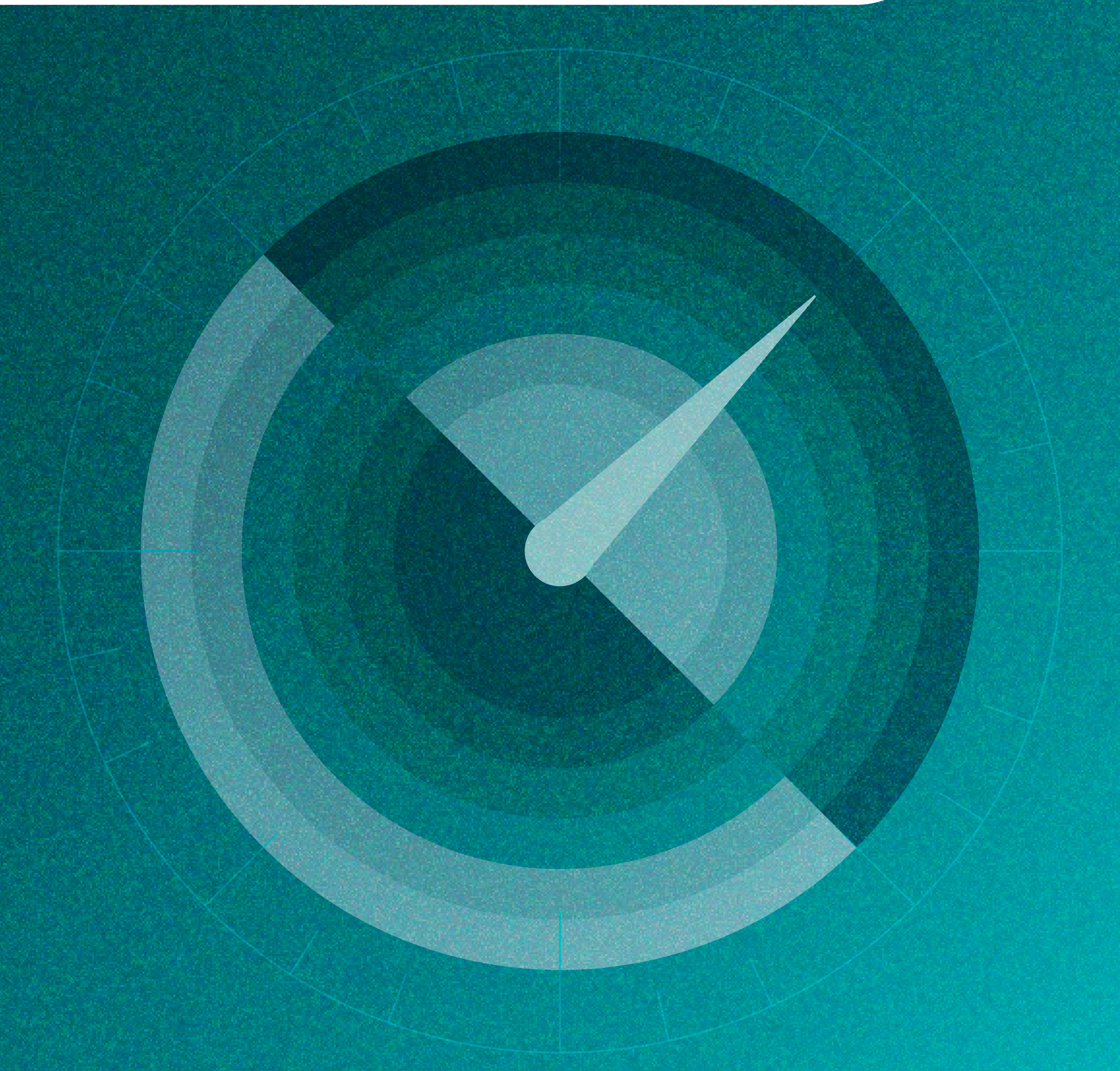
Competitiveness of European Energy-Intensive Industries



European Round Table for Industry

BCG

Europe's proud history of industrial progress has long been one of the sources of its standing in the wider world. Indeed, the leaders of many of the continent's most significant manufacturers and technology companies are Members of ERT and household names in their native countries.

For the continent to continue to thrive, economic growth is needed. In every successive national and/or European election, those elected are expected to lead, to advance change, to navigate crises and to bring jobs and prosperity. Prosperity and sustainability can co-exist, but the change requires a period of varying degrees of transition, depending on the section of society and the sector of business activity.

The past 5 years have been a period of extraordinary events and intense, significant change. As evidence, consider how the EU's Green Deal has gone from being presented with a growth and climate lens, to a strategic autonomy lens, to a security lens. What it really needs however, is a competitiveness lens.

Throughout the past years, ERT has consistently underlined the need for the energy transition to be inclusive of energy intensive industries. This is not easy, all the less so in parallel to an energy shock.

Transitions happen gradually, then suddenly. At some point in the not-too-distant future, it will be clear which country or bloc has succeeded in becoming the first climate neutral economy.

This is such a potent moment, yet also a delicate one. If we as Europeans get it right, we can become the reference, exporting sustainability solutions and allowing us to remain global market leaders – but that needs to happen in a way that still allows energy-intensive manufacturing to continue, albeit with access to less polluting forms of energy.

This report aims to explain the complexity of this aspects of the transition, the challenges and recommended solution. Navigating the intricate terrain of policy, technology and economic viability, this publication stands as a testament to the indispensable role of competitively priced renewable energy in propelling Europe's energy-intensive industries towards a sustainable, prosperous future.

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Executive Summary

European energy-intensive industries (EIIs) face significant challenges and seek opportunities to adapt

European energy-intensive industries (EIIs) are committed to decarbonisation and the EU's climate targets. The EU's EIIs acknowledge their responsibility in Europe's green transition and have therefore committed to ambitious net-zero targets, often exceeding what EU regulations impose and taking the lead in rolling out lighthouse projects. ***However, four key factors are putting pressure on business models and competitiveness:*** (1) the burden of comparatively high energy prices; (2) the constraint of limited access to renewable[1] energy sources; (3) the weight of high CO_2-related costs; and (4) the substantial investment required to facilitate decarbonisation.

The potential consequences of these factors are price increases and deindustrialisation. If the increased production costs can be passed on to customers, production stays in Europe, and prices increase. However, export business suffers. If price increases cannot be passed on, production relocates outside of Europe, leading to decreased exports and increased imports. Since 2017, EIIs' trade balance worsened by approximately €100 billion.

Deindustrialisation of Europe has already started. The number of EU firms in the Fortune Global 500 has shrunk[2] and labour productivity growth[3] has also declined significantly. Sectors including aluminium, refining, steel, and ammonia have already started deindustrialising: Europe's share of worldwide aluminium production fell from 30% in 2000 to 5% in 2022, while the EU has lost 2/3 of its primary aluminium production since 2008.[4] Moreover, 70% of ammonia production capacity was curtailed during the peak energy prices in 2022.

Despite these challenges, EIIs are committed to European prosperity and the green transition and are seeking opportunities to adapt. European EIIs are aware that they are essential for a climate-neutral economy and have committed to significant net-zero targets. Some have temporarily closed production sites during high energy price peaks but were able to reopen since. They are actively working towards a green future, innovating in new technologies and business models and bringing them to scale. The European EIIs are committed to reduce and flexibilise energy consumption, avoid carbon emission from the production processes, and cooperate with energy providers to promote production of low carbon energy. For example, BASF builds its own offshore wind projects, and Shell is building low-carbon hydrogen production.

However, the risk of further deindustrialisation is tangible. Foreign Direct Investments (FDIs) have already shifted away from Europe (Europe: 23% in 2011 down to 10% in 2021; comparatively, the US was able to increase inflow by 10% from 2017 to 2022). For several industries, imports are cheaper than locally produced products, e.g. steel, where German HRC steel was globally cost-competitive in 2020 but is expected to be ~20% more expensive in 2030 compared to US steel. Similarly, grey steel from the US will outcompete European steel in 2030.

EIIs are a key pillar of European prosperity and should be supported

These industries also enable the vitality of downstream sectors across Europe, e.g. in the automotive and wind industry. Their inherent connection to local value chains can be attributed to five pivotal factors: (1) Supply chain efficiency and resilience; (2) Knowledge sharing and collaboration; (3) Circular economy; (4) Shared regulatory factors; and (5) Transport simplicity. The consequences of deindustrialisation would extend beyond EIIs, causing detrimental effects on the broader EU economy, technological sovereignty, employment and eventually salaries of EU citizens.

1 For an overview the definitions of the key terms used in this publication, such as 'renewable', 'green', or 'low carbon', please refer to section 4.6 in the Appendix.

2 Vanham, Peter and Gordon, Nicholas, 2023

3 Deutsche Bundesbank, 2021

4 European Aluminium, 2022

Furthermore, EIIs play a crucial role in the European economy by generating jobs, boosting GDP and driving innovation. In 2021, EIIs employed over 18 million people, contributing approximately €3.2 trillion in value added to the European economy. These industries also invest significantly in Research & Development (R&D), with expenditures reaching around €200 billion in 2022 (just for comparison, the Next Generation EU fund contains just over €700 billion until the end of this decade).

European EIIs are at the forefront of the green transition and contribute to global emissions reductions. They have already reduced their greenhouse gas emissions by nearly 40% between 1990 and 2017, boasting some of the world's best carbon-efficiency levels. An example of their environmental leadership is evident when comparing European and Chinese aluminium production. Chinese aluminium emits approximately six times more carbon per tonne than Europe's leading aluminium producing nation, Norway. Clearly, relocating European EIIs will lead to significant carbon leakage and hinder global emissions reduction efforts.

Additionally, EIIs are vital for preserving the EU's Open Strategic Autonomy and ensuring supply security. This concept is closely tied to *EIIs* due to their economic significance and environmental considerations. Several key sectors, including steel, aluminium, refining and various chemical products, are part of the energy-intensive ecosystem. EIIs also play a pivotal role in ensuring food security within the EU. For instance, while China achieves self-sufficiency in phosphatic fertilisers, Europe imported half of its consumption in 2022, highlighting the essential role of these industries in maintaining the region's supply security.

We propose regulatory changes to create a framework for a positive business case for the green transition along three key asks:

Ensure the availability and affordability of low-carbon energy and Carbon Capture, Utilisation and Storage (CCUS). This can be achieved by: 1) Accelerating permitting and enhance private investments; 2) Adjusting market design for supply to match future energy portfolio; and 3) Thinking and planning in a pan-European manner.

Increase financial attractiveness of decarbonisation. This can be accomplished by reducing uncertainties in investment business cases by 1) Simplifying State aid procedures; 2) Incentivising innovative technologies which don't have a positive business case yet; and 3) Ensuring further simplification of the permitting process. Simplifying the process complexities, e.g. by increasing share of incentives allocated on a European level and based on pan-European standards, are the key requirements to keep up with successful incentive schemes, including the US IRA. Additionally, creating demand for low-carbon products is important: 1) Increasing transparency for consumers by communicating Product Carbon Footprints (PCFs) for all products; 2) Establishing stable green demand via public procurement; and 3) Incentivising demand for low-carbon products.

