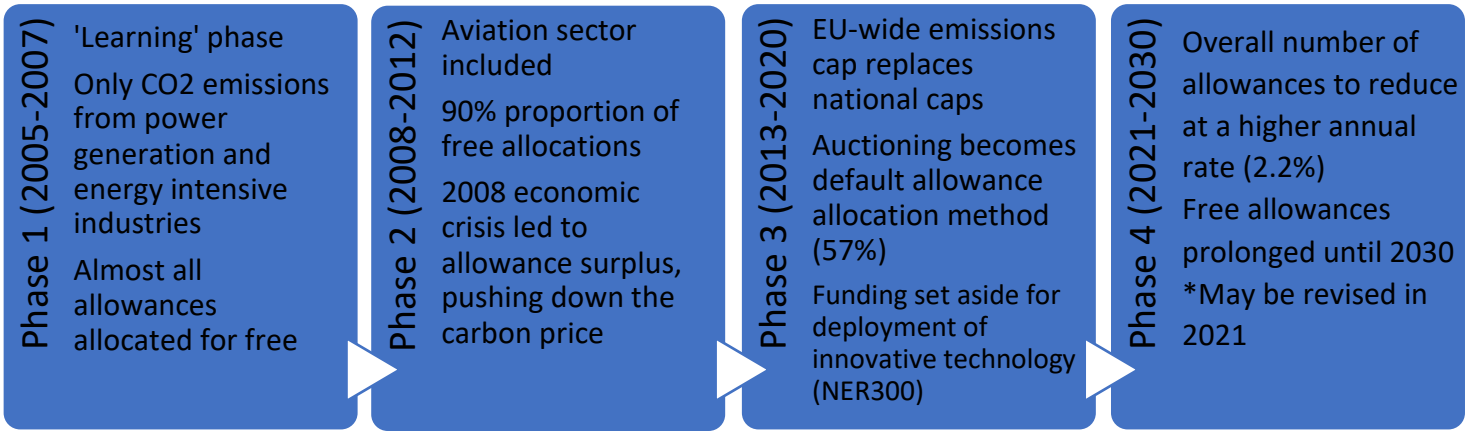
How the EU ETS works

The EU Emissions Trading Scheme (ETS) is the world's largest carbon market, covering 40% of EU greenhouse gas emissions and roughly 11,000 installations.[5] It was originally created in 2003, as a means of jointly achieving the EU target agreed under the 1997 Kyoto Protocol.

The ETS aims to help EU member states cost-effectively reduce greenhouse gas emissions, via a 'cap and trade' scheme that sets a limit on the amount of CO_2 emissions that can be produced in key sectors. Within this limit, companies can trade emissions allowances. In theory this ensures that emissions are reduced in places where it would cost the least to make those cuts. The overall emissions limit (or cap) is then reduced over time so that total emissions decline, based on a linear reduction factor.

The sectors covered and the allowance allocation method in the ETS have evolved in four distinct 'phases' since the scheme was launched (see figure 1)[6].

Figure 1. ETS Phases



The current ETS covers installations in the power and heat generation sectors, energy intensive industries and commercial aviation (limited to flights between airports located in the European Economic Area), with some exceptions based on installation size. Allowances are either auctioned or allocated for free, based on benchmarks that aim to reward the most efficient installations. Auctioning is

[5] European Commission, **EU Emissions Trading System**

[6] European Commission, **EU ETS Phases 1 and 2 (2005-2012);** European Commission, **EU Emissions Trading System (EU ETS)**

currently the default method for allocating allowances. However, 43% of allowances are still allocated for free, in particular to energy-intensive industry sectors deemed to be at risk of carbon leakage due to their exposure to international competition.[7]

How the EU ETS allowance price has evolved over time

The EU ETS allowance price has fluctuated over time (see Figure 2). There are various reasons for these fluctuations, including the number of allowances available, market design, economic growth, energy prices, the wider political context and market expectations. Both the low level and volatility of the allowance price has limited the extent to which the scheme has incentivised the reduction of greenhouse gas emissions. A market stability reserve (MSR) introduced in 2019 to reduce allowance surplus and ensure a higher and more robust carbon price has had some success in stabilising the price, by transferring surplus and unallocated allowances to the reserve including during the COVID-19 crisis. However, it was initially designed to deal with existing oversupply in the system rather than remedy exogenous shocks and may eventually not be up to the task of managing such shocks.

