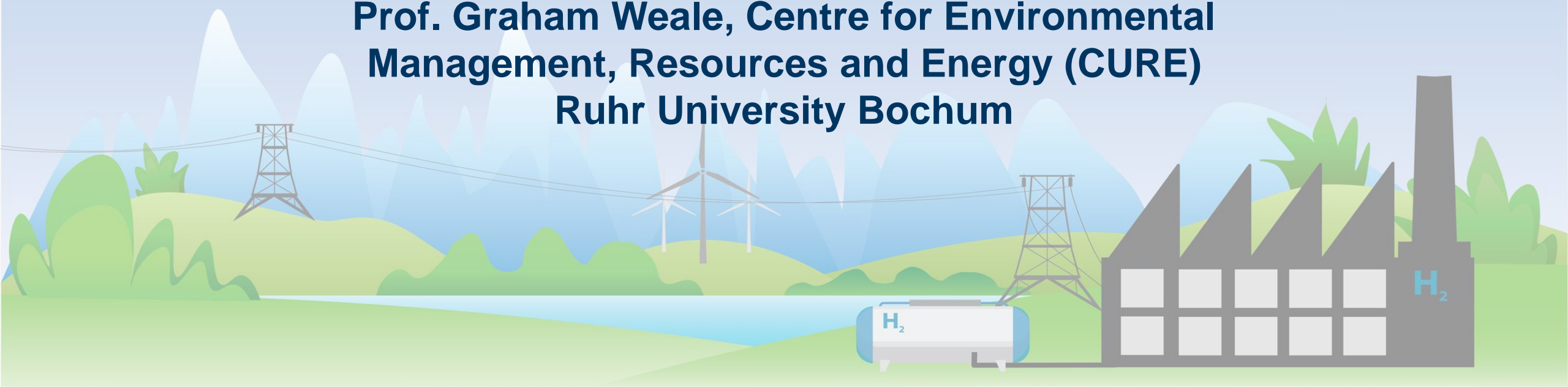


The role of carbon prices vs. other drivers for industry decarbonisation – case studies from Germany

Argus Europe Carbon Conference, Nice 21-23 May 2024

Prof. Graham Weale, Centre for Environmental
Management, Resources and Energy (CURE)
Ruhr University Bochum



The limited relevance of the CO2 price for German industry

“It’s not the CO2 price which counts, it’s the end-game, that after 2039 there will be no more CO2-certificates”

(German Oil Company)

“Decarbonisation is our future licence to operate, it’s not driven by the CO2 price”

(German chemical company)

“The business case for decarbonisation is at present missing – the CO2 price is far too low”

(German chemical company)

“So many climate measures are driven by laws independent of the ETS that the CO2 price is losing its importance”

(German manufacturing company)

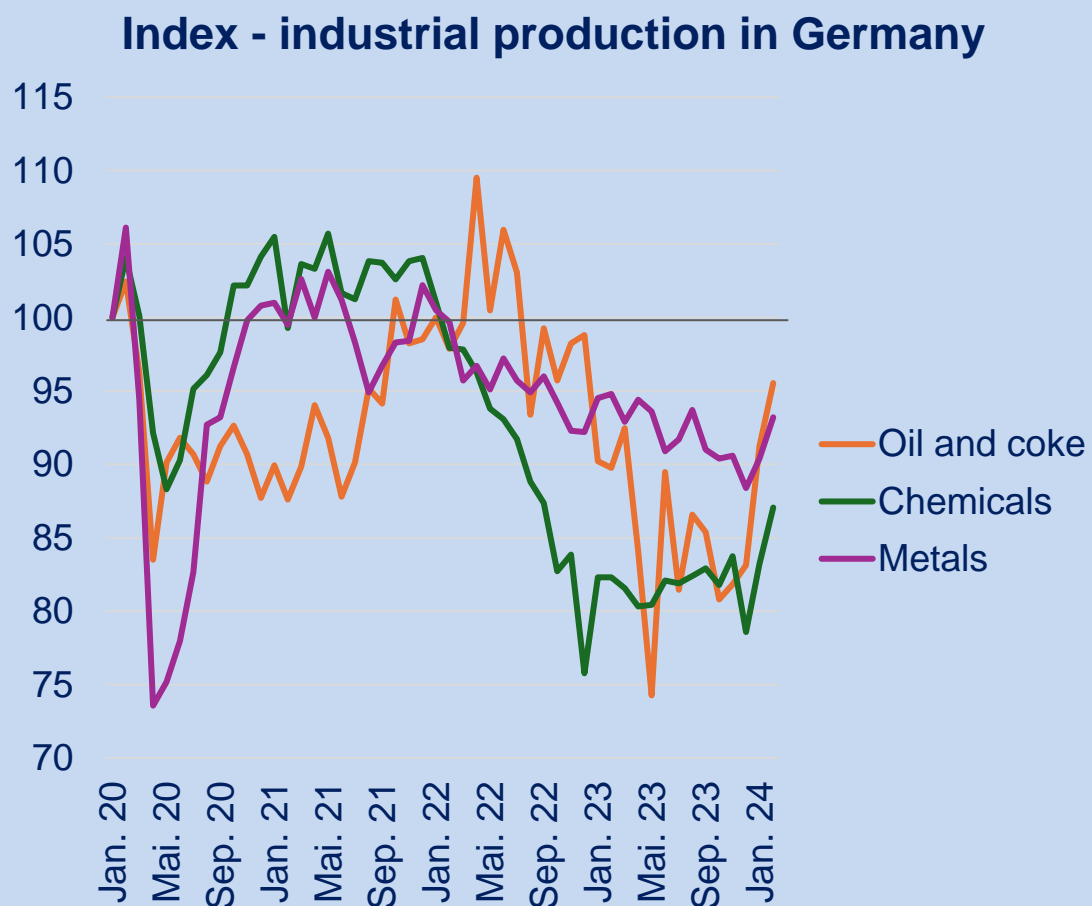
CO2 price cannot do the heavy lifting and is supplanted by other measures