Create a level playing field vs international competition. The key requirement is to establish the Carbon Border Adjustment Mechanism (CBAM) as an effective tool via: 1) Conducting the planned effectiveness review in close cooperation with the industry; 2) Diminishing risk of import loopholes; and 3) Maintaining export competitiveness. Additionally, global partnerships need to be optimised: 1) Promoting fair competition on trade under the WTO (World Trade Organisation) framework and enhancing collaborative partnerships; 2) Further prioritising secure and diverse supply chains, e.g. in public procurement; and 3) Taking a leadership role in orchestrating coordinated global climate action.

1. European energy-intensive industries (EIIs) are under acute competitive pressure

1.1 The energy transition and decarbonisation efforts put Europe's EIIs at a competitive disadvantage

EIIs such as cement, glass, steel, chemicals, refining, and aluminium generate around a fifth of Europe's total GDP.[5] This significant contribution to GDP comes with a considerable energy consumption and emissions.

First, European EIIs consume a significant amount of the continent's total energy, and thus EIIs are very dependent on competitive energy prices.

Second, EIIs are responsible for 22%[6] of the EU's overall GHG (greenhouse gas) emissions, equalling ~736 million tonnes of CO_2-equivalents.[7] Emission reduction of EIIs plays a significant role in achieving the EU's climate neutrality targets, e.g. becoming a net-zero region by 2050.

EIIs in Europe have been at the forefront of innovation for decades.[8] They have set global benchmarks in terms of quality, health, safety, and environment. Through product and process innovations, the EU's EIIs have historically been able to compete with lower costing and resource-rich countries while being more sustainable on average than their global competitors.

Today, the EU's EIIs are facing mounting pressure: increased costs for energy and costs related to decarbonisation result in margin pressure. EIIs in Europe are not able to pass these costs through to their customers in full, as they are in global competition with non-EU players that do not face the same extent of costs but are selling to EU consumers. As a result, the EU's EIIs are less cost-competitive, therefore lose global market share, translating into lower outputs. This is also reflected in the ERT Vision Paper from October 2023[9] which elaborates upon the competitiveness of energy-intensive industries and beyond.

Aditya Mittal
CEO, ArcelorMittal

"As the world's leading steel and mining company, with steelmaking operations in five continents, we have a global perspective on the competitiveness of doing business in Europe. What we see is that European steelmakers are operating at a significant disadvantage compared with other regions, higher energy costs and higher CO_2 costs to name a few. This is not a strong foundation on which to build our decarbonisation programme – which is the biggest investment we have made in ArcelorMittal Europe since the founding of the business."

Dr. Ilham Kadri
CEO, Syensqo

"Let us not forget that the European chemical industry is the governments' partner in the fight against climate change. We need more support than constraints. Europe should act upon other regions' wake up calls; we have little time left to reverse the curve. Competitive energy, funding, fair competition, circular economy, and decarbonisation should be Europe's industrial policy priorities. We cannot build new sites on ruins."

5 Oxford Economics, Statis, Destatis; 2021, EU-27 + UK + Norway + Switzerland,

6 European Commission, 2022 (number for 2019)

7 European Environment Agency, 2023 (number for 2019)

8 ERT paper "Innovation made in Europe: Setting the foundation for future competitiveness", March 2023

9 ERT "Vision Paper 2024-2029, Securing Europe's place in a new world order", 2023

The focus of this chapter is on the four drivers of competitive pressure that European EIIs are facing:

1. High energy prices
2. Limited access to affordable low carbon energy
3. High CO_2 costs
4. High investment intensity for decarbonisation

EII sectors are all affected by these four drivers, but the relevance of each driver differs by sector (see Figure 01). For example, the steel, chemicals and aluminium sectors are most affected by energy prices and the availability of low carbon energy, whereas in the cement industry, the biggest impact comes from high CO_2 costs and investment intensity for decarbonisation. While the EIIs are significantly affected, the loss of competitiveness from these drivers impacts the overall European industry.

European EIIs are losing competitiveness due to 4 drivers of pressure in 2030

Loss of competitiveness due to	Cement	Glass	Steel	Chemicals[i]	Refining	Aluminium
1 Energy price differential	●●●○	●●○○	●●●●	●●●●	●●○○	●●●●
2 Limited access to affordable low carbon energy[ii]	●●○○	●●●○	●●●●	●●●○	●●●○	●●●○
3 CO_2 Costs[iii]	●●●●	●●○○	●●●○	●●●○	●●○○	●●●○
4 Investment Intensity (EU Market)	●●●●	●●○○	●●○○	●●●○	●●●○	●●●○

Effect on competitiveness in medium-term (2030): Lower ●○○○ High ●●●●

Figure 01: European EIIs are differently affected by pressure from energy transition and decarbonisation in 2030

i High variance between chemical products; ammonia is highly energy intensive compared to other chemicals but one of the most produced chemicals

ii Highly different based on location (proximity to renewable electricity and biofuels); Rating for steel driven by reliance an access to hydrogen, for which no infrastructure available currently.

iii Direct emissions (Scope 1)

Note: Scope of the analysis is Europe, i.e. including Norway and Iceland

Source: BCG analysis, expert interviews, IEA, Zier et al., Indexbox, LME, S&P Global, boerse.de, Cembureau, Bloomberg, Aluminium France, Concawe, Eurofer, European Aluminium, Glass International, Business Research Company, Euractiv, Ibis World

The pressure from these four drivers decreases competitiveness and, therefore, the private investment appeal of the EU's EIIs. As the green transition requires significant investments, EU EIIs need to increase their appeal to attract more private investment in the future.

In this section, we will assess in detail how the four elements impact the competitiveness of the EIIs.

1.1.1 Europe's energy prices are significantly higher than in other regions

Europe currently faces some of the highest energy costs worldwide. This puts the continent at a significant cost disadvantage – particularly within EIIs, as energy expenditure is a key component of their cost structures.

Unfortunately, forecasts for 2030 indicate a continuation of Europe's energy cost disadvantage: European electricity prices are expected to be up to twice as high as prices in the US and Saudi Arabia (see Figure 02). This is especially problematic considering that electrification is key in the decarbonisation of EIIs. Natural gas will be necessary as a transition fuel until net-zero targets are met. It could play a continued global role even after 2050 – including as a feedstock for low carbon hydrogen – if abated with help of CCUS and if methane emissions are managed.[10]

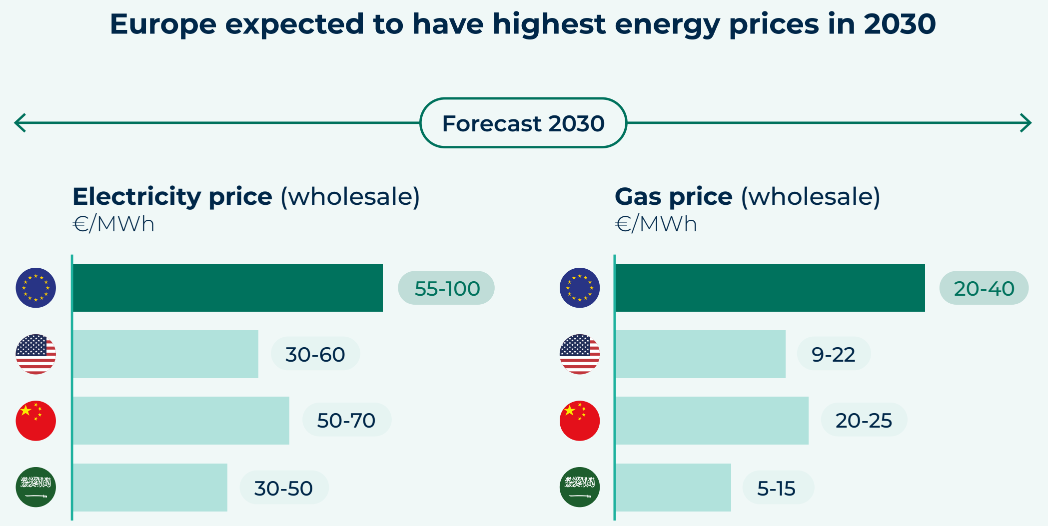


Figure 02: Forecast gas and power costs 2030[11]

Note: German prices are assumed to represent EU prices, given the influence of Europe's interconnected energy markets, harmonised policies, regional factors, and the Dutch TTF NG hub as EU gas benchmark; Ranges based on external scenarios and experts for wholesale prices

Source: Bloomberg, EEX, IHS, NBC, Morgan Stanley, Nexant, BDEW, EnergyScan, IEE, Eikon Refinitiv, Aurora, Rystad, Nymex, Enerdata, ICE, IEA, BCG analysis

We see several key drivers for high electricity prices in Europe:

1. **Carbon costs which result from the EU ETS (Emissions Trading Scheme):** One major driver for the high electricity prices in Europe is the cost of CO_2 emissions under the EU's ETS. In 2021, the CO_2 cost increase to approximately €30 for each tonne of CO_2 led to a higher energy price of €10 for every megawatt-hour (MWh) of electricity generated from gas,[12] and roughly €25 for every MWh of electricity generated from coal.[13] In the coming years, Europe will remain dependent on fossil-based electricity generation. With the continual phase-out of free allowances, electricity prices will continue to rise.

2. **Energy market design:** In the ERT 'Single Market for Energy' expert paper, it is stated that:

10 ERT paper on "Strengthening Europe's energy infrastructure", February 2024

11 Aurora, IEA, European Parliament, Henry Hub, natural gas indices, Eikon, EUA, IETA Market Sentiment 2022, BCG Analysis

12 Assuming that it is 50% efficient, i.e. that 100MW gas gives 50MW power

13 Assuming that it is 40% efficient, i.e. that 100MW coal gives 40MW power

"The energy markets currently expose consumers and energy-intensive industries to highly volatile and high prices, affecting European competitiveness."[14] Moreover, new investments for decarbonised production capacities and security of supply are not enabled by the energy-only market set-up. Prices are being driven upwards because the wholesale electricity market clearing price currently reflects the marginal natural gas cost, which is priced significantly higher than before the Russian invasion of Ukraine due to supply constraints. Despite this, thanks to the effectiveness of the short-term price signals based on the marginal costs of production in each Member State, EU electricity markets are currently still achieving both an optimised dispatch to consumers and efficient mobilisation, at any moment, of the most cost-efficient production asset. Even with a significant decline of electricity generated by fossil fuels, fossil fuel-based plants are expected to maintain a significant influence on electricity prices. According to a forecast by the European Commission's Joint Research Centre, the amount of time the electricity price is set by fossil fuel-based plants is expected to stay at 86% between 2022 and 2030, even if the share of generation is declining from 24% to 16% during the same time.[15]

3. **Lack of energy supply:** The peak in EU energy costs during 2022 was due to a lack of supply, in particular a lack of gas, an impact of the Russian invasion of Ukraine. When energy was scarce, European industry has had to cut production significantly: 32% of EIIs at least partially shut down business units during 2022.[16]

While energy prices have eased since their peak in 2022, it is forecasted that they remain up to four times higher than before the crisis, even after 2025 (see Figure 03).[17]