Figure 2. EU allowance price over time

Figure 2 Data Source: ETS price from Ember Daily EU ETS carbon market price **https://ember-climate.org/data/carbon-price-viewer/**

[7] European Commission, **EU ETS Free allocation**

Design flaws

The ETS has been hampered by design flaws from the start. Emission caps are set ex-ante by policymakers who worry more about high carbon prices than low ones. As a result, a surplus of allowances has led to systematically low prices, with the carbon price being virtually ineffectual in its first decade. Price levels for instance went from around 30€/tCO2 in 2008, to less than 5€/tCO2 in 2013 (see figure 2). Moreover, EU policymakers chose to award free emissions allowances to energy-intensive industry on the basis of historical output levels, thereby creating perverse incentives to keep older, more polluting plants active.

Recent reforms to the ETS have partially addressed these flaws, and prices have risen to around €40/tCO2 today. This price level has been high enough to trigger important changes in the electricity sector. It, however, still falls short of where it needs to be for meaningful investments to happen across ETS sectors (see Section 2.1).

Does the EU ETS reduce emissions?

The EU ETS has, on balance, not delivered emissions reductions on the scale or at the speed required to achieve climate neutrality by 2050. The European Commission estimates that emissions from installations covered under the EU ETS have decreased by around 35% between 2005 and 2019[8]. However, this conceals large differences between the sectors: for example, emissions from the industrial sector only dropped by 1% between 2012 and 2018, while emissions from the power sector dropped by 22% over the same period.[9] This difference can be partially attributed to the fact that the industrial sector still receives more than 95% of its emissions allowances for free, while there is almost no free allocation in the power sector.[10] This poorly targeted allocation of free allowances has numbed carbon price signals for some of the most polluting sectors in the EU.

In addition, it is difficult to isolate effects of the EU ETS on emissions reductions from other policies (such as subsidies to develop renewable electricity sources, power plant pollution standards under the Industrial Emissions Directive, declining renewable energy costs) and external factors (such as changes in European consumption patterns). In the industrial sector, according to the International Energy Agency (IEA), "the EU ETS does not seem to have significantly contributed

[8] European Commission, **EU Emissions Trading System (EU ETS)**
[9] Carbon Market Watch (2020), **The EU ETS as an important tool to achieve the European Green Deal objectives**
[10] Carbon market Watch (2021), **Recommendations for the EU ETS Review**

to the decarbonisation of industrial installations."[11] In the electricity sector, according to the Institute for Climate Economics (I4CE), the EU reduction in CO2 emissions from electricity generation (2005-2018) are to be first and foremost attributed to the development of renewable electricity sources.[12]

Section 2: What's the role of carbon pricing for innovation?

One of the key ways in which the ETS is supposed to drive down emissions in covered sectors is by incentivising clean innovation development and deployment in these sectors.[13] There are two main dynamics at play here:

> *Direct*: carbon pricing as an incentive for innovation investment

> *Indirect:* carbon pricing as a means of generating revenues for innovation investment.

The following section explores how these two dynamics have played out in the ETS.

How good is the ETS at driving innovation investment?

Although the effects of the ETS on low-carbon technology innovation can be difficult to isolate, there is evidence that the creation of the EU ETS generated a boost to certain incremental clean energy innovation.[14]

One study finds that patenting in sectors covered by the ETS increased by up to 10% compared to sectors not covered by the ETS.[15] Nevertheless, carbon pricing has so far largely failed to incentivise the development of solutions to reduce emissions in the sectors that **are most difficult to decarbonise**.[16] This can be partially explained by the fact that putting a price on carbon gives an incentive to

