

The decarbonisation of the European Integrated Steel Industry



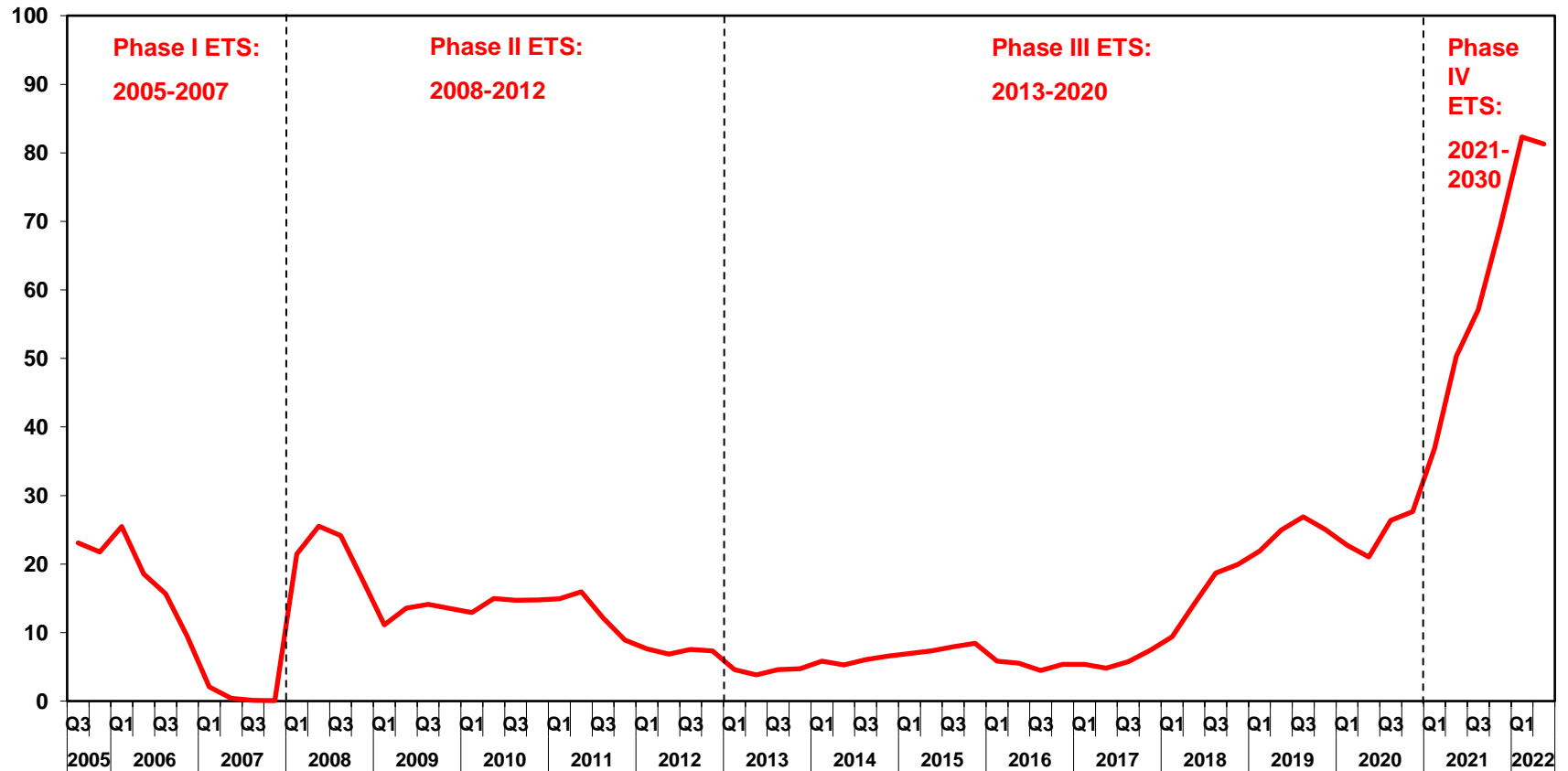
**Presentation to Kallanish
Europe Steel Markets Conference
Milan (Italy) 30 May 2022**