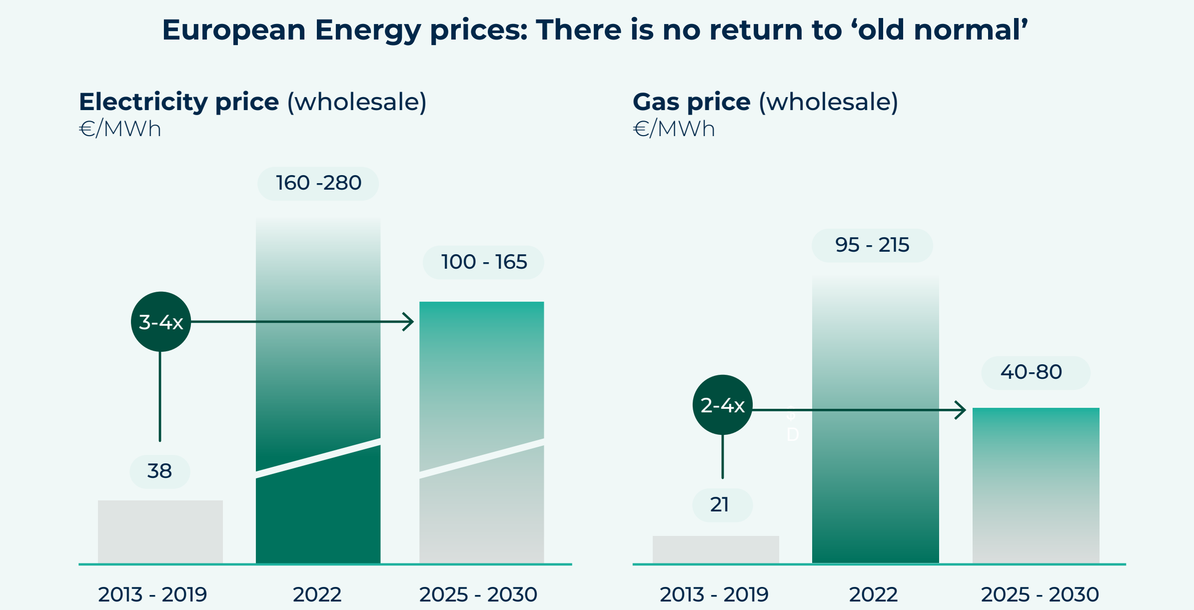


Figure 03: European energy costs forecast

Note: Prices show wholesale average; ranges based on external forecasts and experts, assuming current energy pricing mechanism
Source: Aurora, IAE, BCG, European Parliament, Henry Hub, natural gas indices, Eikon, EUA, IETA Market Sentiment 2022, BCG analysis

14 ERT Expert Paper "Single Market for Energy", December 2022

15 Gasparella, A., Koolen, D. and Zucker, A., 2023

16 DIHK / Energiewendebarometer 2022; numbers are for Germany

17 Aurora, IAE, European Parliament, Henry Hub, natural gas indices, Eikon, EUA, IETA Market Sentiment 2022, BCG Analysis

1.1.2 Europe will continue to face supply shortages of low carbon energy

EIIs have started the transition from using fossil fuels for their production towards green energy sources. The ambitious commitments from EIIs will result into a rapidly increasing demand for renewable energy and low carbon hydrogen.[18]

The example of hydrogen illustrated in Figure 04 shows an estimated undersupply in the EU of low carbon hydrogen (i.e. hydrogen with zero, or lowest possible emission intensity within EU taxonomy, for example hydrogen produced using renewable/nuclear sources or conventional sources if combined with carbon capture) vs the demand resulting from all plans currently announced. Consequently, the EU will be highly dependent on imports of low carbon hydrogen from outside the region, resulting in a potential supply gap of approximately 3 million tonnes of hydrogen per annum from 2030. That is equal to roughly 15,000 shiploads of hydrogen from tankers with 200 tonnes capacity.[19] In a more ambitious 1.5°C scenario, BCG's forecast for low carbon hydrogen demand is even higher, increasing the supply gap to approximately ~6 million tonnes.

This situation in Europe differs from the situation in both the US and China where, based on current projections, supply is likely to cover demand by 2030.

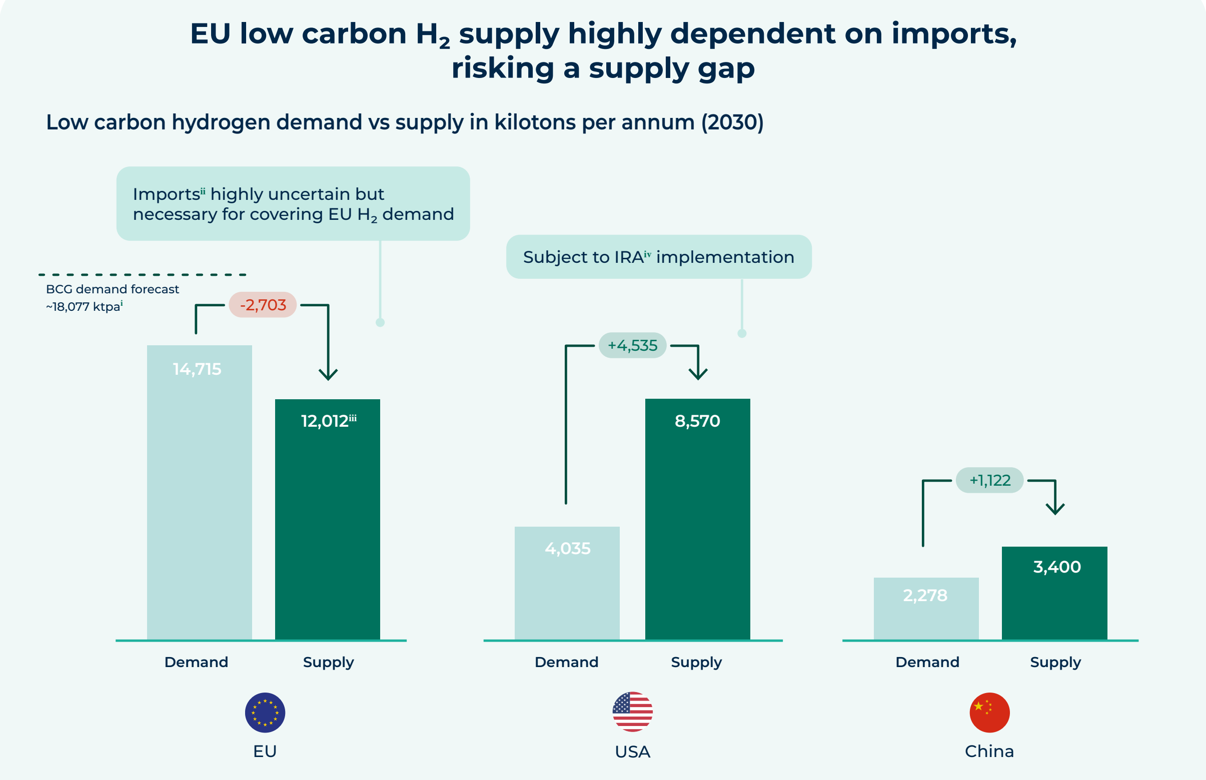


Figure 04: Demand vs supply of low carbon hydrogen in 2030

i. NZE BCG forecast for Western Europe

ii. Imports potentially reach up to ~5,000 ktpa

iii. EU supply estimate excl. imports

iv. IRA = Inflation Reduction Act

Note: calculations based on announced projects – some may not materialise

Source: European Hydrogen Backbone EU supply and import estimate, GlobalData Hydrogen Projects Database; BCG's Hydrogen Demand Model and BCG's Supply Model

18 European Commission, 2020

19 Renewable Energy Magazine, 2002

The shortage of renewable energy in Europe will drive prices up. As a result, European-based EIIs will face higher prices for hydrogen and renewables than their direct competitors based in China and the US. For example, green steel produced in Europe using hydrogen as its primary energy source will cost 20% more than the same steel produced in the US using the same technology.[20]

For Europe to restore its energy competitiveness, it must address this scarcity and increase the supply of green energy. Strong investment will be required (notably in infrastructure to increase generation, distribution, transport capacities and storage), so that renewable production is brought in line with demand.[21]

1.1.3 Europe's high CO_2 price pressures competitiveness

As of today, the EU is the only region worldwide with a significant CO_2 price. Other regions have either spotty coverage (e.g. the US) or very low CO_2 prices (e.g. China). European CO_2 prices hit a record high of €100/tonne in March 2023 and remain at high levels of around €80/tonne.[22] The future carbon price is expected to reach ~€130/tonne by 2030,[23] as free allocations will phase out continuously for CBAM covered sectors.

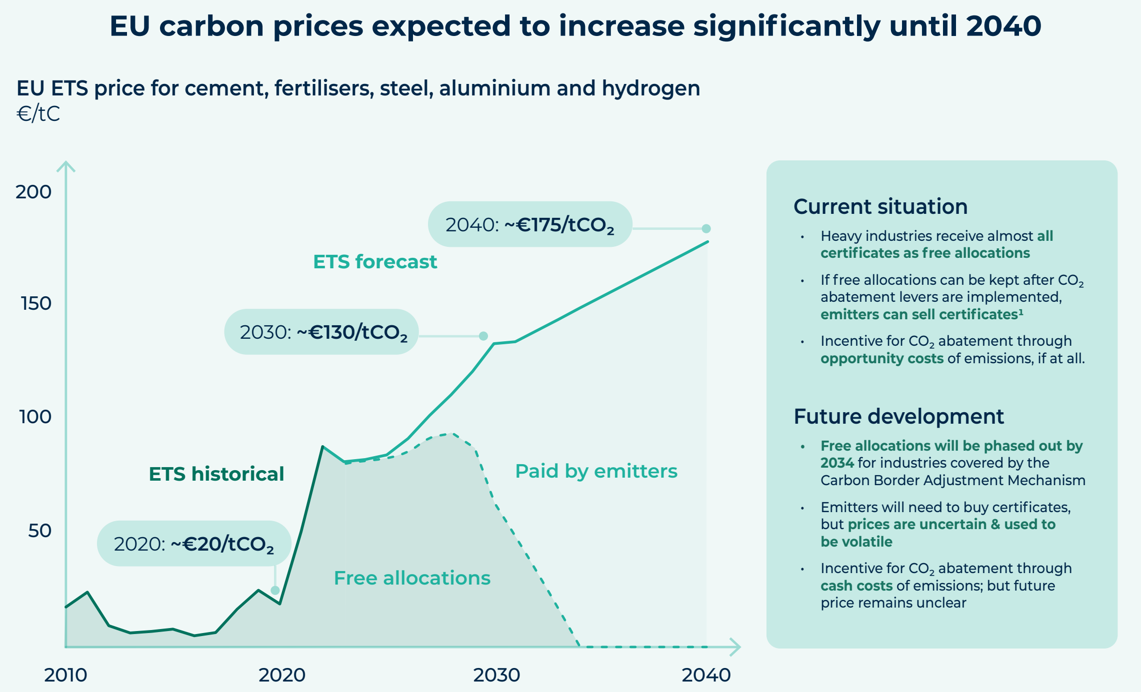


Figure 05: EU ETS price forecast

i. In some cases, free allocations are lost when reducing emissions, eliminating the ETS price incentive
Source: Eikon; IEA WEO 2022; European Commission; BCG analysis

