HOW LOW CAN WE GO?

Residual emissions in ETS1 by 2040 and 2050

November 2026

CARBON MARKET WATCH

Developed by Carbon Market Watch based on an Öko-Institut study.

INTRODUCTION

The EU Emission Trading System (EU ETS) must plan for its endgame.

With an EU climate goal of net -90% of greenhouse gas emissions by 2040, and a continent-wide 2050 climate neutrality target, the EU's carbon market must enable a decrease in emissions aligned with this trajectory while taking into account sectoral peculiarities, and a variance in levels of technological readiness.

However, the latest EU ETS review proposal pushes the date of the endgame further away, allowing higher emissions both in the short and long term, practically shifting the burden away from energy and industry towards non-ETS1 sectors: this equates to higher pressure and decarbonisation demand on agriculture, land sinks, and the forthcoming emissions trading system for road transport and buildings (ETS2).

This Carbon Market Watch briefing summarises an Öko-Institut study that investigates in detail how each ETS1 sector can reach its lowest emission levels based on currently available technological abatement options. The study shows low emission levels in ETS1 are possible, and that the technologies that are mostly available today will allow most ETS1 sectors to take strides towards net-zero. While certain sector-specific bottlenecks do exist, action must be taken today by policymakers and companies to pick up the pace of industrial decarbonisation.

A clean European industry that generates low to zero emissions is possible, even without (or scarce) decrease in demand-driven production. Self-sufficiency paths could reduce residual emissions levels even further, but such scenarios are outside the scope of this study.

Clean re-idustrialisation can be achieved in Europe: the EU ETS can help make it a reality.

SCOPE OF STUDY

The analysis covers all EU ETS1 emissions (energy, industry, maritime transport, aviation) using ETS transaction log activity codes and sector clustering to allocate emissions across industries. It provides detailed analysis of the 14 largest sectors, which account for 99% of 2024 emissions, and a top-down assessment of the remaining sectors. Although not covered under current ETS rules, waste incineration is also included in the study, given its standardised monitoring requirements and proposed inclusion in the next ETS1 phase.

Across all sectors, the study covers two possible scenarios: medium and high progress.

The medium-progress scenario is based on existing literature and additional assumptions to fill data gaps - it assumes that production volumes generally increase or experience limited, demand-driven decreases, alongside medium availability of relevant technologies, feedstocks and infrastructure.

Conversely, the high-progress scenario projects a more ambitious transition, where alternative products and better efficiency lower product demand and decrease production volumes. It also assumes higher availability of technologies, feedstocks and infrastructure, supporting greater emissions reductions by 2040 and 2050.

KEY RESULTS

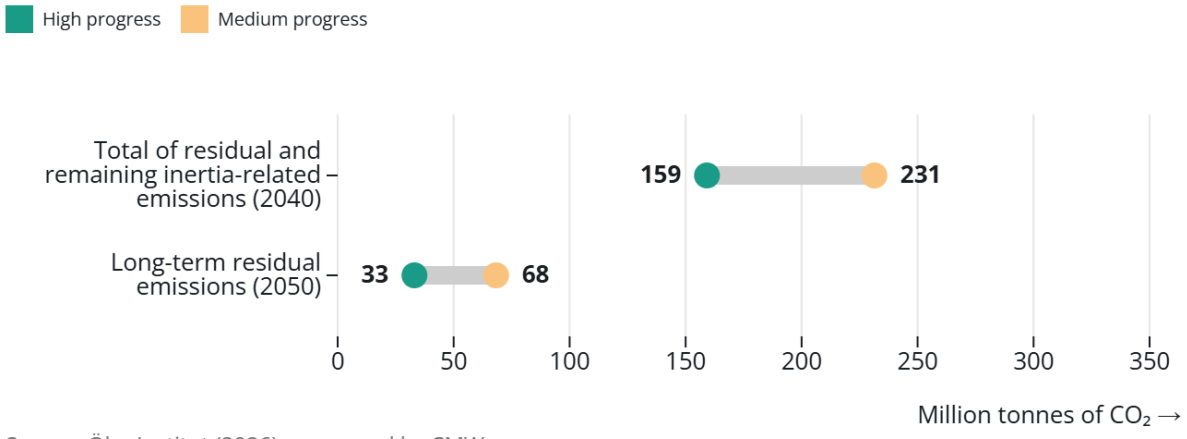
As shown in the figure below, the key takeaways from this study are encouraging:

- In 2040, emissions levels can reach between ~159 and ~231 million tonnes of CO_2 and would be dominated by remaining inertia-related emissions rather than long-term residual emissions. This is in line with the 2040 Impact Assessment's 90-95% domestic net emission reduction scenario (S3) which projects approximately 200 Mt of CO_2e emissions from energy, industry and international transport.
- In 2050, long-term residual emissions are projected between ~33 and ~68 million tonnes of CO_2. The 2040 Impact Assessment projected significantly higher 2050 emissions (around 85 Mt across S1, S2 and S3).