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CO₂ prices have risen sharply in the last years. Prices had fallen back somewhat in 2020 during the Coronacrisis, but surged to new record levels of upto €96/t of CO₂ in Q1 2022

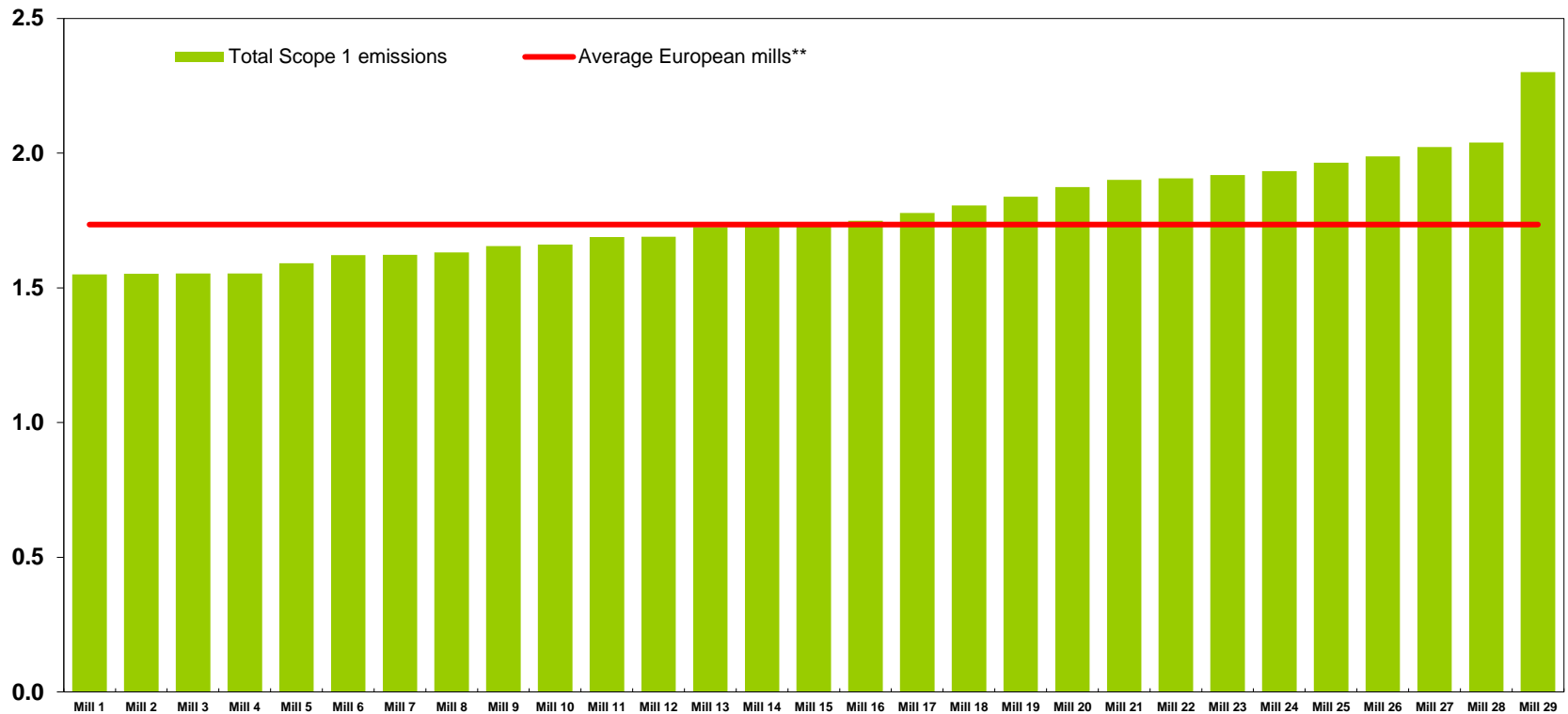
Spot carbon emission price ETS (€/t CO₂)



Source: EEX

CO₂ emissions curve of European integrated steel plants: Emissions vary considerably from mill to mill, key differentiators include coking yields, carbon consumption in the BF and scrap rates in the BOF