[11] International energy Agency (2020), **European Union 2020 Energy Policy Review**
[12] I4CE (2019), **Mind the gap – aligning the 2030 EU climate and energy policy framework to meet long-term climate goals**
[13] European Commission, **EU Emissions trading System**
[14] Incremental innovations involve smaller improvements in individual components (e.g. making a wind turbine bigger so it can generate more electricity). They can be distinguished from breakthrough innovations that involve substantial changes in components as well as product architecture (e.g. battery electric vehicles are an example of this: they replace internal combustion engines with electric motors, driveshafts with cables and fuel tanks with batteries, etc.).
[15] Calel & Dechezlepretre (2016), **Environmental Policy and Directed Technological Change: Evidence from the European Carbon Market**
[16] Boston Review (2020), **The trouble with carbon pricing**

develop innovations that are already close to the market.[17] In edge cases it can, for example, switch the economics of producing a slightly more expensive and marginally cleaner version of cement over conventional processes but it will not trigger the large scale adoption of a breakthrough climate-neutral technology that would radically reduce emissions from cement production. In other words, carbon pricing measures have so far proved useful to accelerate incremental innovation, but unable to trigger the development of breakthrough innovations.

Three key factors help explain this dynamic:

1) The carbon price has been too low

Many of the breakthrough innovations needed to decarbonise the EU economy will require a carbon price on the order of €100-170/tCO_2 to become competitive[18]. This goes beyond what the EU allowance price is likely to reach over the next 10 years, and price levels in excess of €100/tCO_2 may not be politically viable. As a result, the ETS needs to be embedded in a much broader policy framework drawing on regulatory as well as market-based tools, including: product standards and requirements to mandate the production of cleaner technologies, procurement policies to grow demand for cleaner products and services, carbon contracts for difference to bridge the price gap and ensure targeted support for breakthrough innovative production processes.

[17] Dechezlepretre, Bassi & Duffy (2016), **Submission to the consultation by the Department for Energy and Climate Change on ensuring regulation encourages innovation**

[18] Agora Energiewende (2020), **A clean Industry package for the EU: making sure the European Green Deal kick-starts the transition to climate-neutral industry**

Figure 3. Break even CO2 cost estimates for selected low-carbon energy intensive industry technology

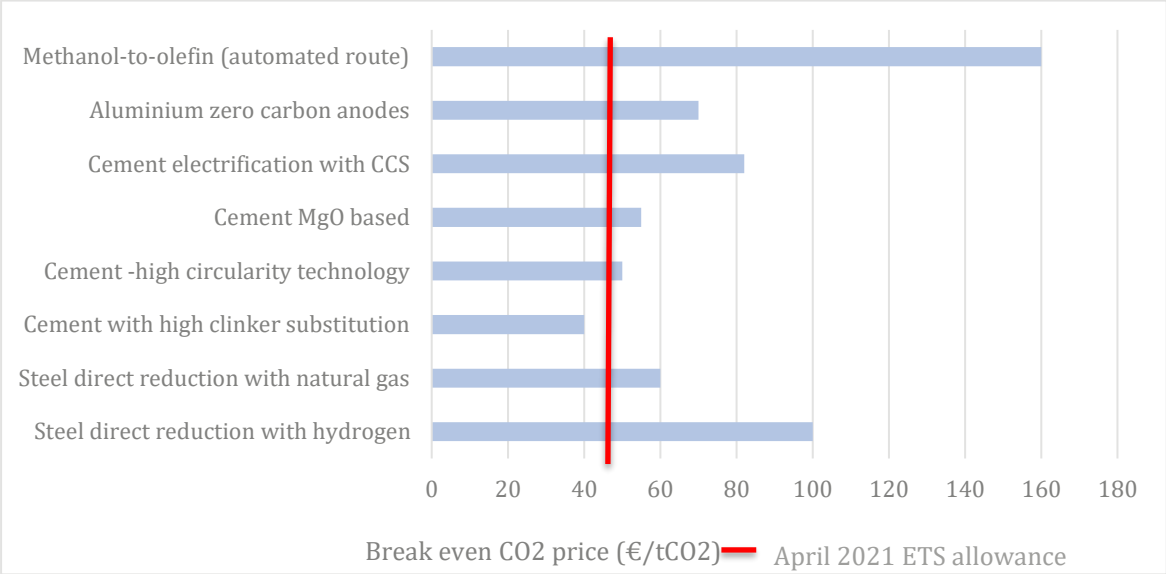


Figure 3 Data Sources: Break even costs from Agora Energiewende (2019), Sartor and Bataille (2019), Material Economics (2019), ETS price from Ember Daily EU ETS carbon market price **https://ember-climate.org/data/carbon-price-viewer/**
NB: Figure 3 represents lower bound estimates for several technology costs and typically assume €50/MWh of electricity