Agenda

1. German energy-intensive industry
2. Different drivers for decarbonization
3. Strategies of German energy-intensive industries
4. Conclusion

1. The German energy intensive industry is serious decline – major driver of reduced emissions in 2023

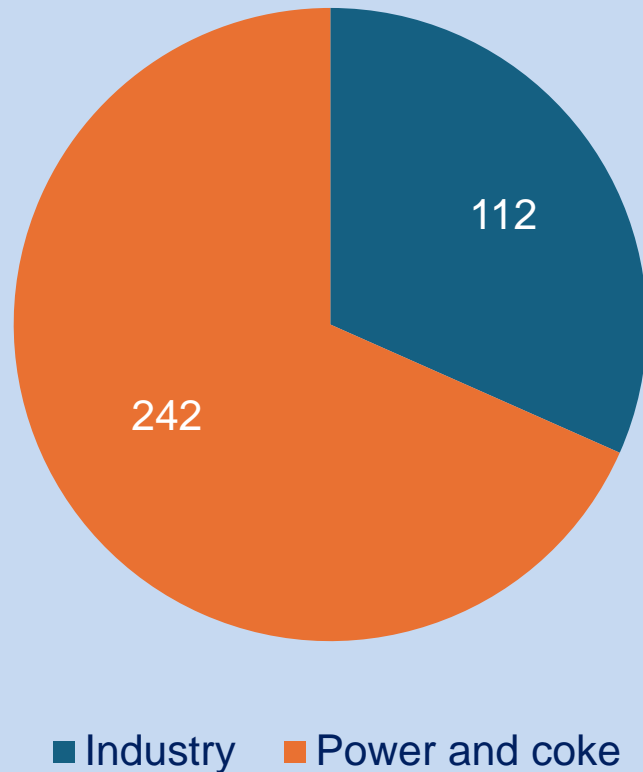


- **Reasons for decline in production:**
 - Electricity prices are > 40% higher than in 2020 and over twice price outside Europe
 - Gas prices have declined but are still high
 - Germany suffers from other disadvantages:
 - Bureaucracy
 - Shortage of skilled workers
 - Poor logistics
- German industry investing preferentially outside Europe and reducing production nationally
 - Reduces pressure on ETS and weakens CO2 price

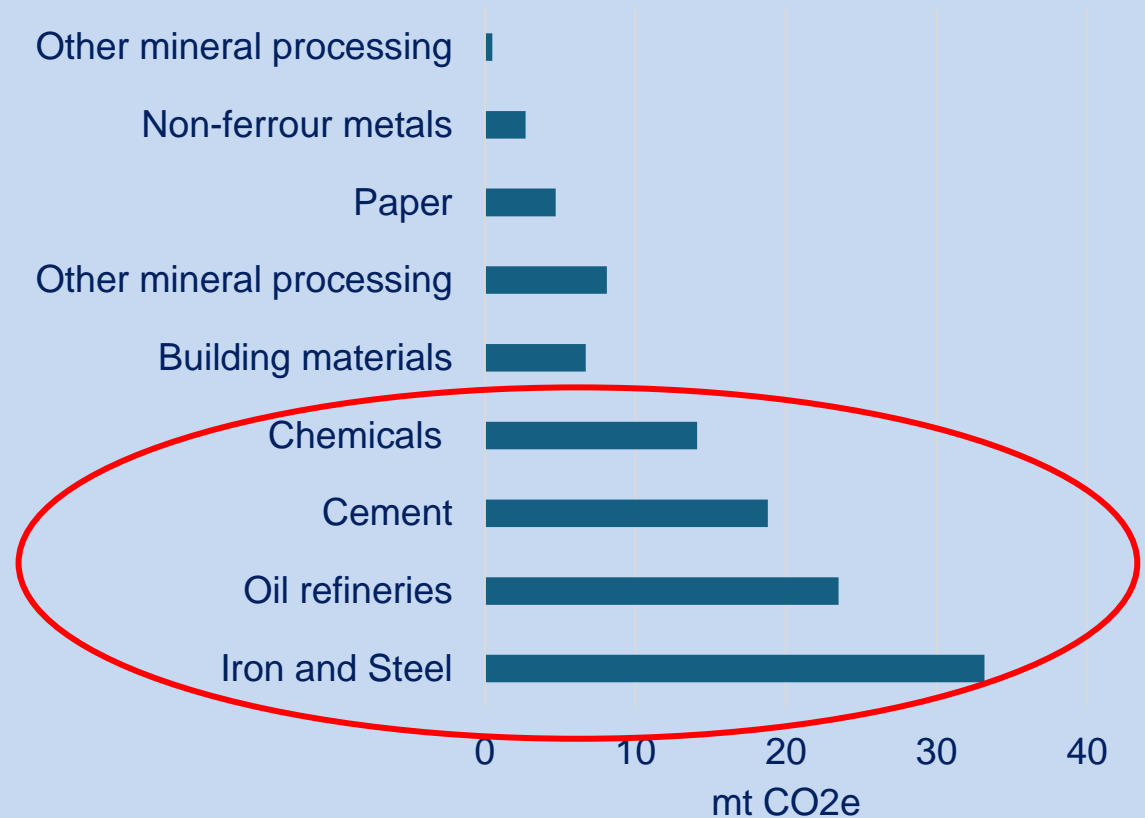
Source; <https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Industrie-Verarbeitendes-Gewerbe/produktionsindex-energieintensive-branchen>