Scope 1 CO₂ emissions curve European integrated steel industry (t CO₂/t crude steel*), 2021



Source: SteelConsult multi-client study “CO₂ emissions and ETS costs of the European integrated steel industry: Outlook to 2035”

Note: *Upto crude steel, excl. downstream **Mills in EU-27+UK

In response, European mills are stepping up efforts to adopt short term decarbonization measures. Longer term, most mills are looking at natural gas/hydrogen based DRI plants, and some also at CCU/CCS

Short term measures:

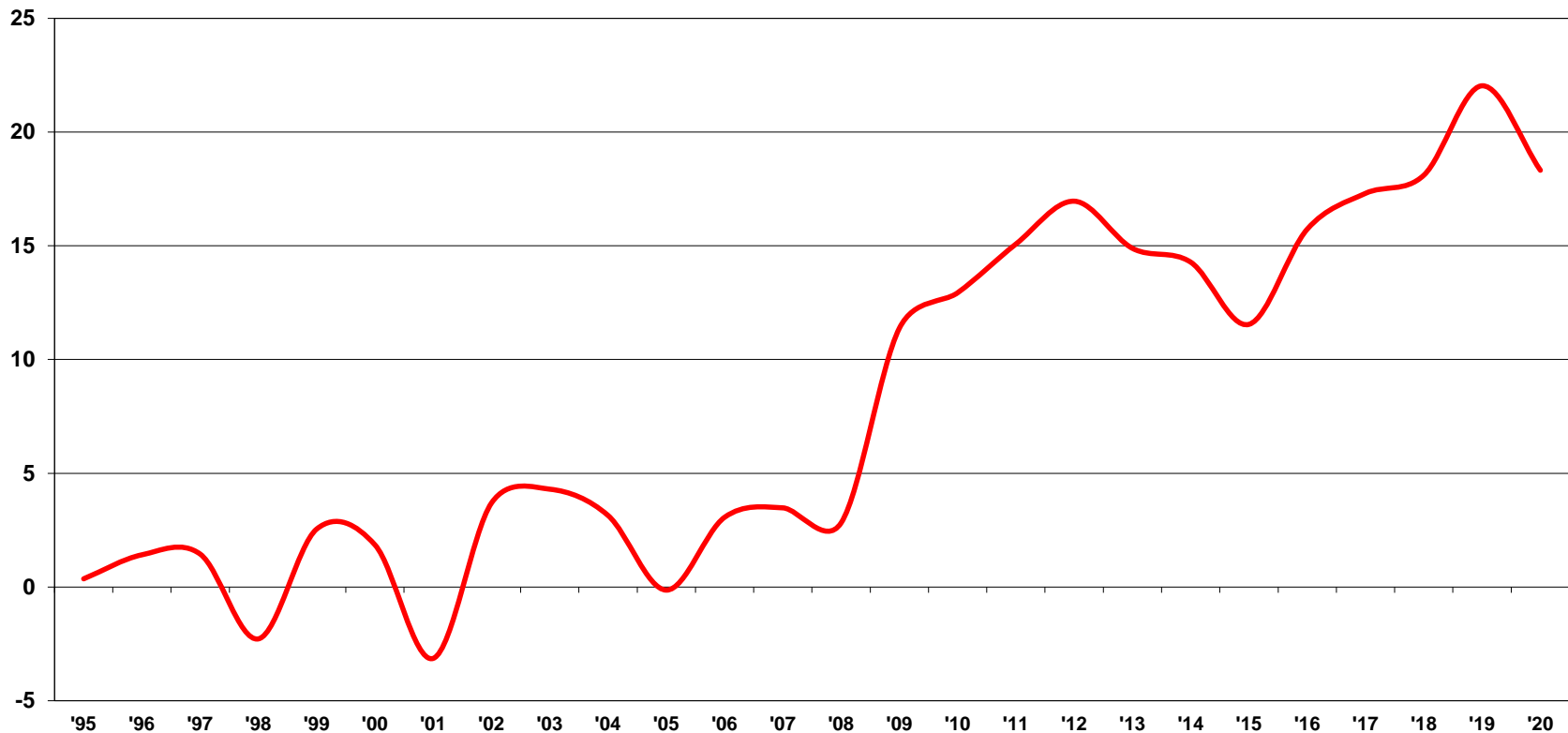
- Raising scrap rates in the BOF
- Decreasing reductant in the BF incl. through:
 - Hydrogen injection
 - Coke gas injection
 - Waste plastics, municipal waste, wood waste and biomass charging
 - Scrap and HBI charging in the BF
- Offgas utilization