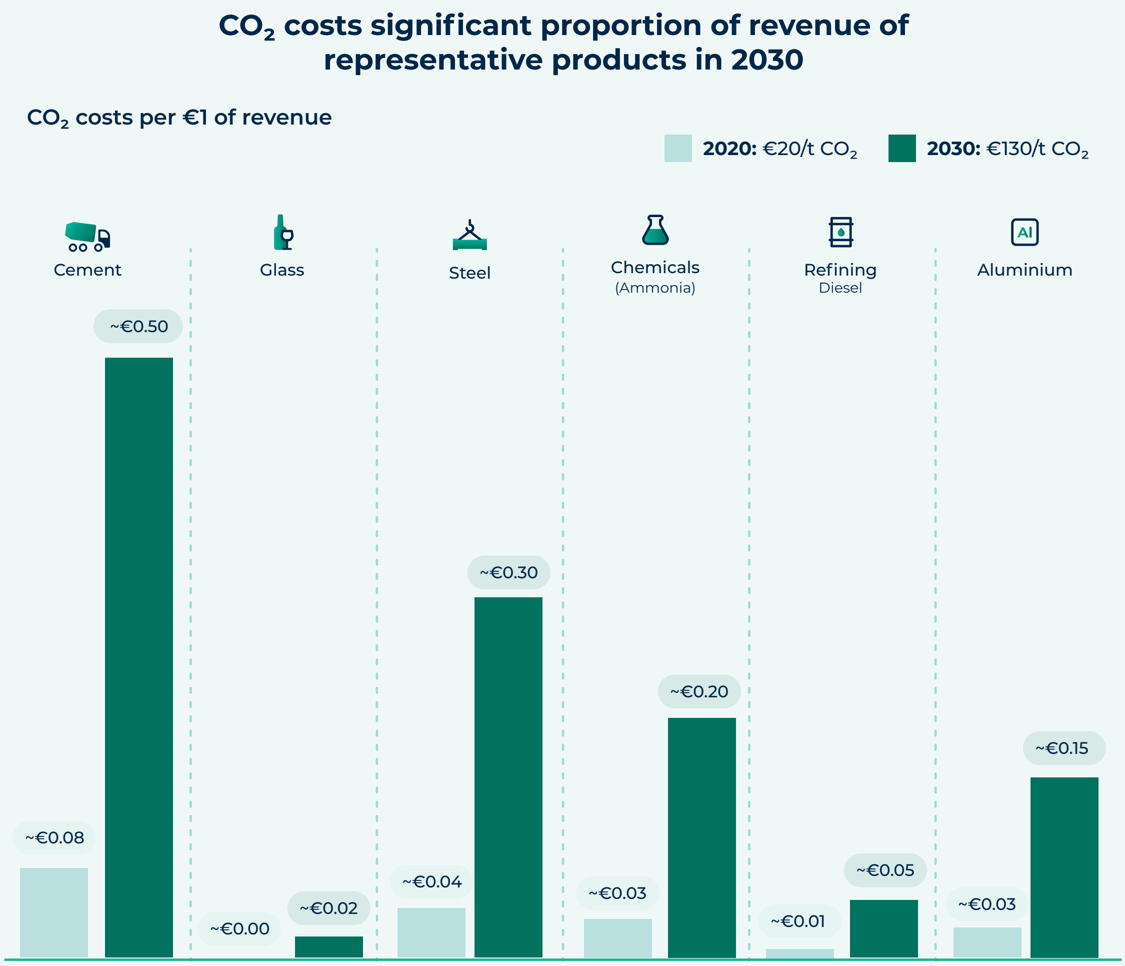
By 2030, with an estimated carbon price of €130/tonne, carbon costs would result in a doubling of the price for grey cement, and result in an increase in grey steel prices of 50% (see Figure 06).

20 Comparison of production cost (without transport), see Figure 14 for more details

21 Comparison of production cost (without transport), see Figure 14 for more details

22 Bloomberg

23 Eikon, International Energy Agency "World Energy Outlook", 2022 (see Figure 05)



CO_2 costs will **affect cost set-up** significantly (assuming other cost factors remain similar), increasing the risk of **losing competitiveness** compared to EIIs outside Europe. A **well functioning CBAM should balance this loss of competitiveness for local market sales** if applied entirely in 2035 and on all EII products.

Figure 06: CO_2 costs per €1 of revenue for EIIs in 2030

Note: Direct emissions (Scope 1) used for calculation. Numbers equal CO_2 costs when free allowances are reduced to zero. The current values for revenue are used which are likely to change until 2035. Ranges are given as numbers vary due to divergent emissions and prices in different countries of the EU

The following calculations use average values:

Cement: 0.6 t CO_2/t of cement * 20 €/t CO_2 / 160 €/t cement (Source: Cembureau, BCG analysis)

Glass (flat glass): 0.4 t CO_2/t of flat glass * 20 €/t CO_2 / 3000 €/t flat glass (Source: Zier et al., Indexbox)

Steel: 1.3 t CO_2/t of steel * 20 €/t CO_2 / 630 €/t steel (Source: Bloomberg, LME (London Metal Exchange))

Chemicals (ammonia): 2.4 t CO_2/t of ammonia * 20 €/t CO_2 / 1500 €/t ammonia (Source: IEA, S&P Global)

Refining (petroleum diesel): 0.3 t CO_2/t of petroleum diesel * 20 €/t CO_2 / 810 €/t petroleum diesel (Source: Concawe, boerse.de)

Aluminium: 2.5 t CO_2/t of aluminium * 20 €/t CO_2 / 2000 €/t aluminium (Source: Aluminium France, LME)

European EIIs are only partly protected against the loss of competitiveness through the Carbon Border Adjustment Mechanism (CBAM).

CBAM aims to assure that EII products from outside the EU that get imported into the EU do not have a CO2 cost advantage versus local EU-based products. However, in its currently discussed form the CBAM still has still key challenges (see chapter 3.3.1). For once, for the time being, the EU's CBAM scope is limited to imports. Therefore, European EIIs that are paying carbon costs will not be able to compete on the export markets outside of the EU with peers that produce outside the EU and do not pay carbon costs.

The European EIIs are working hard to defend their competitive position by converting their operations from gray to low or zero carbon. However, it is not technically or economically feasible to convert every industry entirely by 2030 or even 2040. It is therefore crucial that EIIs remain competitive and successful in order to finance their decarbonisation.

1.1.4 Decarbonisation efforts require substantial investment from EIIs

The EU's EIIs acknowledge their responsibility in Europe's green transition and have therefore committed to ambitious net-zero targets.

The decarbonisation efforts they have committed to are often even higher than those which EU regulations impose, or what the rest of the world has committed to. In the long term, most EU steel players, for instance, are aiming for carbon neutrality by 2050. Additionally, their targets for cutting emissions by 2030 are more ambitious than those of players from other regions with similar carbon neutrality targets, like Japan, South Korea or the US. The same is true for EU aluminium producers; many have committed to more than a 30% emission reduction by 2030.

Decarbonisation of EIIs would require a full-scale transformation of manufacturing processes, which in turn need huge investments with margins currently under pressure, as outlined in the previous sections.

In response to the EU Green Deal, the EU cement industry, for example, committed to reach net-zero emissions along the cement and concrete value chain by 2050. To achieve that goal and support Europe in becoming the first climate neutral continent by 2050, the cement industry needs to develop low-carbon technologies ranging from carbon capture, utilisation and storage (CCUS), and circular use of waste, to recarbonation ("the process where part of the CO_2 emitted during the cement production is re-absorbed by concrete in use through carbonation"[24]). These are just a few examples of decarbonisation levers applicable in the cement industry. However, these levers also have their price. Totalling up the costs, €94.4 billion would be required to achieve net zero ambitions.[25] To put this into perspective and understand the massive investment needed, Figure 07 illustrates that per €1 of annual revenue, the cement industry needs to invest €4.70. These costs also have a significant effect on consumer prices: current estimates show that production of green cement is ~20%[26] more expensive (+~€30/t)[27] than regular cement, putting significant pressure on margins and consumer prices.

In total, €1.7 trillion of CapEx investment will be needed to decarbonise the EU's cement, glass, steel, chemicals, refining and aluminium production facilities by 2050.[28] This is a rough approximation that does not apply any discount factor – inflation or amortisation are not considered. While the necessary investments are substantial, it does highlight that decarbonisation is possible if the right circumstances for investments are provided. However, these investments currently lack an attractive business case as, (1) it is difficult to forecast the actual demand for green products and hence decrease uncertainty, and (2) the operational costs of green production are uncertain and likely to be higher in the EU than the rest of the world, as outlined in the previous sections. As EIIs in other regions do not have as ambitious decarbonisation targets as EU EIIs, they do not require such huge investments. European EIIs are therefore subject to a competitive disadvantage with margins being under enormous pressure (see Figure 07).

24 Circular Economy European Union, 2023

25 Cembureau, 2021

26 BCG cement cost model, August 2023

27 Global Product Prices, Cement

28 BCG analysis, Cembureau, Business Research Company, Eurofer, Cefic, Euractiv, Ibis World, S&P Global, European Aluminium (see Figure 07)

Significant investments needed to decarbonise EIIs in Europe

Total investment for EII sector decarbonisation in Europe per €1 yearly revenue

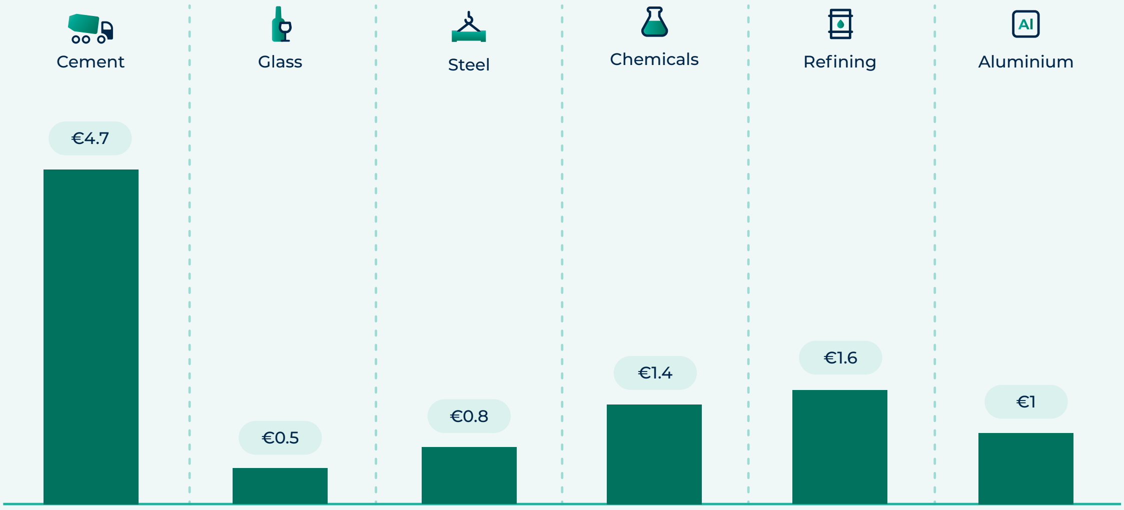


Figure 07: Huge investments needed to decarbonise EIIs in Europe

CAPEX investment needed for decarbonisation (€ billion) / annual turnover (€ billion)

Cement: investment needed €94.4 billion / annual revenue €20.1 billion = 4.7 - For every € revenue €4.7 must be invested (Source: BCG analysis, Cembureau)

Glass: investment needed €23.7 billion / annual revenue €49.5 billion = 0.48 - For every € revenue €0.5 must be invested (Source: Glass International, Business Research Company)

Steel: investment needed €102 billion / annual revenue €125 billion = 0.8 - For every € revenue €0.8 must be invested (Source: BCG analysis, Eurofer)

Chemicals: investment needed €800 billion / annual revenue €594 billion = 1.35 - For every € revenue €1.4 must be invested (Source: Cefic)

Refining: investment needed €650 billion / annual revenue €400 billion = 1.6 - For every € revenue €1.6 must be invested (Source: Euractiv, Ibis World)

Aluminium: investment needed €40 billion / annual revenue €40 billion = 1 - For every € revenue €1 must be invested (Source: S&P Global, European Aluminium)

1.2 Potential consequences of combined pressures are price increases and deindustrialisation

The production cost in the EU is currently higher than in other regions due to increased energy prices. This puts margins under pressure and makes investing into the green transition even more difficult, as EIIs are not able to generate a financial buffer. In addition, the energy transition and decarbonisation costs lead, inevitably, to production cost increases. Production in Europe will become more expensive due to higher energy costs, the need to pay CO_2 costs, and simultaneous investment in decarbonisation technologies on production assets. This means that the business case for green investments is not strong as it stands.