Emissions from large installations in Germany 2022 – 354 mt (Total national emissions – 750 mt)

Emissions from large installations



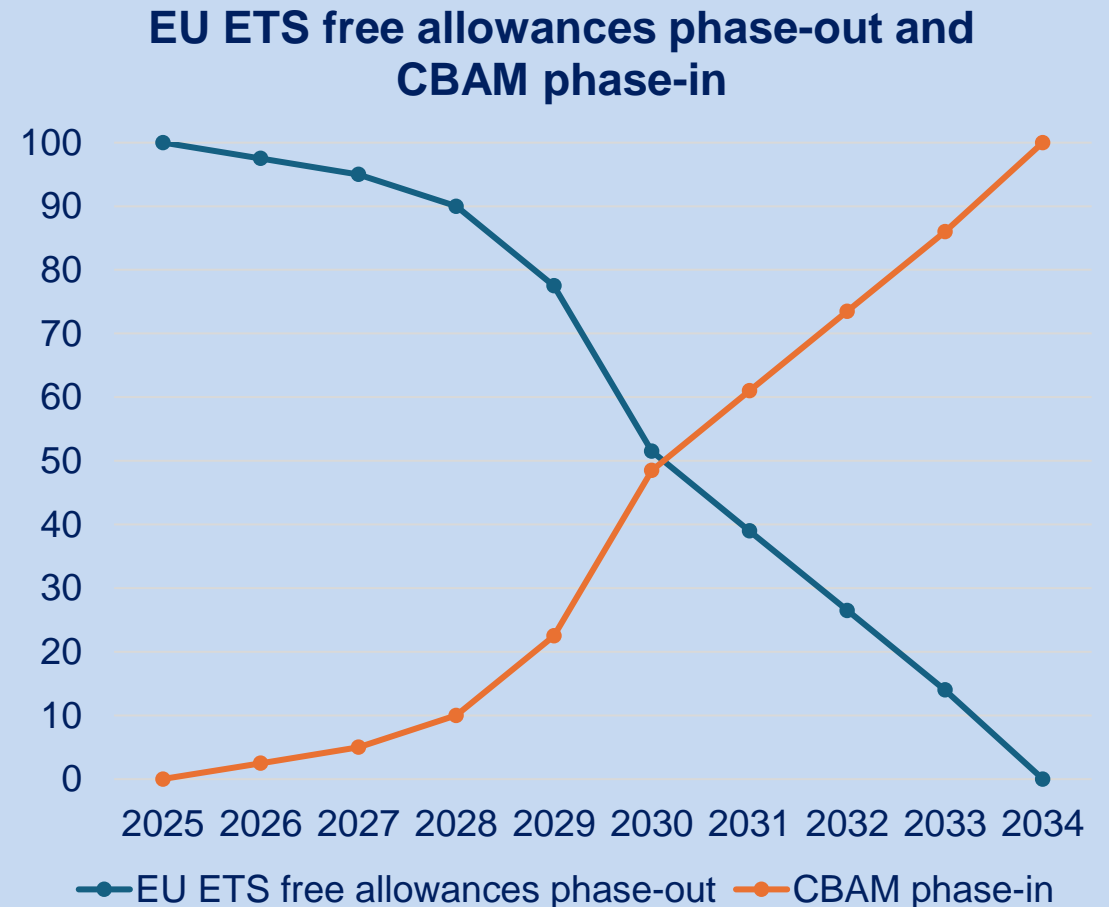
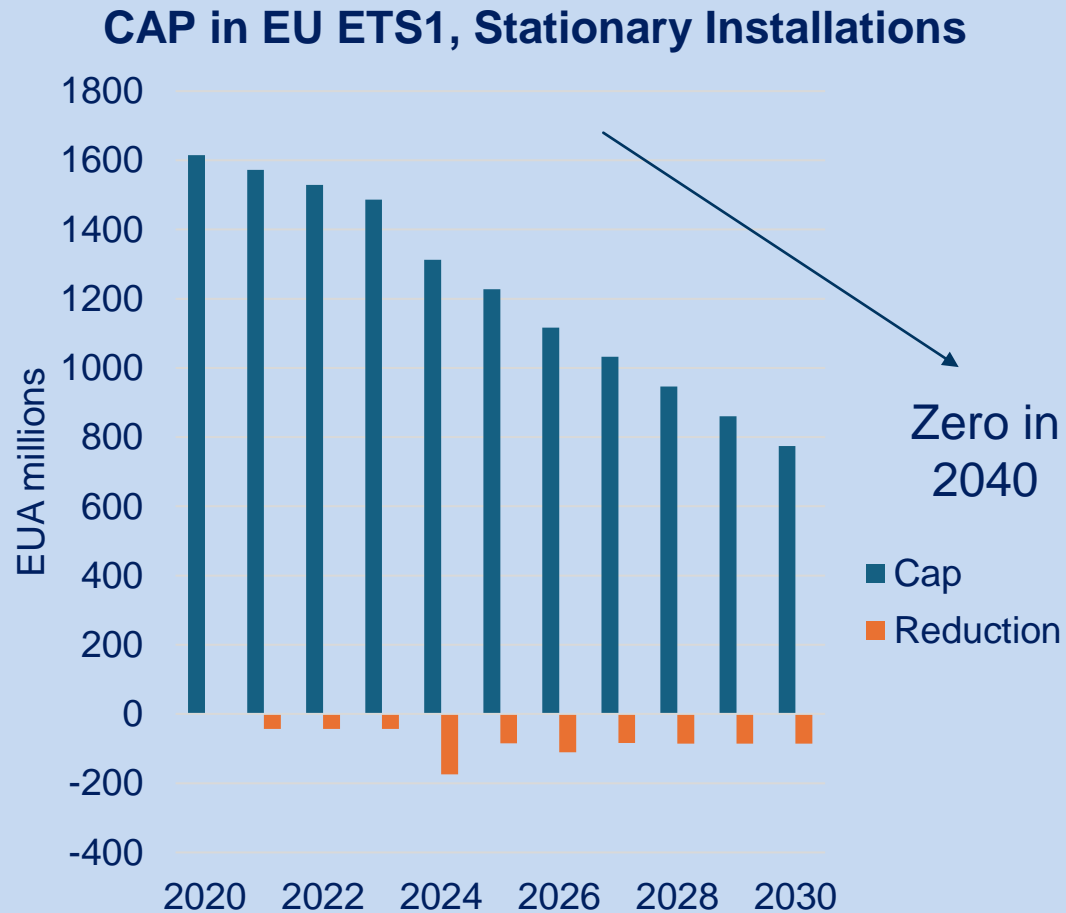
Greenhouse gas emissions 2022