Long term solutions under development:

- Natural gas/hydrogen based DRI
- DR Smelter (OSBF + SAF)
- Scrap fed/hybrid EAFs
- CCU/CCS as partial, complimentary option

Europe has a scrap surplus of around 20 mln tpy, that is currently exported. In the future, this excess scrap is likely to be used within the region, by both integrated mills in their BOFs and by scrap based EAFs, as scrap becomes a more valuable 'green' raw material in Europe

Net scrap exports Europe* (mln tonnes)



Source: WSA, SteelConsult

Note: *Europe incl. EU-27, plus other European countries, excl. Turkey.

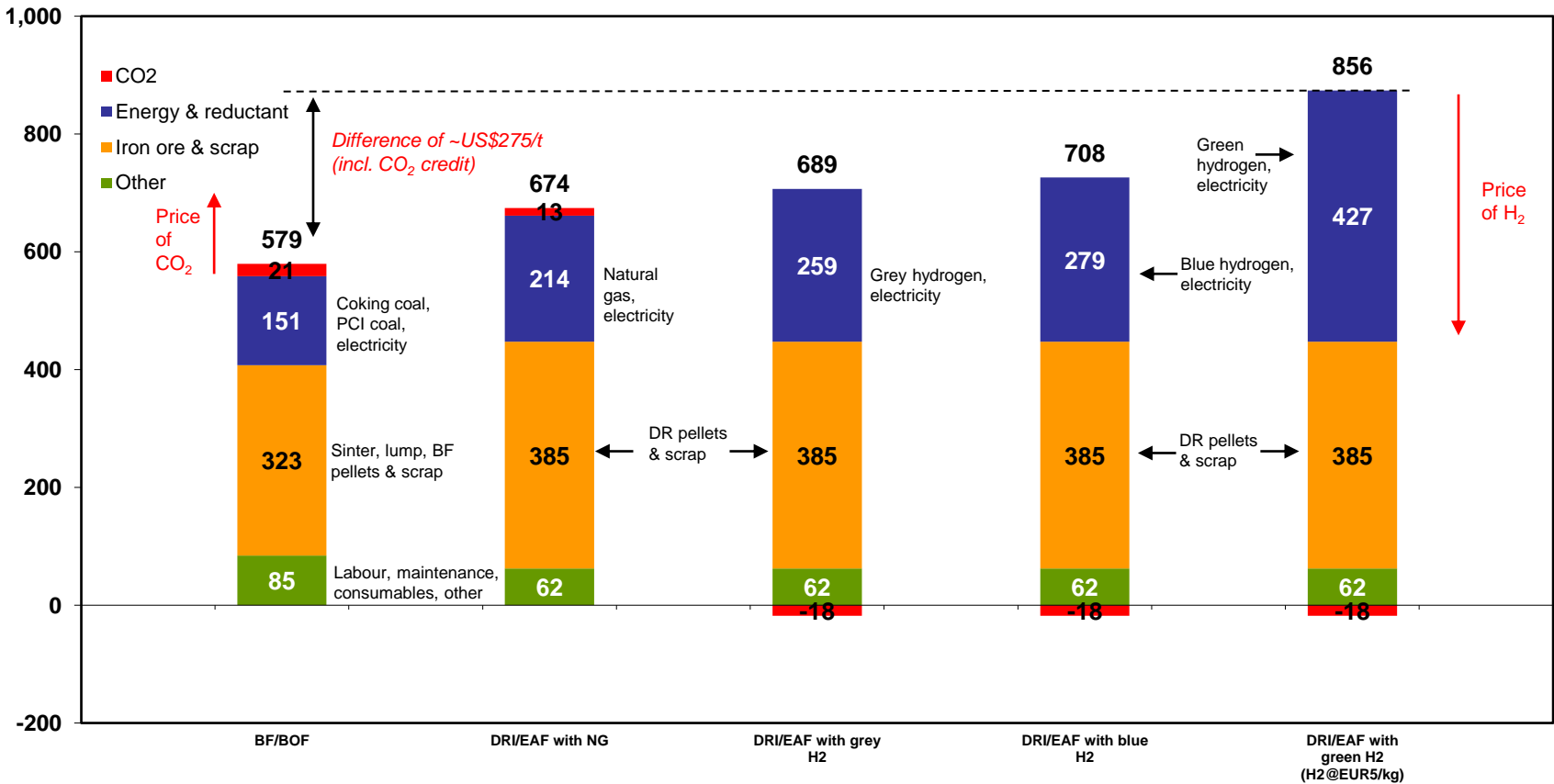
The challenges that integrated steel mills are facing in their decarbonization process are huge