- In the vast majority of sectors considered, direct decarbonisation technologies are already at a high technology readiness level (TRL). The main bottlenecks identified are infrastructure and grids, with few exceptions in specific sectors.

A clean European industry is possible by 2050, without degrowth

Residual and remaining inertia-related emissions in 2040 and residual emissions in 2050 under high and medium progress scenarios ($MtCO_2$).

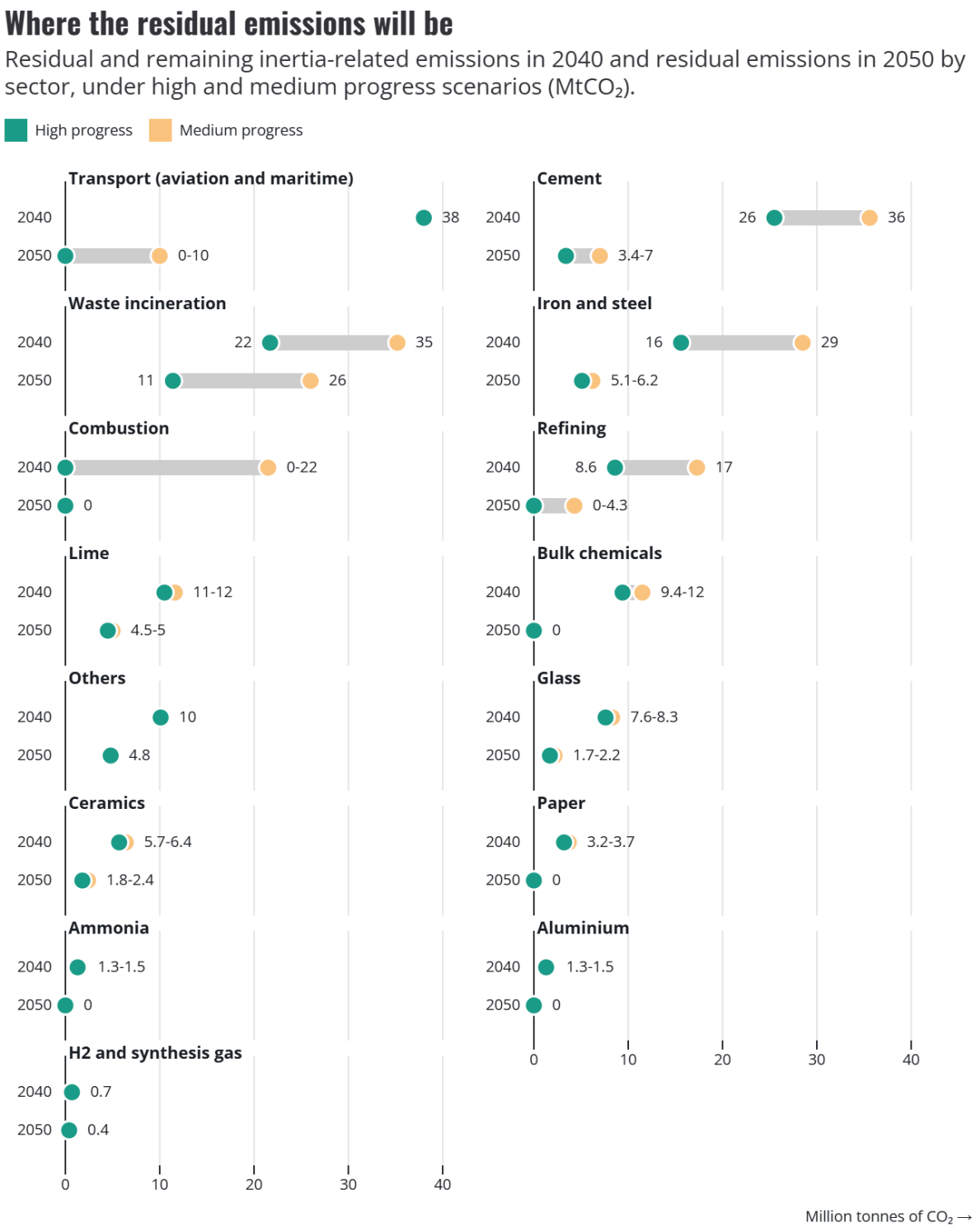


Source: Öko-Institut (2026), processed by CMW

Combustion (electricity and heat production) can already reach zero emissions by 2040, with high renewable energy rollout and related infrastructure such as power grids, energy storage and interconnection. Bulk chemicals, ammonia, paper, and aluminum productions can all reach zero emissions by 2050 if supported by suitable investment and policy choices.

In 2050, only a few sectors are expected to continue demonstrating long-term residual emissions in the high-progress scenario. Emissions are expected from the iron and steel, cement, lime, waste incineration, glass and ceramics industries, and to a lesser extent hydrogen and syngas production.

Residual emissions - contribution for each sector



* Note: A single visible dot means both scenarios give (nearly) the same value. A range label means the two values differ slightly.