Source: https://www.dehst.de/SharedDocs/downloads/DE/publikationen/VET-Bericht-2022.pdf?__blob=publicationFile&v=4

2. ETS drivers for reducing carbon emissions

- declining cap, phase-out of free allowances and carbon price



Source: <https://www.umweltbundesamt.de/publikationen/alignment-of-the-eu-ets-1-the-new-eu-climate-target>

Other drivers for reducing emissions in Germany

Other drivers

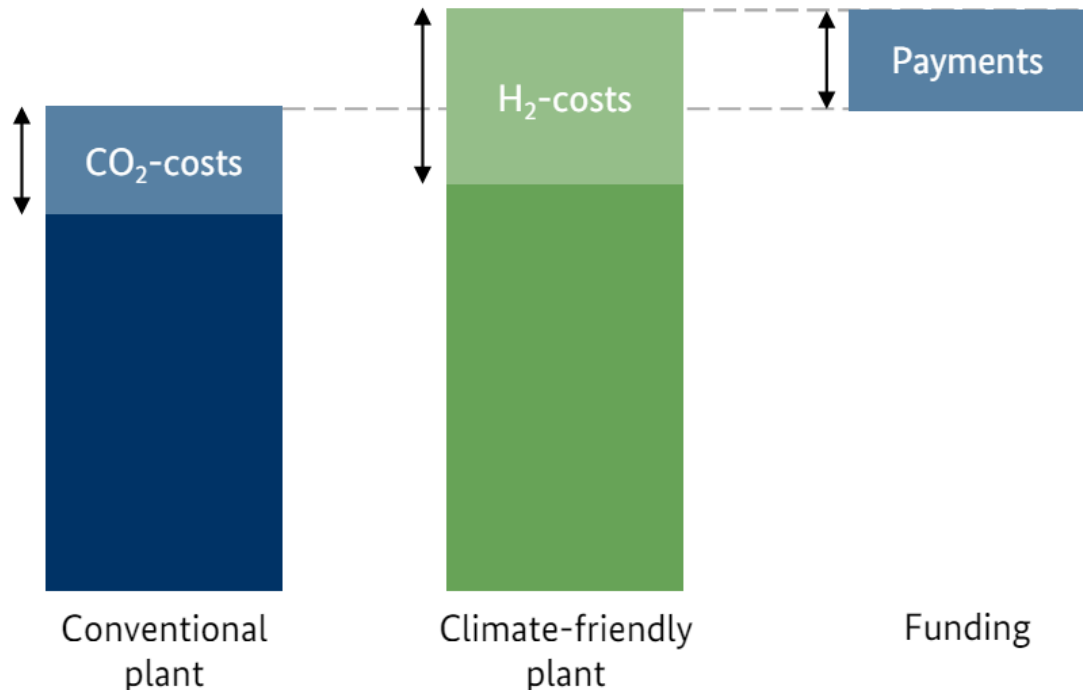
- Loss of international competitiveness – reduced national production
- Customers wanting green products
- Companies' ESG targets and “licence to operate”
- Strong government measures
 - Continuing support for renewables
 - Closing coal-fired plants by law
 - Grants for hydrogen-based production facilities and other support
 - Climate protection contracts for heavy industry (CO2 price factored in)