Challenges:

- Natural gas cost and availability (gas supply crisis, LNG?, competition with other sectors)
- Cost of green energy
- Availability of green energy (competition with other sectors)
- Reliability of green energy (24/7, 365 days)
- Electricity grid capacity
- Availability of pellets
- Quality of pellets
- Scrap availability and quality
- Producing premium steels with EAF
- How to finance the massive investments required, in particular in green energy generation
- Permit lead times can take many years
- Bottlenecks in equipment supply and E&C

The formidable challenge of decarbonization in steel: DRI using green hydrogen has an OPEX of upto 50% higher than BF/BOF steel. It is not just the cost of hydrogen that is more expensive, but also the need to use mainly (DR) pellets, which is an expensive raw material

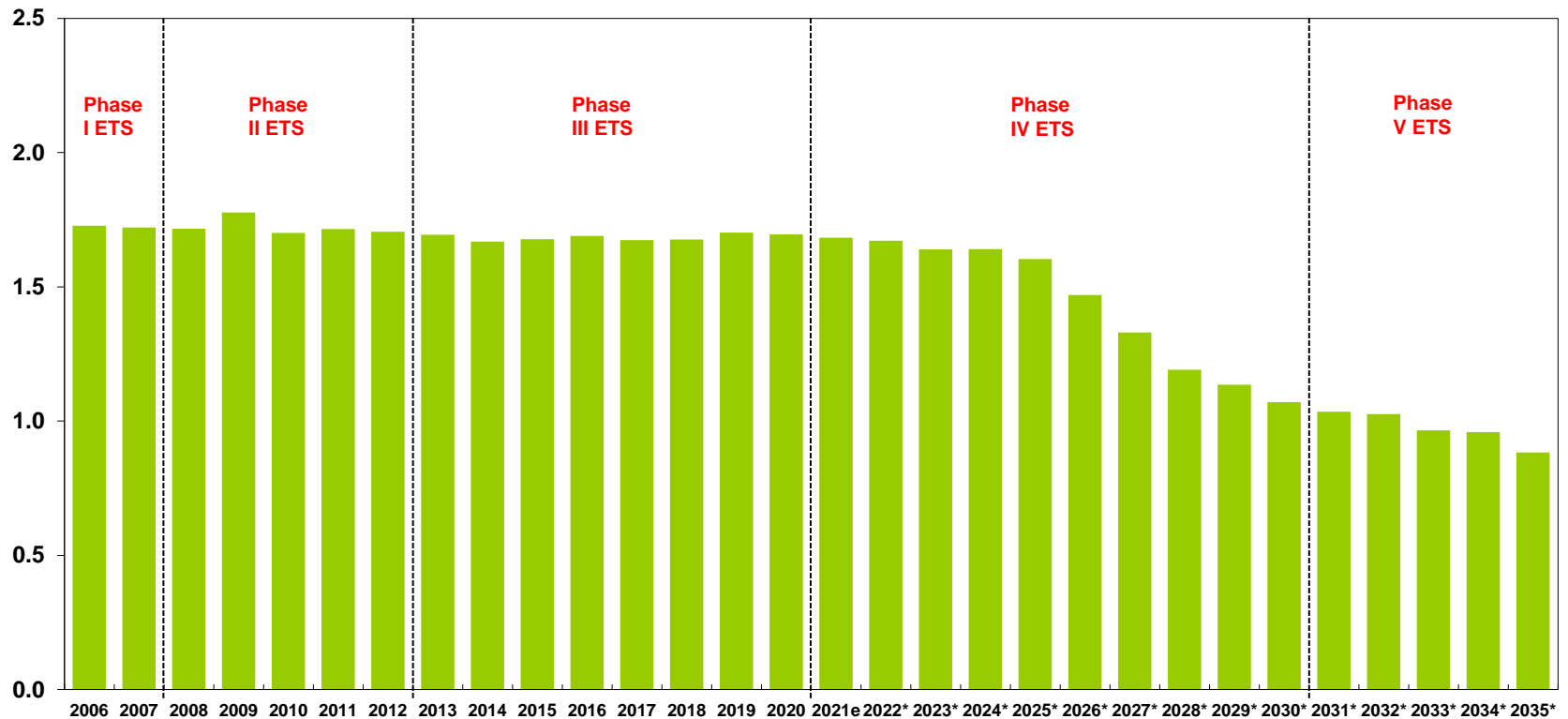
Operational production cost/t slab/billet EU mill, US\$/t (2021)