2) The carbon price has been too unpredictable

Price predictability is critical to trigger a significant reduction of greenhouse gas emissions as it incentivises both innovation and long-term investment decisions in clean technologies. However, the design of an emissions trading system leaves the price determination to market forces, making price fluctuation inherent by nature[19]. The excessive variability of the carbon price over the past few years has severely hindered long-term investment choices, since they were considered riskier. Even though we cannot expect the ETS to reach the price predictability of a carbon tax[20], improving the predictability of carbon pricing will be essential to restore investors' confidence.

To that extent, the update of the ETS regulation might help increase long-term price predictability. In theory, the EU climate neutrality objective, alongside the updated 2030 emission reductions target of 55% relative to 1990 levels, may offer the credibility the market was lacking in the eyes of the participating entities, as

[19] Delbeke, and Vis (2019), **Towards a Climate-Neutral Europe | Taylor & Francis Group**
[20] Hassler, Krusell, and Nycander, (2016), **Climate policy**

long as they are not struck by myopia[21]. While it is coincidental, the fact that the end of phase 4 occurs in 2030, should ensure a stable and predictable legal basis over an extended period of time which is highly beneficial when it comes to providing certainty to investors. Moreover, the recently introduced market stability reserve (MSR) is likely to help to stabilise the carbon price in the face of shocks, policy changes or technological development, which make it harder to predict future demand for allowances. Indeed, banking surplus allowances to the reserve will allow short-term flexibility, resulting in better price stabilisation.

3) The carbon price signal has been dampened by too many loopholes

Another issue to address is the free allocation of allowances to energy-intensive industries. Many energy-intensive basic materials are internationally traded commodities. Free allowances are in place to protect against possible carbon leakage and industry sectors have successfully lobbied to retain free allowances through successive ETS revisions.

However, as highlighted by the European Court of Auditors[22], free allocation has not been sufficiently well targeted to date. Some sectors have benefitted from significantly more allocation than needed. Free allocation has created distortions in the way the carbon price operates, dampening the carbon price signal for these sectors and has thus failed to sufficiently incentivise producers in these sectors to invest in breakthrough innovations.

The upcoming ETS revision presents an opportunity to shift from a system which has prioritised preserving industry in the face of external competition to one more focused on transforming industry in the shift to a climate-neutral economy. Phasing out free allowances or ensuring a more targeted approach will mean that EU industries will face a stronger carbon price signal, but it will also generate resources to ensure that industries can be supported to transition in a more concerted way via direct innovation support. After all, an accelerated shift to breakthrough clean production processes will be the best protection against carbon leakage in the long run. However, to make it politically viable the phase out of free allocation should be paired with new solutions to address carbon leakage risks, including, for example, the carbon border adjustment mechanism.[23]

[21] Quemin and Trotignon (2019), **Intemporal emissions trading and market design: an application to the EU-ETS**. According to the authors, myopia implies that firms decreasingly account for estimated annual abatement efforts the farther away they look into the future.

[22] European Court of Auditors (2020), **Special Report: The EU's Emissions trading System: free allocation of allowances needed better targeting**

[23] Lamy, Leturcq, Pons (2020), **A European border carbon adjustment proposal – greening EU trade**

Finally, there is a built-in expiration date on free allowances. They are drawn from a fixed share of an overall pot of allowances that is decreasing in line with the ETS cap. Depending on the level of ambition set in the upcoming ETS revision, free allocation may have to be phased down in any case somewhere between 2026 and 2030.