Increased production costs can have two different implications. For some products, increases can be largely passed on to customers e.g. when there are barriers to entry from international competition such as high transport costs and limited substitutes. In these cases, production stays in the EU and prices increase. For other products, cost increases cannot be passed on to customers, and production needs to shut down; not only do exports decrease,[29] but imports also increase.[30] This could lead to an increase in trading of EIIs. If prices cannot be passed on, such as in industries that are highly exposed to international competition like basic metals and chemicals, costs will be absorbed by industry.[31]

29 Chiacchio, F.; De Santis, R.; Gunnella, V. and Lebastard, L., 2023

30 Impact could be reduced by CBAM depending on its implementation

31 Sgaravatti, G.; Tagliapietra, S.; Zachmann, G., 2023

Landed costs, i.e. production costs plus costs for exporting the products to the EU, are for many European producers, e.g. cement, steel, polyethylene, and aluminium, higher than their non-EU competitors (Figure 08). For example, aluminium imported from China, including the cost of transporting it into Europe, can be offered at a 18% lower price than locally produced aluminium.[32] This drastically decreases the competitiveness of the industries mentioned – imports of EII products from outside the EU increase. Self-evidently, the EU's EIIs will struggle more to export, as they cannot even compete in their local market.

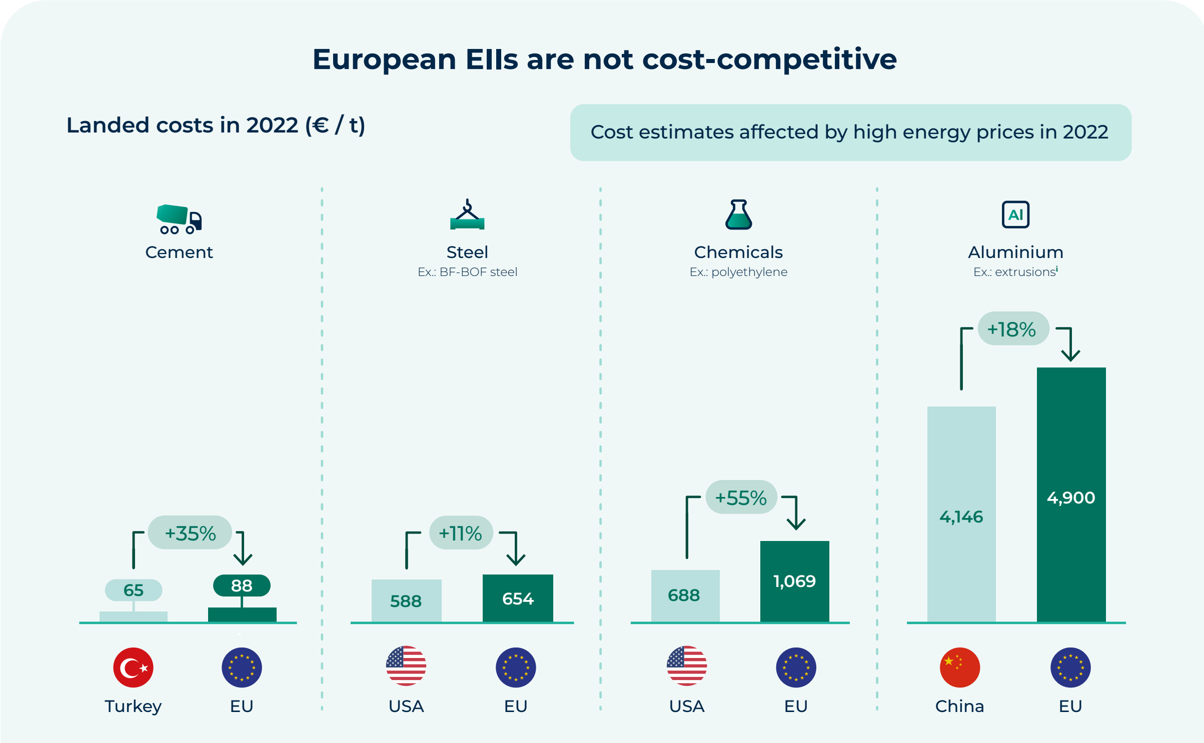


Figure 08: Landed cost comparison EIIs 2022

i. For EU average of France and Germany unit price

Landed costs include production cost and transport cost per ton

Source: Wood Mackenzie database of world aluminium plants, BCG analysis

Together with the fact that EII products are being increasingly traded (+23% trade value between 2018 and 2022 alone)[33] and that imports of EII products are increasing, the risk of EIIs relocating outside the EU is growing. EU production capacity could be replaced by non-EU production (see Expert corners 1-3 for more details).

Over the past few years, Europe has already seen a surge in net imports (defined as exports minus imports) of EIIs (see Figure 09).[34] For example, in 2012, more steel was exported than imported, while in comparison during 2022 Europe imported €20 billion worth of steel.[35] Other EIIs have seen similar drastic changes with imports doubling or tripling. This illustrates a decrease of EIIs operating locally and a tendency towards importing goods from non-European countries.

32 See Figure 08, Wood Mackenzie, BCG Analysis

33 UN Comtrade data

34 UN Comtrade data

35 UN Comtrade data

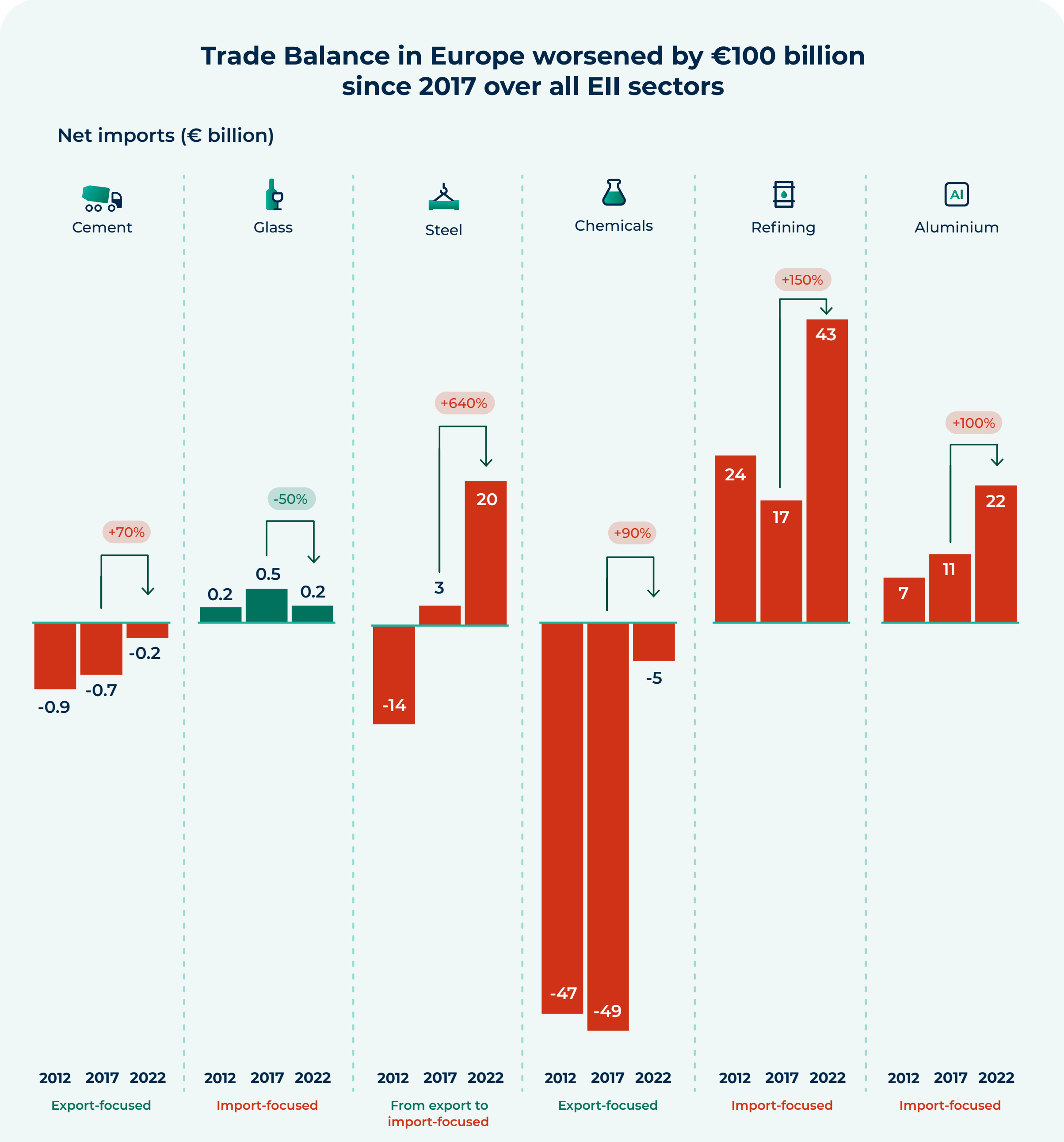


Figure 09: Increase in net imports

Note: $ billion (Net imports = Total imported goods and services – Total exported goods and services); Scope of the analysis is Europe, i.e. including Norway and Iceland; Source: europa.eu, Comtrade

The continent's ability to export will be further impacted in the future, as the CO_2 price will increase, and free allowances will be phased out as the CBAM is introduced. This is due to the fact that the current CBAM is not yet including a clause related to safeguarding EU industry's export competitiveness. While it adds a carbon levy on imports to a limited scope of products covered by the CBAM, the carbon price paid by EU EIIs is not deducted for exports. They therefore compete in the export markets with 'grey' products from other countries that are not subject to a carbon price, and thus losing competitiveness. This also affects products not covered by the CBAM that are created from the starting product covered by the CBAM. All these products lose their competitiveness in third markets as well as on the domestic market, as they would have to compete permanently with 'grey' products not covered by CBAM.

The resulting decrease in exports would shrink the market accessible to EU EIIs tremendously. This could force them to reduce their fixed costs in the EU i.e. close plants and reduce production capacities, contributing to deindustrialisation.