Source: SteelConsult analysis

Progress has been slow so far, but emissions are expected to decrease more steeply in the future. However, zero carbon will require much more time beyond 2035

Scope 1 CO₂ emissions, average of European integrated steel mills* (t CO₂/t crude steel**)



Source: SteelConsult multi-client study "CO₂ emissions and ETS costs of the European integrated steel industry: Outlook to 2035"

Note: *Mills in EU-27+UK **Upto crude steel, excl. downstream

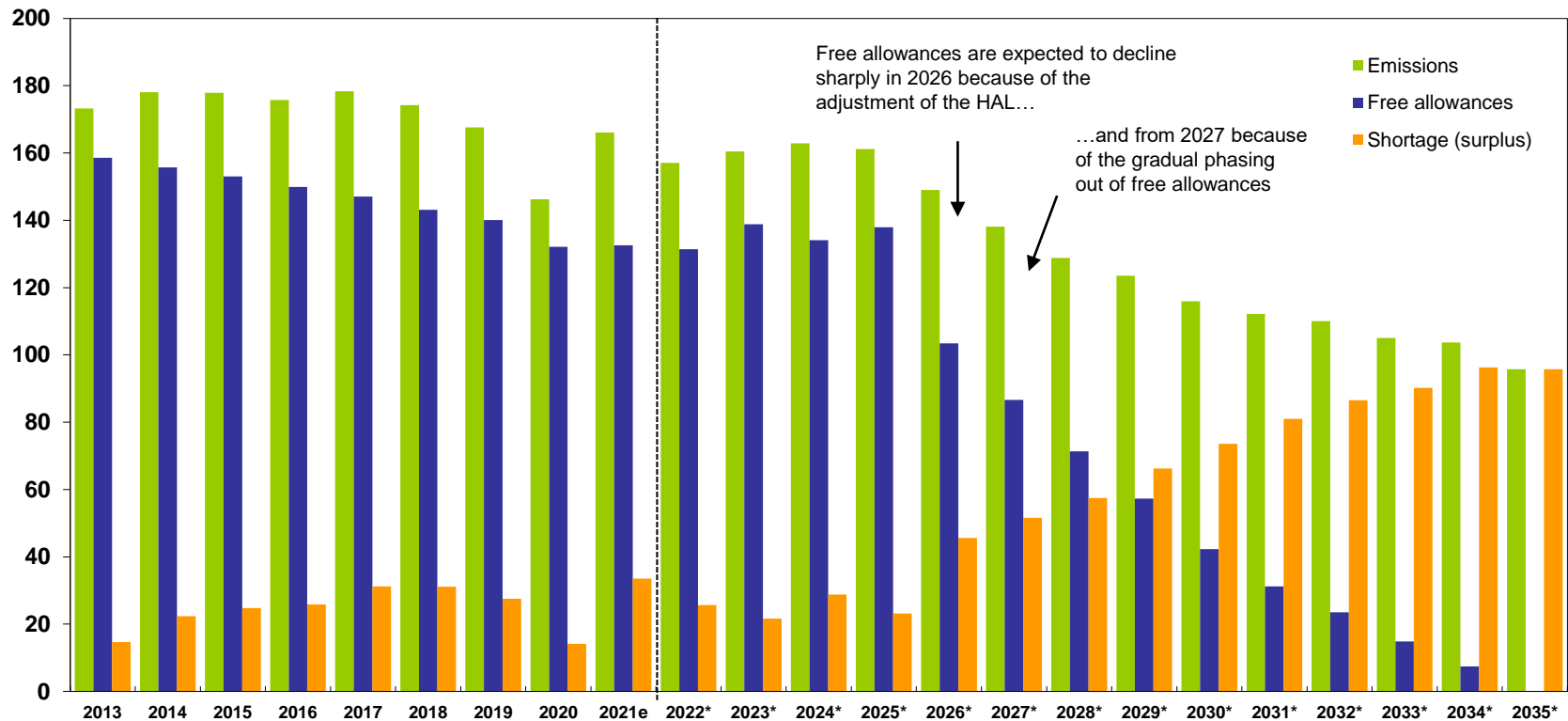
The European Commission's proposed "Fit for 55 package" includes much tougher regulations for the steel industry from 2026 onwards, and will put extra pressure on mills in terms of time and costs, if adopted