A powerful catalyst to accelerate the decarbonisation of the power sector

As the price of allowances increased in the last few years, the ETS proved to be particularly effective at reducing the use of coal to generate electricity in the EU. As coal is the most polluting way to generate electricity, it is also the most impacted by the increase in the ETS price. The ETS thus seems to accelerate the ongoing phase-out of coal, resulting in more market space for the use of existing natural gas power plants in the short term, an incrementally innovative carbon-intensive technology, as well as the necessary deployment of renewable electricity sources in the medium term.[24] This is confirmed by recently released data from the European Environment Agency, that assesses the major decline in coal power generation between 2018 and 2019 in EU countries, especially Germany, Spain, and the Netherlands.[25]

In other words, in the electricity sector, clean energy innovation was first and foremost triggered by non-ETS instruments, but the ETS now acts as a catalyst to accelerate the phase out of the most outdated and polluting technologies, thus opening market space for the deployment of more renewable capacities in this decade. As the International Energy Agency puts it, the "success of the combination of the ETS and sector-specific policies is an important lesson learned"[26] for the electricity sector. The European Commission should therefore approach its ETS reform in a manner that increase the chances that such success could also occur in other ETS sectors, including energy-intensive industries.

Use of ETS revenues for innovation investment

Between 2012 and June 2020, the ETS revenues (from installations in EU member states, the UK and EEA countries) generated more than €57 billion[27]. Despite the COVID-19 crisis, €7.9 billion euros have already been generated for the first half of 2020 as compared to the €14 billion generated both in 2018 and in 2019. In comparison, in 2018 research & innovation public investment for clean energy

[24] IEA (2020) **European Union 2020, Energy Policy Review** (p. 292)
[25] EEA (2020), T**he EU Emission Trading System in 2020: trends and projections**
[26] IEA (2020) **European Union 2020, Energy Policy Review** (p. 70)
[27] European Commission (2020), **Report on the functioning of the European carbon market**

only represented €3.3 billion in the EU-27 (excluding investment made within the framework of the Multiannual Financial Framework)[28].

Under the EU ETS directive, member states should allocate at least 50% of auction revenue for climate and energy purposes, leaving the rest to be spent at their own discretion. According to the 2020 EU Climate Action Progress Report[29], from 2013 to 2019, "almost 78% of the revenues went to climate and energy expenditure". During that time frame, these funds were mainly directed towards renewable energy (€12.9 billion) and energy efficiency (€11 billion), while a small margin went to sustainable transport (€3.1 billion) and R&D (€2.1 billion).

The Modernisation Fund, [30] which became operational in January 2021, will support energy investments (renewable energy, energy efficiency, energy storage, energy networks and a just transition in carbon dependent regions) in ten beneficiary member states[31]. As those ten member states have different starting points when it comes to energy transition, some will benefit more from the expected €14 Bn envelope for the 2021-2030 period. Capped at 2% of the ETS-cap the fund will primarily help member states meet their 2030 target.

The EU Innovation Fund was created to ensure that more ETS revenues support clean energy innovation. An estimated €12.5 billion from the auctioning of 450 million[32] allowances (at a price of €25t/CO_2) will be available during the 2020-2030 period to finance the commercial demonstration of innovative low-carbon technology solutions in all member states. Projects like carbon capture use and storage, energy storage, innovative renewable energy generation or cleaner production processes for energy-intensive industries could, if selected, rapidly benefit from the fund to invest in new demonstration projects[33].

Although the Innovation Fund has great potential to help support climate-neutral innovation in ETS sectors, it lacks the resources to do so at the scale and pace required. The first call for the Innovation Fund launched last year was 20 times oversubscribed,[34] clearly showing the huge appetite for more funding in this area

[28] Pellerin-Carlin (2021), **Europe needs to innovate to become a front-runner**

[29] European Commission (2020), **Kick starting the journey towards a climate-neutral Europe by 2050**

[30] European Commission (2021), **Fact sheet on the Modernisation Fund**

[31] Those 10 countries are the 13 countries who joined the European Union after 2004, minus Cyprus, Slovenia and Malta. They are Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia.

[32] As well as any surplus coming from the NER300 program its ancestor.

[33] European Commission (2021), **Factsheet on the Innovation Fund**

[34] Carbon Market Watch (2021), **A new hope – recommendations for the EU emissions trading system review**

prompting the Commission to explore ways of speeding up the application process for future calls.