1.3 Deindustrialisation of Europe has already started

High energy costs combined with trade competition from countries like China and the US have already had a real-world impact on today's EIIs' operations. Some industries have had to close plants and cut jobs – see *below* for an overview of some key sectors across Europe *that stopped their production (temporarily and permanent)*. This was often due to higher costs which left them unable to remain competitive.

Several examples can be observed:

1. **Aluminium:** One example is within the aluminium industry, where more than 50% of production capacity has been idled since 2021 – see 'Expert Corner 1: Aluminium as a warning sign for European deindustrialisation'.

2. **Ammonia:** Another example is the European ammonia industry (both fertilisers and chemical production), which, despite being of strategic importance for food security (fertiliser production), rapidly curtailed 70% of production capacity in Q3 2022 due to temporary much higher energy prices in Europe compared to the rest of the world[36] – see 'Expert Corner 2: Short-term impact from high energy prices: The case of ammonia'.

3. **Refining:** Similar developments can be observed in the refining sector; 26 European refineries have closed since 2010. Of these, 22 refineries were mainstream and four were specialty. These closures equal 2.8 million bbl/d (2.8 million barrels of oil per day, 125 Mt per year), or 17% of refining capacity. Three refineries were converted to biorefineries and a fourth one is currently in the process of being converted.[37]

4. **Steel:** The same is true for the steel industry, where site closures in Europe since 2009 equal 26 million tonnes of lost steel production capacity. These closures caused the loss of 80,000 direct jobs, around 25% of the total EU steel workforce.[38]

36 See Figure 11, AG Energiebilanzen, Nexant, World Ban, COMTRADE, Fertilizers Europe, BCG Analysis

37 Concawe Refineries Map, 2023

38 Eurofer, 2022

EXPERT CORNER 1

Aluminium as a warning sign for European deindustrialisation

Europe's share of worldwide aluminium production has fallen from 30% in 2000 to 12% in 2021.[39] In addition, more than 50% of production capacity has been idled since 2021. International competition has intensified, with China increasing production and doubling its exports worldwide between 2020 and 2022 (~$17.5 billion).[40] Other countries, such as India and the UAE, were also able to significantly increase their production with around a 10% CAGR (compound annual growth rate) between 2009 and 2019.[41]

Two main factors have led to a diminution of European players on the global competition field:

Firstly, comparatively high energy prices: The cost of electricity represents up to 40% of aluminium smelting costs. This is not the first time aluminium production has faced high energy costs: in 2006, the EU terminated long-term energy contracts. As a result, primary aluminium production in the EU dropped temporarily by two thirds. Today, only the two largest European (but not EU-27) aluminium producing countries, Norway and Iceland, are able to produce below the global average cost level of $2,383/tonne, with $2,042/tonne (14% below global average cost level) and $2,024/tonne (15% below global average cost level) respectively, due to their access to high volumes of base load-compatible renewable energy such as hydro or geothermal.[42] However, the two next largest European producers, France and Germany, both produce at above average costs.[43] However, due to declining energy prices after winter 2022, only the marginal producers still suffer from profit losses in the first half of 2023. This puts European players in a difficult position, given the predicted continuation of high energy prices in the near- and mid-term future.

Aluminium is an example of how sectors with rather flat cost curves, like most of the EIIs, are more vulnerable to higher energy prices, as there are few other options to compensate higher prices and products are less differentiated between competitors.

Secondly, more favourable policies abroad: China has not only profited from significant GDP growth and a surge in demand for aluminium, but also high levels of subsidies; $62 trillion or > 90% of worldwide subsidies have been allocated to Chinese smelters.[44]

This negatively influences the EU's efforts to decarbonise Chinese production focuses on coal power-based aluminium, which emits on average six times more CO_2 than green aluminium (based on renewable energy sources). Due to an increase in Chinese production, the share of coal power-based aluminium rose from 36% in 2000 to 57% in 2022. As Chinese players are not yet subject to any meaningful sustainability measures, they can use cheap coal power to produce a relatively cheap aluminium.[45]

39 Italpres, 2022

40 UN Comtrade data

41 UN Comtrade data

42 See Figure 10, Wood Mackenzie, BCG Analysis

43 See Figure 10, Wood Mackenzie, BCG Analysis

44 OECD, BCG analysis

45 BCG analysis using public company data, e.g. China Hongqiao coal power production

Chinese aluminium production, which is largely coal power-based, emits 22 tonnes of CO_2 per tonne produced, while Norwegian production emits only 3.7 tonnes of CO_2 per tonne. If the entire Chinese aluminium production was as CO_2 efficient as the Norwegian one, the world would emit a stunning 585 megatons less CO_2.[46]

In summary, we are now in a situation where, if the deindustrialisation of aluminium continues to take place in the EU, we will see more closedowns of aluminium smelters across the continent, which will further increase Europe's dependency on aluminium imports from other continents and worsen carbon leakage.

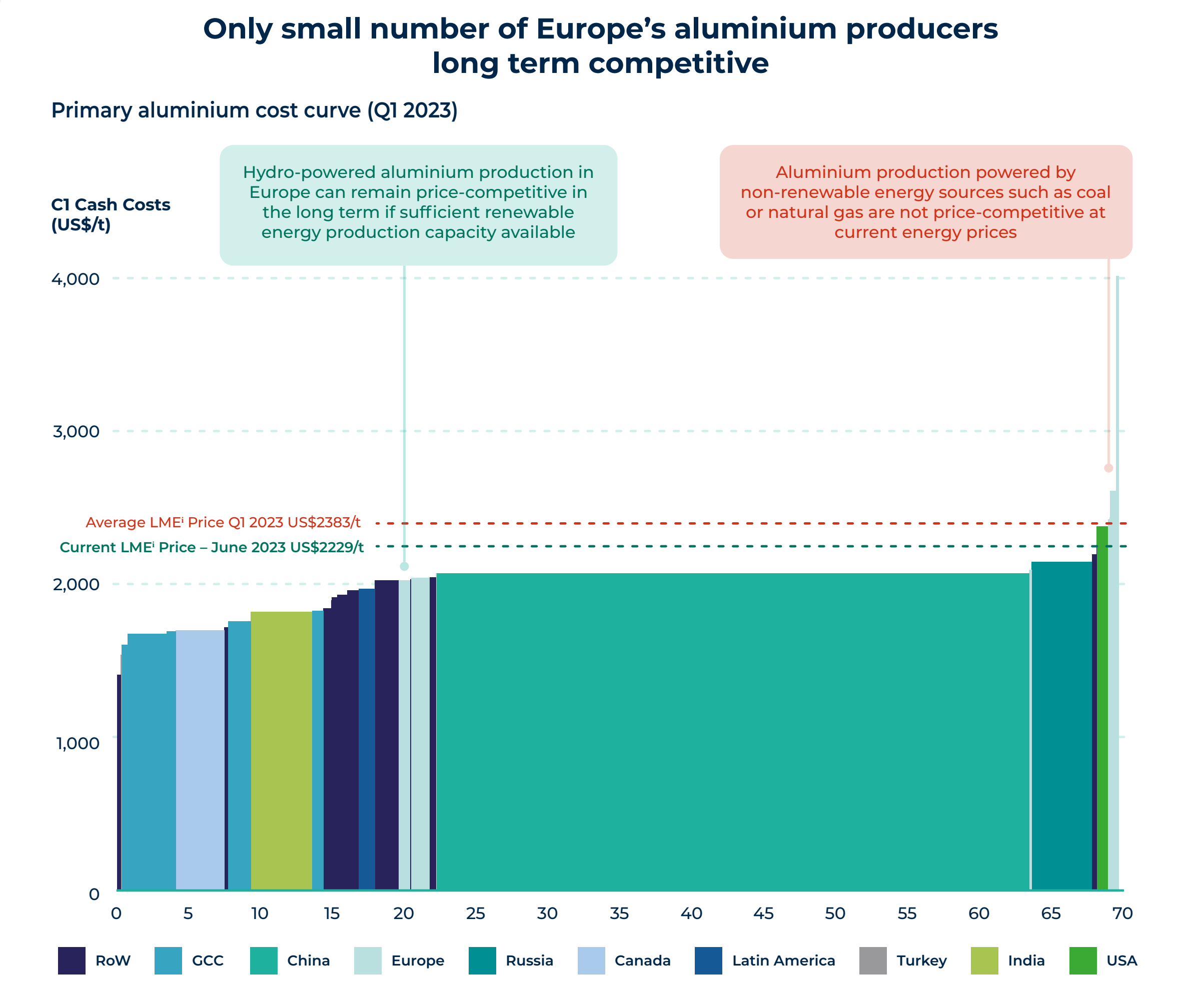


Figure 10: Aluminium Cost Curve (Q1 2023)

i. London Metal Exchange; Note: Impact of relatively high coal prices: At lower coal prices, China with cost advantage also over hydro-powered aluminum production in Europe. Source: Wood Mackenzie, BCG analysis

46 BCG analysis using public company data, e.g. China Hongqiao coal power production

EXPERT
CORNER 2

Short-term impact from high gas prices: The case of ammonia

Recent developments in ammonia highlight the importance of competitive energy prices to maintain local production of EIIs in Europe. This is particularly true for ammonia, which uses gas not only energy but also as a feedstock for its production.

In 2019, European ammonia cash costs ($188/tonne) were below the global average. The surge in gas prices in 2022 led to a significant increase in cash costs, which made European ammonia production costs three times higher ($1200/tonne) than the global average. These cost increases hugely reduced the industry's ability to compete, leading European producers to rapidly halt 70% of their production. This highlights how quickly industries are forced to adapt to fluctuating costs and that it can lead to temporary curtailment of production. Keeping production of chemical products active is essential, as it ensures European autonomy in critical fields such as food security.

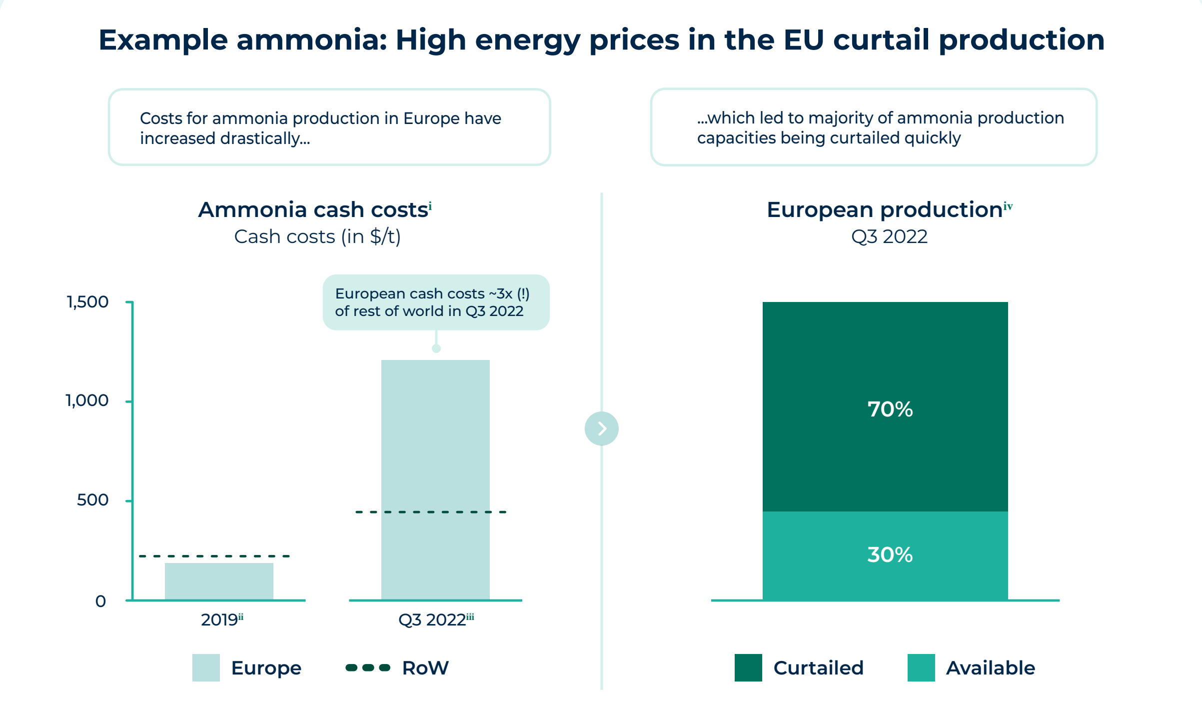


Figure 11: Ammonia production in Europe strongly impacted by short-term energy peak in Q3 2022

i. The cash cost represents the regional averaged Factory Gate Cost without Depreciation & ROCE;
ii. Based on annual 2019 gas prices;
iii. Based on Q3 2022 gas prices;
iv. Includes Western and Central Europe
Source: AG Energiebilanzen, Nexant, World Bank, COMTRADE, Fertilizers Europe, BCG analysis