Proposed measures include:

- Significant reduction of the total volume of available allowances
- Limiting the volume of free allowances, incl. through lower product benchmarks, and possible inclusion of new breakthrough technologies
- Introduction of Carbon Border Adjustment Mechanism (CBAM), with mixed implications for EU mills and foreign mills, incl. phase out of free allowances from 100% (of benchmark levels) to 0% between 2026 and 2035, by reducing the CLF. The CBAM will allow EU mills to better pass on higher costs and investments related to green steel in the EU market and lead to higher prices in the EU steel market
- Effect for EU mills: positive vs higher carbon foreign competitors on the EU domestic market, but negative vs lower carbon 3rd country competitors and negative for EU mills on export markets.
- For foreign mills: Negative for higher carbon integrated mills in 3rd countries, but opportunity for low carbon integrated leaders, scrap based EAF mills and DRI based mills outside the EU, esp. those producing flats (eg in USA, Canada, Brazil, MENA, China)
- Package needs to be negotiated with the European Parliament and European Council, and may end up even more challenging for the EU steel industry

The Fit for 55 Package will mean steeply rising costs from 2026 and no free allowances by 2035

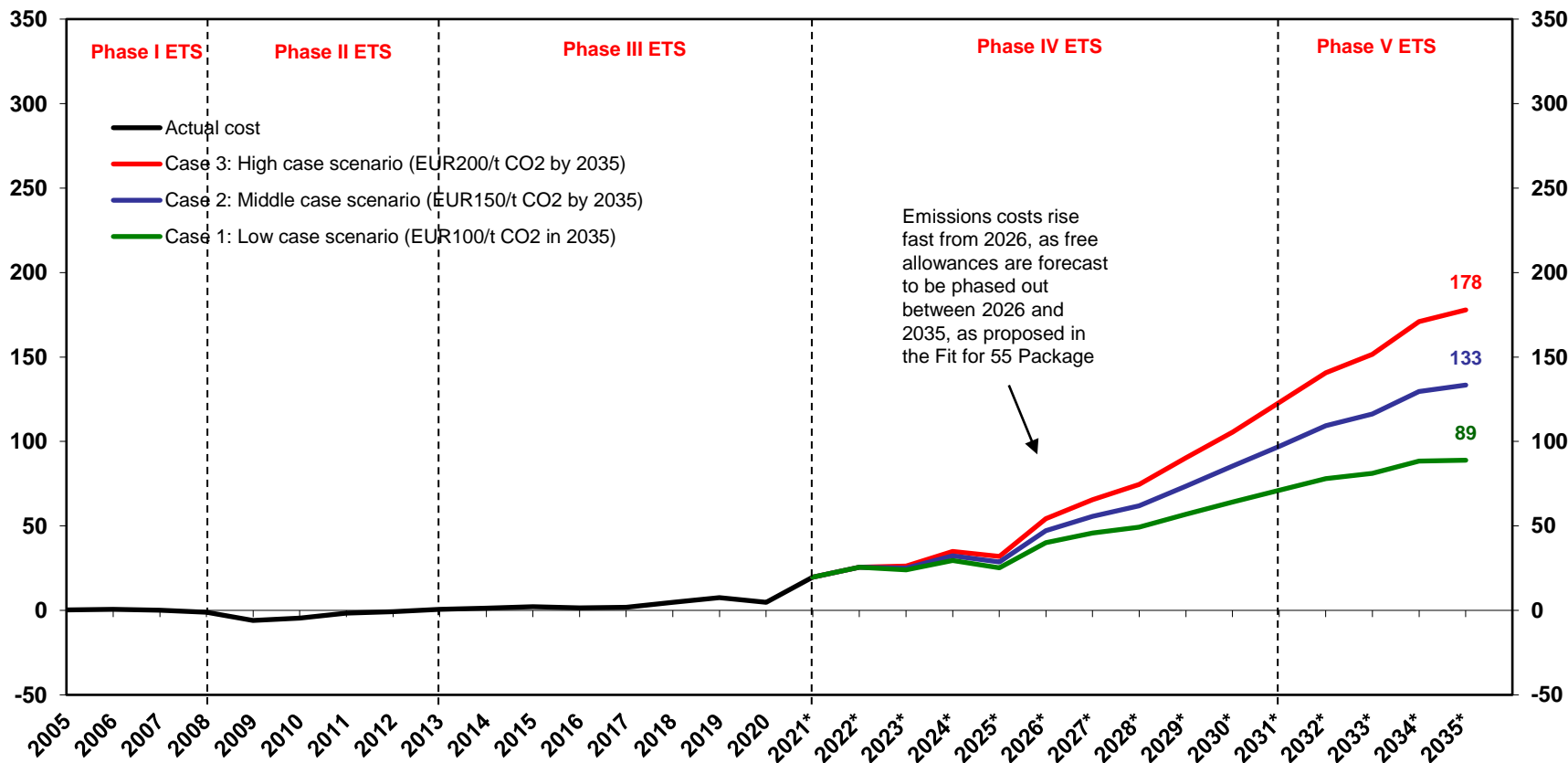
Scope 1 CO₂ emissions*, free allowances and shortages (surpluses) of selected EU mills (mln t CO₂)



Source: SteelConsult analysis, company reports
 Note: *All Scope 1 emissions upto and incl. Hot Rolled Products