Climate Protection Contracts

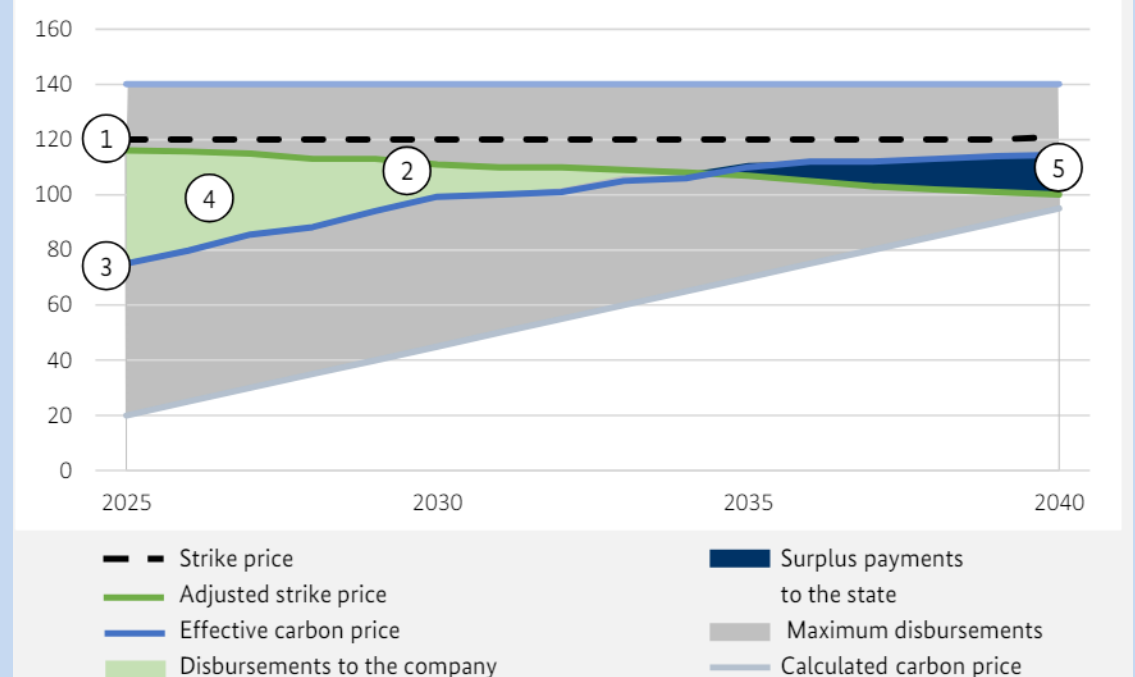
- Contracts offered in tender process to cover additional costs for green products (steel, fertilisers and cement)
- 15-year duration
- Dynamic element to compensate for movements in energy / material prices
- Producers calculate CO2 price necessary for break-even against cost of grey products
- € 4 bn. support allocated over 15 years; € 19 bn. potentially available for subsequent rounds
- Contracts awarded to those bidding lowest CO2 prices
- Bidding has begun; results due in Aug./Sep. 2024

Climate Protection Contracts for Energy-Intensive Industry

Example:



Height of funding per tonne of product over time, in EUR



Source: BMWK Carbon Contracts for Difference 27 March 2024

3. Strategies of industries - weighting of different drivers

| Sector | Strategy | Weighting of drivers (3= high, author's view) | | | | | |
|-------------------------|--|---|-----------|------------|-----------|------------|----------|
| | | EUA decline | CO2 price | Other laws | Subsidies | Firm's ESG | Customer |
| Power generation | <ul style="list-style-type: none"> • Closing coal-fired plants • Continuing with renewables build-out • Building back-up plants • Investing heavily in the grids | 1 | 2 | 3 | 3 | 1 | 2 |
| Oil refineries | <ul style="list-style-type: none"> • Closing capacity • Modifying plants for low-carbon products • Potentially replace grey hydrogen | 3 | 1 | 1 | 1 | 2 | 2 |
| Chemical plants | <ul style="list-style-type: none"> • Buying renewable electricity/change fuels • Electrification - steam-crackers et. al. • Recycling • Potentially replace grey ammonia | 3 | 1 | - | 1 | 2 | 2 |
| Steel | <ul style="list-style-type: none"> • Electric arc-furnaces are low-carbon • Moving to H2-based DRI • Replacing CHP power with renewables | 3 | 1 | - | 2 | 2 | 2 |
| Cement | <ul style="list-style-type: none"> • Changing composition of cement • Lower clinker component • Investing in CCS and CCUS | 3 | 2 | - | 1 | 2 | 2 |

Where is the business-case for investment in industry to decarbonize and what role does the carbon price play?

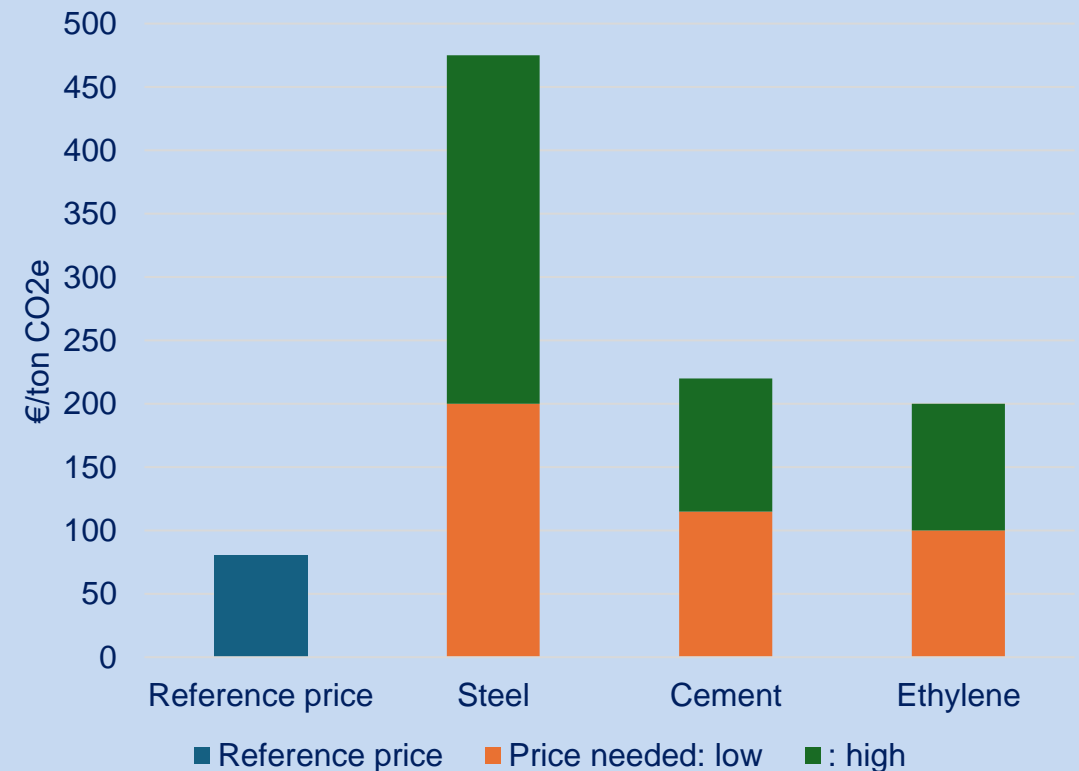
- Carbon price?
- Decline in EUAs – forces zero-C production?
- Subsidies? Funds are very limited
- “License to operate”?
- Customers willing to pay more for green products?
- Required CO2 price for decarbonization:
 - Steel: € 200-475/Ton¹ (Depends on H2 price)
 - Cement: € 115 -220/Ton² (inc. CO2 transport)
 - Chemicals: \geq € 100-200/³ Ton (depends on renewable electricity price vs. gas + CAPEX)