Source: Öko-Institut (2026), processed by CMW.

Three main contributing factors can be identified as responsible for these remaining emissions even in higher ambition scenarios:

- → CO_2 that is not captured by carbon capture units (a capture rate of 85-90% is assumed by Öko-Institut). This is most relevant for the waste incineration, cement and lime, glass and ceramics sectors, which are expected to roll-out carbon capture and storage or utilisation to cover for their process-related emissions.

- → Emissions from small-scale installations that are assumed to be too small to be equipped with a carbon capture unit or to be connected to CO_2 transport infrastructure. The issue of small-scale installations is relevant for glass production, ceramics, non-ferrous metals excluding aluminum (such as copper or zinc), and waste incineration.

- → Consumption and burn-off of electrodes in steelmaking and non-ferrous metals production.

- → Emissions from few processes (including the ones mentioned above) that have a small contribution to total emissions, where necessary new technology is currently at low readiness level and might not be available in time (e.g., alternative reducing agents in some non-ferrous metals production processes).

However, reaching a high-ambition scenario is not a certainty. In the medium progress scenario, much higher climate pollution could still be pumped into the atmosphere even though technologies are available. This indicates uptake of those technologies is lacking - for several possible reasons.

A key element is the lack or low availability of infrastructure: grids for renewable electricity, infrastructure for hydrogen production and transport, CO_2 transport pipelines; this includes grid connection to installation. A related and highly discussed factor is the low availability, or extremely high cost, of climate-neutral energy carriers and feedstocks: regarding electricity, this varies greatly by country (with Nordic countries and Spain showing lower average costs for non-households consumers), while feedstock such as hydrogen remains extremely expensive due to its near-zero availability.

Financial constraints present another obstacle: decarbonisation projects can be capital expenditure intensive and require large-scale investments that are strategically planned over the long term. Moreover, new technology routes may also deliver higher shares of

operational expenditure due to current high costs of climate-neutral feedstock and energy carriers.

Also, some electricity-based technologies may be commercialised too slowly: it could be the case for high-temperature heat generation technologies, direct synthesis of methanol and processes in the chemical industry such as methanol-to-aromatics.

RECOMMENDATIONS FOR POLICYMAKERS

A higher ambition scenario is within reach, and can be achieved through a mix of Paris Agreement-aligned policy and forward looking investments. Available policy frameworks must enable and encourage high ambition from operators in high-polluting sectors, and prevent inertia. In the context of the current EU ETS revision, this means:

1. **Keeping the Linear Reduction Factor (LRF) aligned with what is technologically feasible, not what is politically more convenient**. Several studies already highlight that keeping an LRF above 4% until the mid-2030s is realistic: the amount of allowances in current legislation is already enough to cover yearly emissions, thanks to the current ETS cap being overgenerous, and a mix of continuing coal phase-outs, high RES uptake, energy efficiency, and high number of surplus allowances still in circulation. Keeping the LRF at 4.4% until 2035, and changing it to 2.7% in 2036, would translate into 169MtCO2[1] allowed in 2040 for stationary installations (energy, industry, maritime): still above the outlined ambitious scenario for residual emissions in 2040.
2. **Don't allow for sectoral specificities to open the door for generalised loopholes.** While some sectors like aluminum will need further research and development to make possible the adoption of new technologies, and others such as ceramics could face investment and implementation challenges due to plants being small-scale, these peculiarities need sector specific solutions, rather than translating into blanket exemptions for all sectors. There is no need for increased free allocation (via CBAM factors or looser benchmarks) or for additional allowable emissions under the cap for sectors with high TRL technologies readily available. Any residual free allocation must come with climate investment strings attached.

[1] Numbers elaborated by CMW based on the Climact ETS Simulator.

3. **Clearly guiding companies' decisions towards investment: link public funding and benefits (such as free allocation) with final investment decisions** in decarbonisation projects, and ensure clawbacks are in place if projects don't deliver the required emission reductions. Studies show that even companies that have financial availability often don't invest in decarbonisation projects - but rather waste resources on shareholder payouts.

4. Encouraging investments can happen through binding targets and goals, but also through **providing the conditions for direct decarbonisation projects to take place**: it's an urgent necessity that ETS revenues (and in general public and private investments) are funneled towards the development of energy efficiency technologies, electricity grids, interconnections, energy storage and batteries, and hydrogen and CO_2 infrastructure. Any weakening of the ETS price signal (through even more overgenerous caps or international credits) and any resources given away freely without real strings attached (such as free allocation or indirect cost compensation) reduces the availability and opportunity of ETS revenues to fund the transformation.

5. Providing an investment signal and supporting investments directly can go hand in hand: **unlock private and public investments through the establishment of clear access and disbursement rules for funds** such as the new Industrial Decarbonisation Bank, the Innovation Fund, and state aid. Public money should foster private investments through de-risking certain projects, focusing on sectors where technological solutions are still not commercially available.

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