The phasing out of free allowances and extra fast rising CO₂ prices as a result of "Fit for 55", if going ahead as proposed, will lead to much higher ETS costs of ~€90-180/t steel produced, even if EU mills proceed with their decarbonization plans

CO₂ emissions costs, average of integrated European steel mills* (€/t crude steel)



Source: SteelConsult multi-client study "CO₂ emissions and ETS costs of the European integrated steel industry: Outlook to 2035"

*Excl. HBIS, Erdemir, Isdemir and Kardemir, incl. UK plants

Conclusions: 2026 is a key date for the European integrated steel industry. A CBAM would likely offer attractive opportunities to low carbon foreign mills exporting to the EU

- 2026 is a key date for the European steel industry, as a result of the “Fit for 55 package”.
- However, also as a result of:
 - First new green players emerging in the EU
 - Mining companies moving into green HBI
 - Green steel becoming key supply capability in auto supply chain
- European mills face difficult decisions: From 2026 the impact of the ETS is expected to accelerate, and competition by (new) green players will increase, but 2026 is very short term for investments
- Wrong investments now will mean huge losses of time and resources in the future
- Furthermore, upto 80% of the required CAPEX for the transition to clean steel is needed for the green energy infrastructure. Most mills will not be able to pay for this, and will need very substantial government/EU support
- The introduction of a CBAM as intended by the European Commission would likely lead to higher steel prices on the EU market, which would offer attractive opportunities to low carbon foreign mills exporting steel to the EU

Thank you for your attention!



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