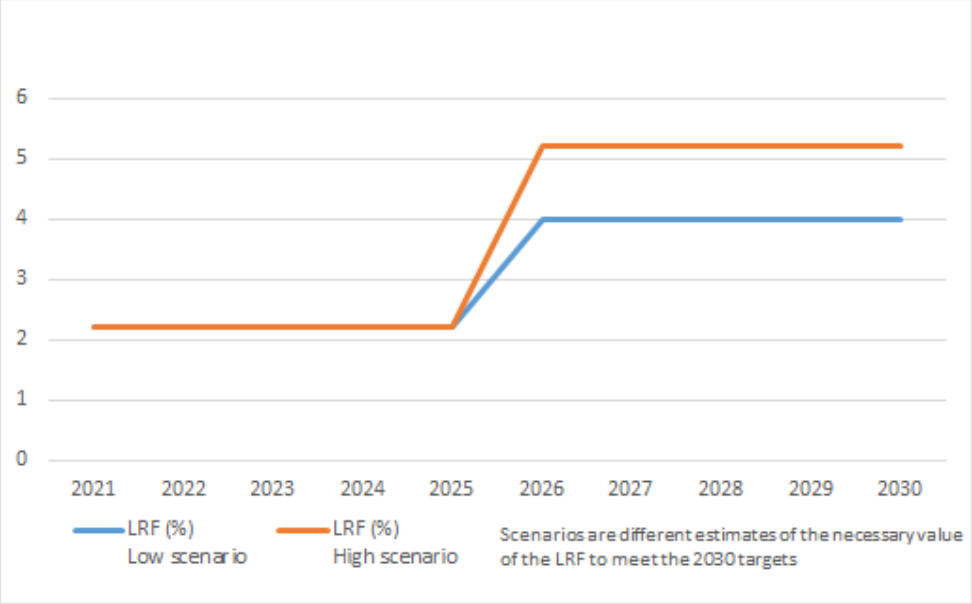
Section 3: Policy recommendations

The upcoming ETS revision presents an opportunity to ensure carbon pricing starts to deliver the innovation development and deployment needed over the next 10 years. Key areas include:

Strengthening carbon price to foster close-to-market innovation

The longer the EU waits, the higher the linear reduction factor will have to be. Starting in 2021, the linear reduction factor has a 2.2% reduction rate of the total quantity of allowances. The politically preferable scenario is likely to keep this value for the 2021-2025 period and increase this factor for the second part of phase 4 (2026-2030). In order to be consistent with the EU 2030 emissions reductions target, this would imply a linear reduction factor of at least 4%[35], with some modelling indicating 5.2%[36].

Figure 4. Linear Reduction Factor increase needed for the ETS to be in line with EU 2030 climate targets



[35] Swedish Environmental Protection Agency (2020), **Measures to strengthen the EU ETS**
[36] Ferdinand (2019), **What a 55% 2030 emission reduction target means for the EU ETS | ICIS**

The European Commission must take into account the fact that negotiations surrounding the ETS revision could take roughly one and a half years, which would leave us with an implementation date of early 2023 at the earliest. Keeping that variable in mind before presenting the upcoming reduction factor is key to ensure visibility and certainty on long-term emissions for investors and to spur technological innovation.

A smooth increase would, first of all, ensure a higher carbon price and increase auction revenues for member state. In addition, it will ensure that polluting industries are effectively exposed to the carbon price signal, thereby increasing the incentive to invest in green innovative solutions.

Reducing price volatility

Implementing an EU-wide carbon floor price[37] with a gradual increase over time (e.g. €30 in 2022, €70 in 2025 and €120 in 2030)[38] could help diminish the volatility of the carbon price, ensuring more predictability for investors and companies. Indeed, a carbon price floor would act as a driver to support investments at scale that have a long payoff period but need to occur in the years to come[39] to be fully effective in the fight against climate change. Moreover, strengthening the parameters of the MSR[40] during its reform could also help diminish price volatility.