(1) A-EW_249_Klimaschutzvertraege-Industrietransformation-Studie_WEB.pdf

(2) https://www.vdz-online.de/fileadmin/wissensportal/publikationen/zementindustrie/VDZ-Studie_CO2-Infrastruktur-Deutschland.pdf

(3) Author's calculation

Comparison of indicative CO2 price vs. indicative price needed for decarbonisation (author's estimates)

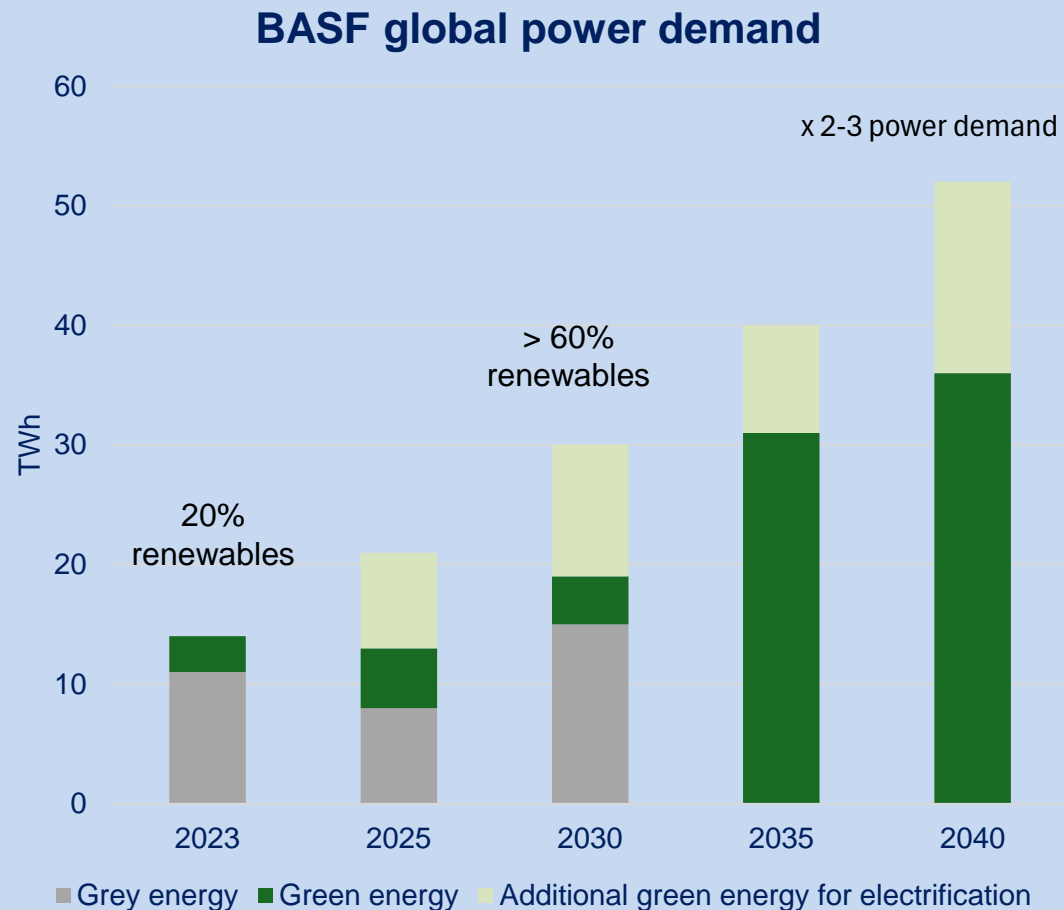


Oil refineries – reducing capacity and producing low-C fuels

- Main drivers: EUA reduction to zero by 2040, RED II, and customer requirements
- Preparing for decline in motor fuel demand as E-Autos share rises
- **Shell**
 - Wesseling refinery (7.5 mtpa): cease crude oil processing at but convert one plant to produce basic oils (e.g. for lubricants) and will save 620 kt CO₂e pa
 - Godorf refinery: continue crude processing but modify to produce low-carbon fuels
- **BP**
 - Gelsenkirchen refinery: reduce capacity (12 to 8 mtpa) to save 500 kt CO₂e pa and restructure to produce low-carbon fuels
 - Lingen refinery: convert to an energy centre using green hydrogen