EXPERT
CORNER 3

Chemicals sales dropping further in Europe compared to global sales

Since 2011, the chemicals market has moved further into a tough combination of a high-cost structure, high energy prices, expensive feedstocks with Asian players buying Russian crude oil and US players having access to shale, and an oversupply from government-backed large Chinese complexes.

For the European chemicals industry, exports become less and less competitive. At the same time, competitive and cheap imports threaten and replace the local production. Products with a significantly high energy consumption, i.e. PVC or polystyrene are strongly impacted. Consequently, various companies idled part of their plants in the last years, like Ineos and PVC. Also, OCI has announced the acceleration of its US products due to IRA's (Inflation Reduction Act's) simplicity. Several drivers for this are structural and are expected to continue to pressure Europe's competitiveness in the future. Therefore, *the* European *chemicals* industry may not be able to participate in the global growth of the market.

1.4 EIIs remain committed to Europe and the green transition and are seeking opportunities to adapt

After the temporary closures of EII production sites in Europe when energy prices soared, many businesses reopened their sites (see Figure 12). In April 2023 compared with April 2022, industrial production increased by 0.2% in the euro area and by 0.1% in the EU.[47] In the steel industry, for example, many idled furnaces have been reopened since the start of 2023, with European distributors restocking since December, as European steelmakers respond to some improvement in demand and prices.[48]

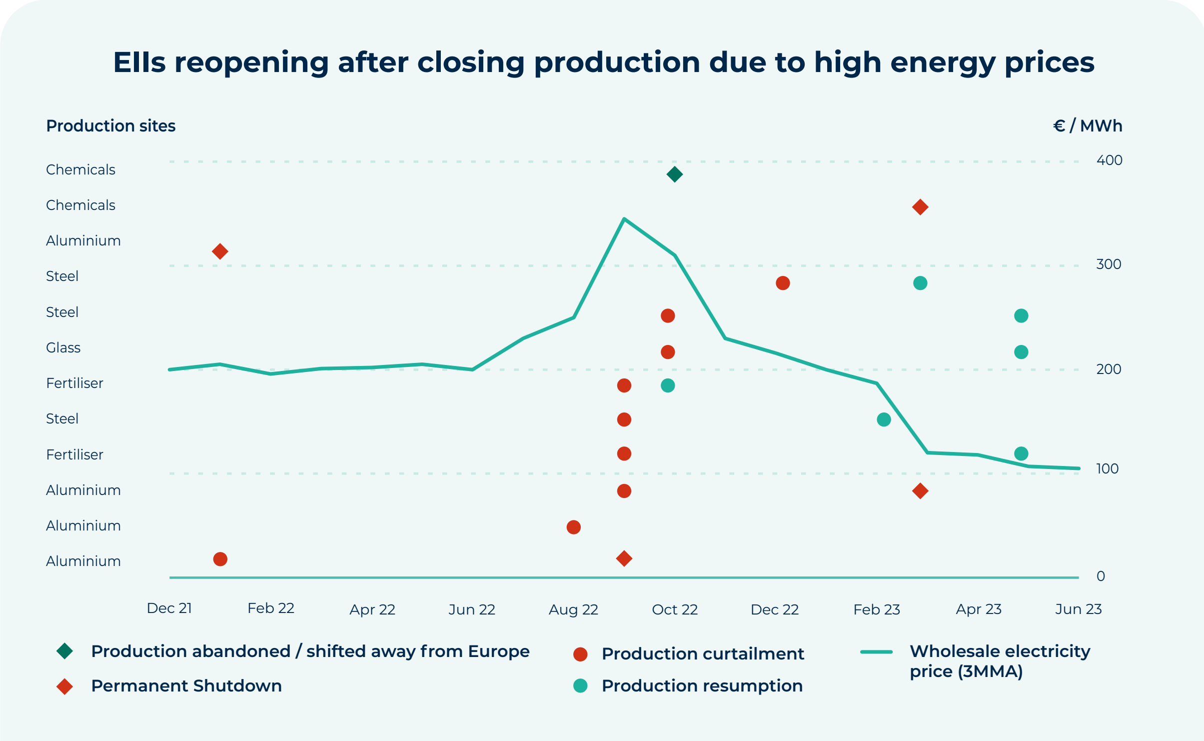


Figure 12: IEA[49] graph on curtailment of production

Moreover, European EIIs are actively working towards a green future, innovating in new technologies and business models and bringing them to scale.[50] They are committed to reduce and flexibilise energy consumption, avoid carbon emission from the production processes, and cooperate with energy provides to promote production of low carbon energy. BASF, for instance, estimated that it will be challenging to cover their renewable energy demand to achieve their ambitious climate targets. To decrease their dependency on energy producers, they purchased 49.5% of the Hollandse Kust Zuid windfarm by Vattenfall and contributed €1.6 billion to fund the wind farm's construction. With 140 wind turbines and a total installed capacity of 1.5 GW (Gigawatts), the development will be one of the largest offshore wind farms in the world. It will also be the first offshore wind farm in the world not obtaining any price subsidies for the power produced. BASF is acquiring the electricity through a long-term power purchase agreement (PPA), enabling it to implement innovative, low-emission technologies at several of its production sites in Europe.[51]

47 Eurostat, 2023

48 S&P Global, 2023

49 International Energy Agency, 2023

50 ERT "Industry4Climate", 2024

51 BASF News Releases, 2021

Another example of massive investment with considerable impact is the Shell Holland Hydrogen 1 (HH1) project. The HH1 project provides a solution for the need for cleaner energy in heavy-duty cargo and industries, sectors that have limited options for other renewable solutions. Powered by wind coming from the offshore wind farm Hollandse Kust Noord, the 200 MW (megawatt) HH1 plant will be the first step in meeting the needs of industry's hard-to-abate sectors. Once operational in the second half of this decade, it will produce up to 60 tonnes of green hydrogen per day, powered by offshore wind from the North Sea. The estimated annual production of 24.8 kilotons of renewable hydrogen represents approximately 5% of the total annual use of hydrogen in the Port of Rotterdam.[52] Shell's investment illustrates the willingness of companies to take risks and invest ahead of a market, despite regulatory uncertainty.

The strong commitment of the EIIs to the EU and its green transition translates to ambitious net-zero targets, as outlined in chapter 1.1.4. EIIs are aware that they are essential for a climate neutral economy. They aim at taking an active role in making the green transition a success and becoming a global role model, all by supporting Europe in becoming the first climate neutral continent by 2050. This is also illustrated by the further examples of carbon reduction projects from across the industry collected by the ERT 'Industry4Climate' initiative.[53]

1.5 Nevertheless, the risk of further deindustrialisation is tangible

1.5.1 Macro-indicators, like stagnant GDP contribution and Foreign Direct Investment as warning signs for deindustrialisation

The pressure lying on European EIIs becomes even more evident when looking at GDP. While EU GDP grew from 2014 to 2022 with a CAGR (Compound Annual Growth Rate) of ~0.8%,[54] EIIs' contribution to GDP has been 20 times smaller and almost stagnant (~0.04% CAGR)[55] from 2014 to 2022.

Other factors indicate that the EU is being left behind other key global regions:

- Research & Development (R&D): In 2022, the EU had one of the lowest R&D/GDP ratios in the world at ~2.3%. China achieved ~2.6% and the US ~2.9%.[56]
- Patents: The EU delivers fewer patent applications than China, the US and Japan.[57]
- Venture capital: Only 18% of global venture capital is invested in Europe, while the US receives roughly half of global venture capital.[58]

Looming deindustrialisation is also tangible in the levels of investments: the Foreign Direct Investment (FDI) inflow to Europe,[59] compared to the total global FDI inflow, has seen a decrease in the past decade from 23% of all global FDI in 2011 ($408 billion) to only 10% ($168 billion) in 2021[60] (see Figure 13). The year 2022 even witnessed negative FDI inflow to Europe, which means that foreign investors divested more FDI from Europe than they invested in Europe during this period. When comparing FDI inflows in 2022 against 2017, it becomes apparent that Europe is the only region with major decreases in FDI inflow (-31pp), while China (+4pp) and the US (+10pp) were able to increase FDI inflow.[61]

52 Shell Holland Hydrogen 1

53 ERT "Industry4Climate", 2024

54 World Bank Data (2014: $15.65 trillion vs. 2022: $16.64 trillion)

55 Oxford Economics, 2023

56 ERT paper "European Competitiveness and Industry – Benchmarking Report", 2022

57 ERT paper "European Competitiveness and Industry – Benchmarking Report", 2022

58 ERT paper "European Competitiveness and Industry – Benchmarking Report", 2022

59 FDI Inflow represents transactions that increase the investment that foreign investors have in enterprises resident in the reporting economy less transactions that decrease the investment of foreign investors in resident enterprises