While each member state is free to establish its own carbon floor price as the UK did in 2013, establishing one at European level would be more efficient, sending a positive signal to investors regarding price stability and ensuring a level playing field within the single market. Indeed, while the UK introduced such a mechanism back in 2013 at €18 and was supposed to increase to €33 by 2020, the government froze the price in 2016 to "limit the competitive disadvantage faced by business and reduce energy bills for consumers"[41]. The Netherlands also intended to set up a carbon floor for power generation plants with a starting price around €12/tCO2 in 2020 rising up to nearly €32 ten years later. However, with the outbreak of COVID-19 and its impacts on the economy, the government decided to postpone its entry into force. Setting a minimum price for the allowances that would increase over time, would help trigger investment in innovative clean technologies by ensuring that the carbon price does not drop under a predetermined level.

Phasing out all free allocations of ETS allowances by 2025

[37] Elkerbout (2018), **Five myths about an EU ETS carbon price floor**

[38] Cleantech for Europe (2021), **How can the EU lead the race to net zero?**

[39] Buck, Peter, Sartor (2021), **Enabling industry to invest into a climate-neutral future before 2030**

[40] Berghmans, Vailles (2020), **Re-shaping the EU ETS as a safety net, not a driver**

[41] UK Parliament (2018), **Carbon Price Floor (CPF) and the price support mechanism**

The Commission should signal its intention to rapidly reduce the number of free allowances allocated towards a full phase-out by 2025. Such a phase-out could be made more politically acceptable by ensuring that the additional revenues generated are used for the Innovation Fund or to fund EU-level Carbon Contracts for Difference to support the first generation of commercial climate-neutral industrial production sites. The Commission is, in parallel, exploring the option of alternative carbon leakage protection tools via its carbon border adjustment mechanism proposal due in June 2021 that should go hand in hand with the phasing-out.[42]

Increasing the share of revenues from auctioning of ETS allowances dedicated to research & innovation

The European Commission should increase the amount of funding available under the EU Innovation Fund, while ensuring that the selection process targets truly transformative innovative projects. In parallel, carbon revenues dedicated to innovation must be increased given that between 2013 and 2019, only 6,5% of the domestic use of revenues of the ETS were dedicated to R&D. As the use of the revenues is left to the discretion of the member state, the European Commission could propose that at least 10% of revenues are allocated to R&D. Finally, as the Modernisation Fund is brand new, the Commission should monitor its effectiveness and ensure efficient funding allocation, for example by reviewing spending at the halfway point (e.g. in 2025) and providing guidance if required.

Combining the ETS with ambitious regulatory policies to help pull through climate-neutral innovations

In addition to the measures suggested above to ensure a strong carbon price signal and strengthened ETS, policymakers cannot neglect the rest of the policy framework. As argued above, the ETS is a helpful catalyser – an accelerator of existing, incremental innovations. To deliver the breakthrough leaps in technology development, and, critically, adoption, that we will need over the next 10 years, the ETS will need to be couched in a wider policy framework, drawing on market-based and regulatory tools. An ambitious ETS reform, in combination with ambitious sector-specific regulatory changes, gives the EU the greatest chances to deliver on both its 2030 and 2050 climate objectives. The European Commission, Parliament and Council should therefore approach those policy choices in combination, to create the greatest possible synergies between price-based instruments (EU ETS, Effort Sharing Regulation, Energy Taxation Directive, Carbon Border Adjustment Mechanism) and regulatory instruments (Renewable Energy Directive, Energy Efficiency Directive, Energy Performance of Buildings Directive, Industrial Emissions Directive, etc.).

[42] Lamy, Leturcq, Pons (2020), **A European border carbon adjustment proposal – greening EU trade**

About E3G

E3G is an independent climate change think tank accelerating the transition to a climate-safe world. E3G builds cross-sectoral coalitions to achieve carefully defined outcomes, chosen for their capacity to leverage change. E3G works closely with like-minded partners in government, politics, business, civil society, science, the media, public interest foundations and elsewhere.

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Based in Paris, it aims to produce analyses and proposals targeting European decision-makers and a wider audience, and to contribute to the debate on the European Union and the major EU policies. Since 2018, its research activities on energy and climate are led by the Jacques Delors Energy Centre.

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