Chemical companies - BASF 25% emissions reduction 2018-2030

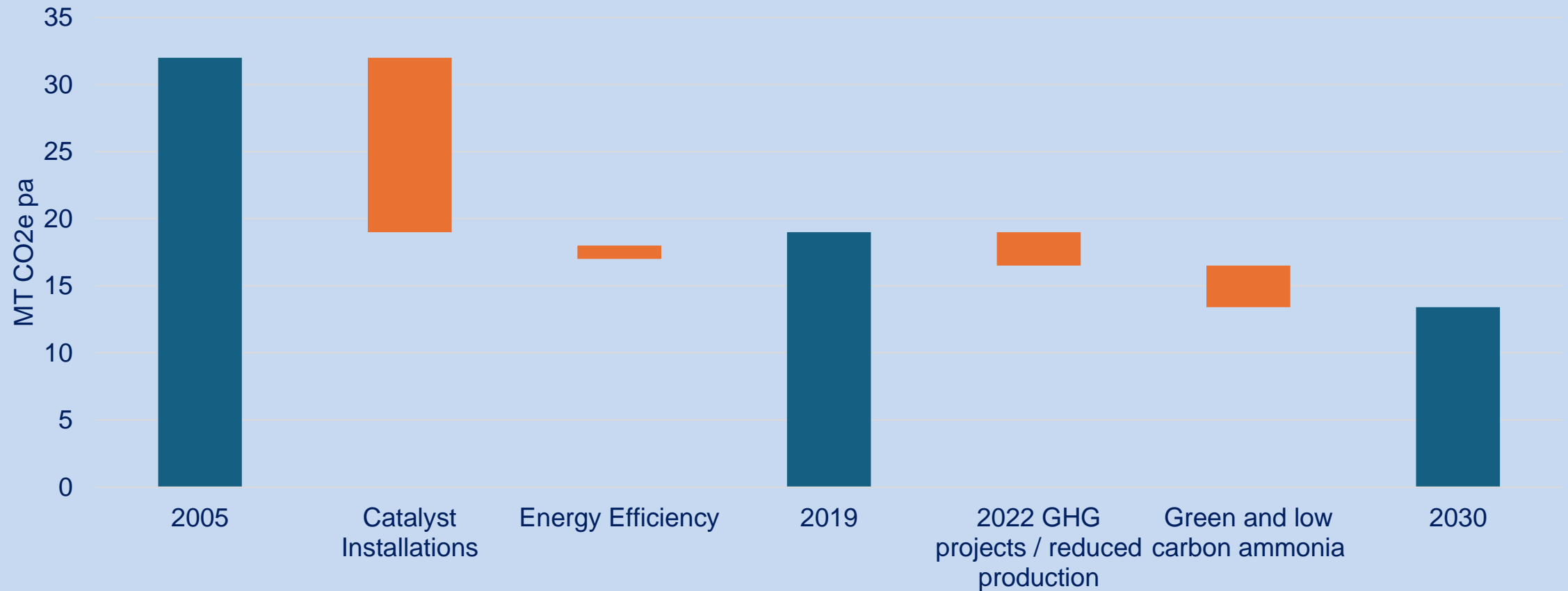
Reduced production in Ludwigshafen ca. 16% 2022-23



- Aims to source at least 60% of power needs from renewable sources by 2030
- Power consumption expected to increase strongly due to electrification e.g. of steam-crackers
- Pursues a make-and-buy strategy to secure access to renewables power
- Early investment in renewable assets expected to offer advantageous economics in the future

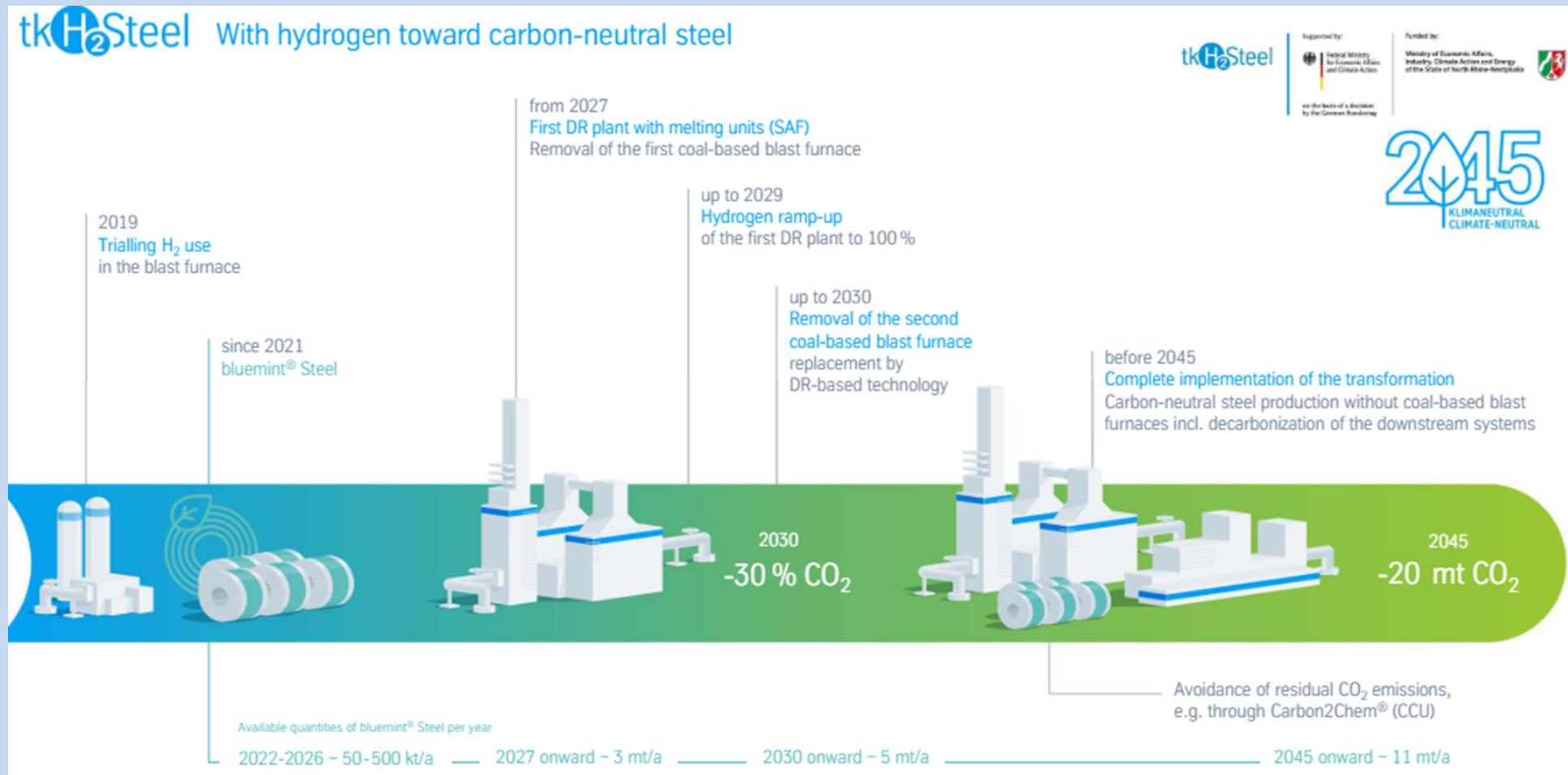
Yara (Fertilizers and Ammonia) – strategy to 2030

Yara's plan to reduce CO2 emissions



Source: Yara Sustainability Report 2022 – Data redrawn by author

Steel companies – two routes (i) ThyssenKrupp Steel



Reproduced with kind permission from ThyssenKrupp Steel

(ii) Georgsmarienhütte – Electric Arc Furnaces with renewable power

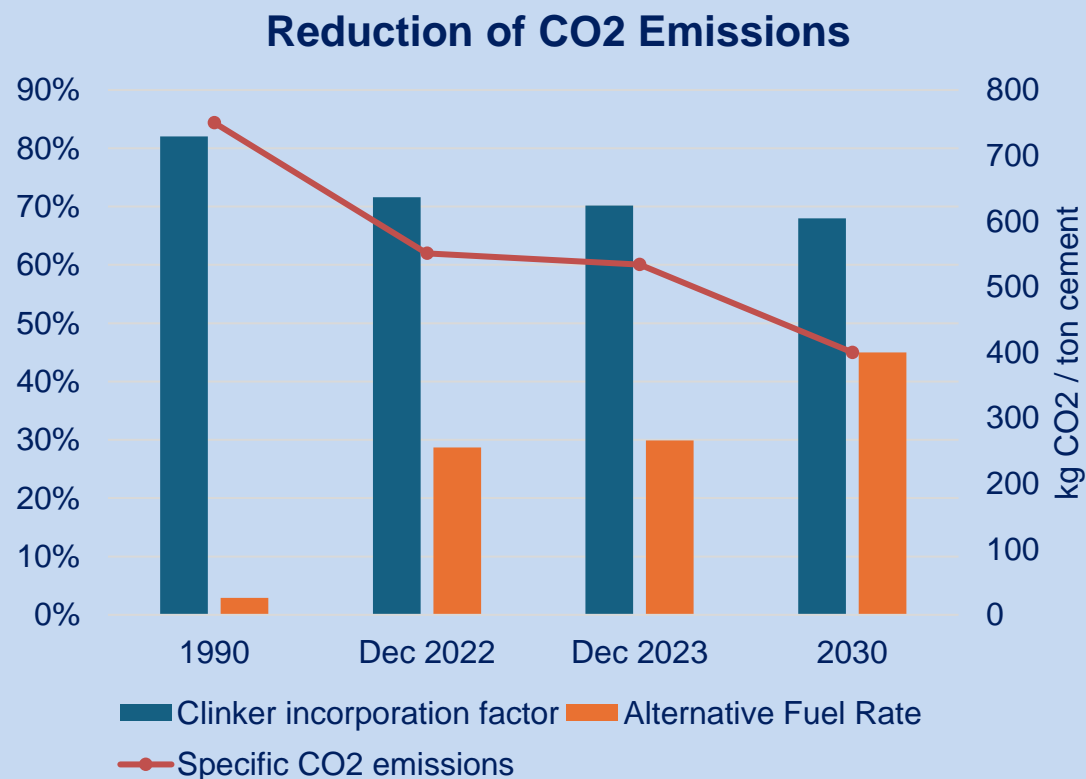
- GMH Gruppe makes 60 percent of its sales to the automotive industry – green steel required!



Source: GMH Gruppe – Data redrawn by author

Cement companies – reduced clinker, alternative fuels and CCS/CCU

Heidelberg Materials



Source: Heidelberg Materials – Data redrawn by author

Dyckerhoff

- Plans to invest 350 million euros in a CO2 capture plant at its plant in Deuna (Thüringen)
- CO2 emissions of the plant will be reduced by around 620,000 tonnes per year
- Store CO2 outside Germany,
 - transport the liquefied CO2 400 km. by train to Wilhelmshaven
 - then by ship to Norway
 - store North Sea

4. Conclusions

- Various projects in these industry sectors are already underway
- Reducing ETS cap to zero by 2040 and rising demand for green products are stronger drivers
- Available subsidies limited - funding has to come from price premium for green products
- The CO2 price will not do the heavy lifting

Thank you!



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