60 See Figure 13, OECD Global FDI Inflow, European FDI Inflow, BCG Analysis

61 See Figure 13, OECD Global FDI Inflow, European FDI Inflow, BCG Analysis

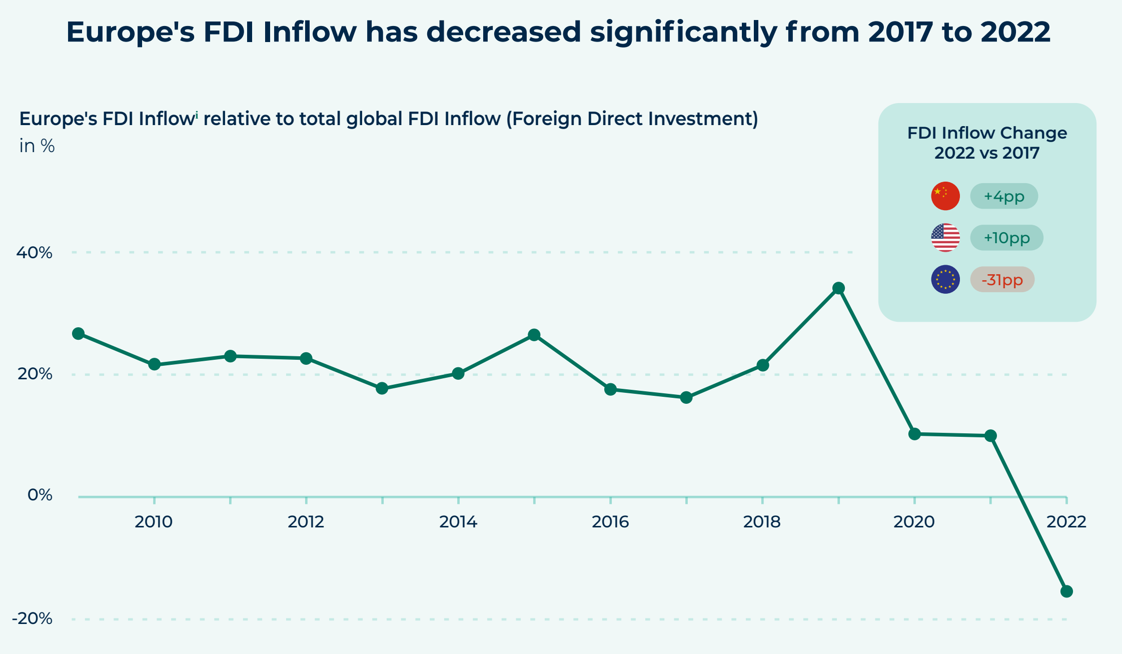


Figure 13: Decline in Europe's FDI investments

i. FDI Inflows represent transactions that increase the investment that foreign investors have in enterprises resident in the reporting economy less transactions that decrease the investment of foreign investors in resident enterprises

Source: OECD, BCG analysis

When comparing greenfield FDI only (which focuses on actual construction and upgrades and excludes brownfield investments e.g. mergers & acquisitions) between key economic regions, Europe has been losing out significantly in comparison to the US. From 2010-2022, EU greenfield investment CAGR (compound annual growth rate) was -4%, while the US has seen a positive CAGR of 4%.[62] Although the EU started at a higher point in 2010, a shift of greenfield FDI towards US markets can be observed. This highlights the looming potential of further deindustrialisation across European EIIs.

1.5.2 Some EII sectors are expected to lose cost competitiveness by 2030, be it for grey or green products

The steel industry is an example of how deindustrialisation may continue across the continent. For both grey and green steel, it is challenging for European players to compete with international imports. Leading European grey steel production used to be cost-competitive with global competition prior to 2022. With increasing energy costs, imported American grey steel, including shipping, is expected to be below European production costs in 2030. This disparity implies that American steel could gain stronger traction within the European market (and replace locally produced steel) due to its lower costs.

A similar development can be seen for green steel. Due to more abundant and cheaper green energy, green steel is likely to have a substantially lower production cost in the US or the Gulf region by 2030 – see 'Expert Corner 4: Europe's competitiveness at risk for grey steel and facing considerable challenges in green steel'.

62 Financial Times Capital Data, BCG analysis

EXPERT CORNER 4

Europe's competitiveness at risk for grey steel and facing considerable challenges in green steel

Germany, the leading European producer of steel, was cost-competitive with foreign steel-producing nations prior to the 2022 price hikes[63] – see Figure 14. However, the recent surge in energy prices significantly impacted the market dynamics, making local production in Germany less appealing than imports from the US in 2022. Costs for Germany's HRC (hot-rolled coil) grey steel from the traditional BF-BOF (Blast Furnace-Basic Oxygen Furnace) production route exceeded US steel by 11% during that period. While 2022 was certainly an exceptional year for the steel industry, Germany's steel production is expected to continue at a disadvantage compared to its US counterpart: by 2030, German HRC BF-BOF steel is projected to remain 3% more expensive than that from the US, even when including the transport cost to Europe.[64]

Europe's steel industry is committed towards the transition to green steel. All major players aspire to have more than half their production switched to green steel (mainly blend-DRI-EAF (Direct Reduced Iron-Electric Arc Furnace)) by 2030. To achieve even greater CO_2 reductions, some producers are considering a subsequent switch to steel based on green hydrogen (H_2-DRI-EAF). However, the supply for green hydrogen is expected to be insufficient to cover the demand, so other routes for decarbonisation, e.g. carbon capture, utilisation and storage (CCUS), will need to be implemented. In addition, other factors such as inflation, high energy prices, nitrogen supply issues, and the economic downturn might impose substantial hurdles for an extensive switch to green steel in the short- and mid-term.

Comparing nations' competitiveness without subsidies, H_2-DRI-EAF is expected to be ~€100/tonne (17%) cheaper in the US or Saudi Arabia than in Europe in 2030 – an even larger gap than there is for the grey BF-BOF steel.[65]

63 See Figure 14, BCG steel cost model, August 2023

64 See Figure 14, BCG steel cost model, August 2023

65 See Figure 14, BCG steel cost model, August 2023

EXPERT CORNER 4

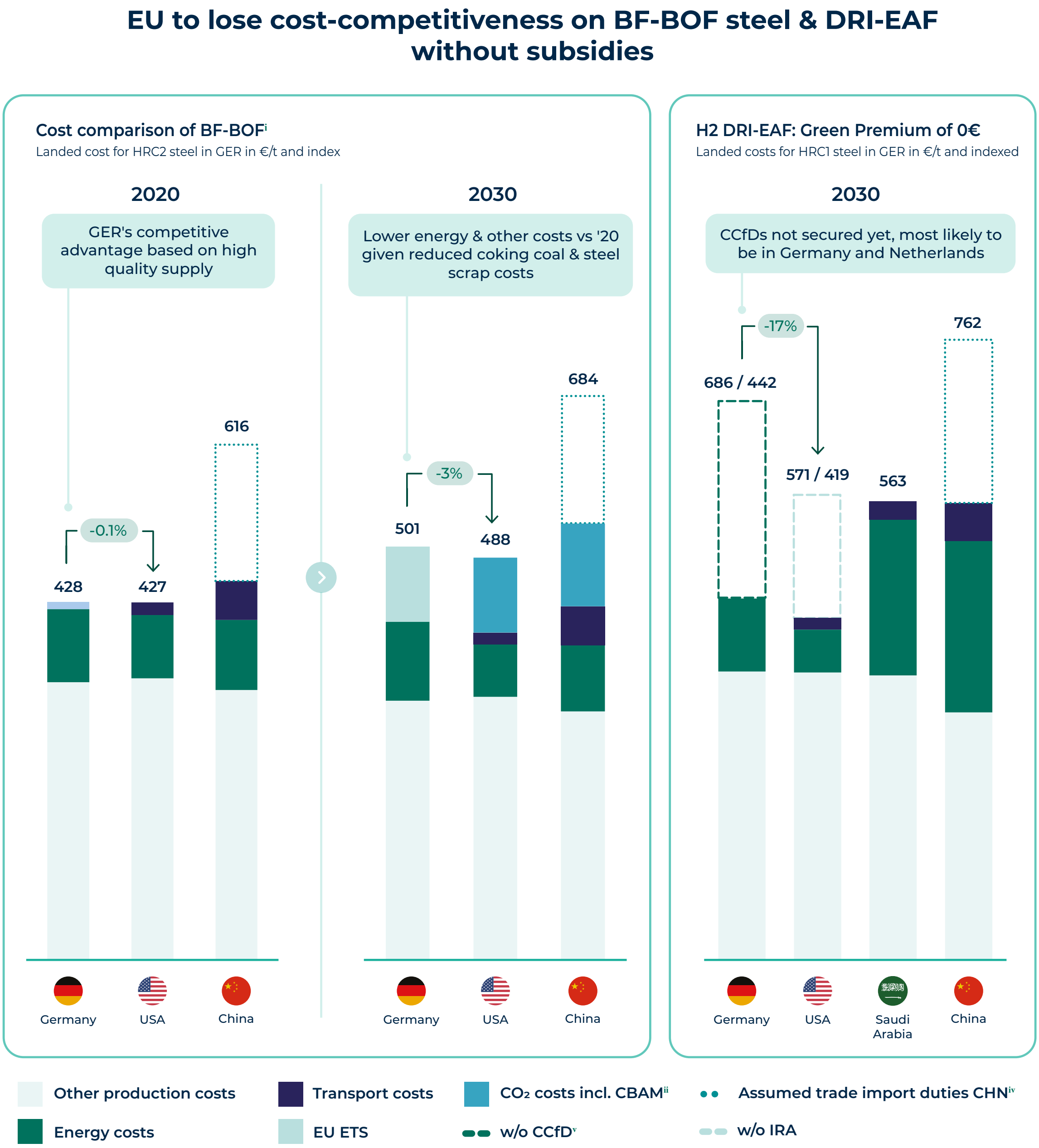


Figure 14: Landed costs of BF-BOF steel and green steel in Europe

Note: OPEX only. CAPEX costs excluded; Analysis from August 2023, numbers particularly dependent on highly variable input prices for energy and raw material, e.g. expected hydrogen prices, which are subject to regular change;

i. Blast furnace- Basix Oxygen Furnace;

ii. Hot-rolled coil

iii. EU carbon border adjustment mechanism (CO_2 costs of ~€90/t CO_2 assumed in 2030) ;

iv. Avg. import duty of 36% for hot-rolled steel assumed for China (import duties assumed to remain for 2030);

v. Assuming a green premium of €0;

Source: BCG analysis

2. EIIs are a key pillar of European prosperity and need to be preserved

The previous chapter showed that Europe is facing a crisis of declining competitiveness. This crisis needs to be overcome, as EIIs are vital to Europe. A decline of European EIIs such as cement, glass, steel, chemicals, refining and aluminium will have a huge negative impact.

EIIs play an enabling role for various downstream industries in Europe. Alongside this, EIIs support Europe's economy by creating jobs, boosting GDP and driving innovation. They are at the forefront of the green transition and have the capacity to contribute hugely towards meeting global emissions reductions targets. EIIs are also important in terms of preserving the EU's Open Strategic Autonomy and industrial supply security in Europe.

This chapter will dive deeper into these factors to highlight EIIs' importance to European prosperity.

2.1 EIIs enable vibrant downstream industries in Europe

European EIIs are highly integrated in the local value chains of their downstream industries. Although imports are increasing, as seen in Figure 09, the majority of EIIs are interconnected with the local value chain. The level of trade intensity, and thereby interconnectedness to the local value chain, varies hugely by sector, as illustrated in Figure 15. Aluminium, for example, is a more globally-traded product. The local aspect is less important. This explains why the deindustrialisation of European aluminium has not had a strong multiplier effect on downstream industries.

Jakob Stausholm
CEO, Rio Tinto

"Producers outside of Europe have drastically lower energy prices and therefore significant cost advantages over European producers. As a big advocate for global trade myself, I understand the reactions to source globally at the expense of the European industry. However, the big risk that we take when we don't place sufficient value on the security of supply is that we make our downstream industries in Europe completely dependent on the mercy of monopoly providers. Thus, we not only put the viability of the base materials but also the downstream industries in Europe at risk."

Stefan Doboczky
CEO, Heubach Group

"Specialty chemicals have always been a stronghold for Europe. The current loss of competitiveness not only takes the production base away, but also drives a loss in research: If we continue on this trajectory, Europe will weaken its competitive edge in terms of knowledge and skilled experts."

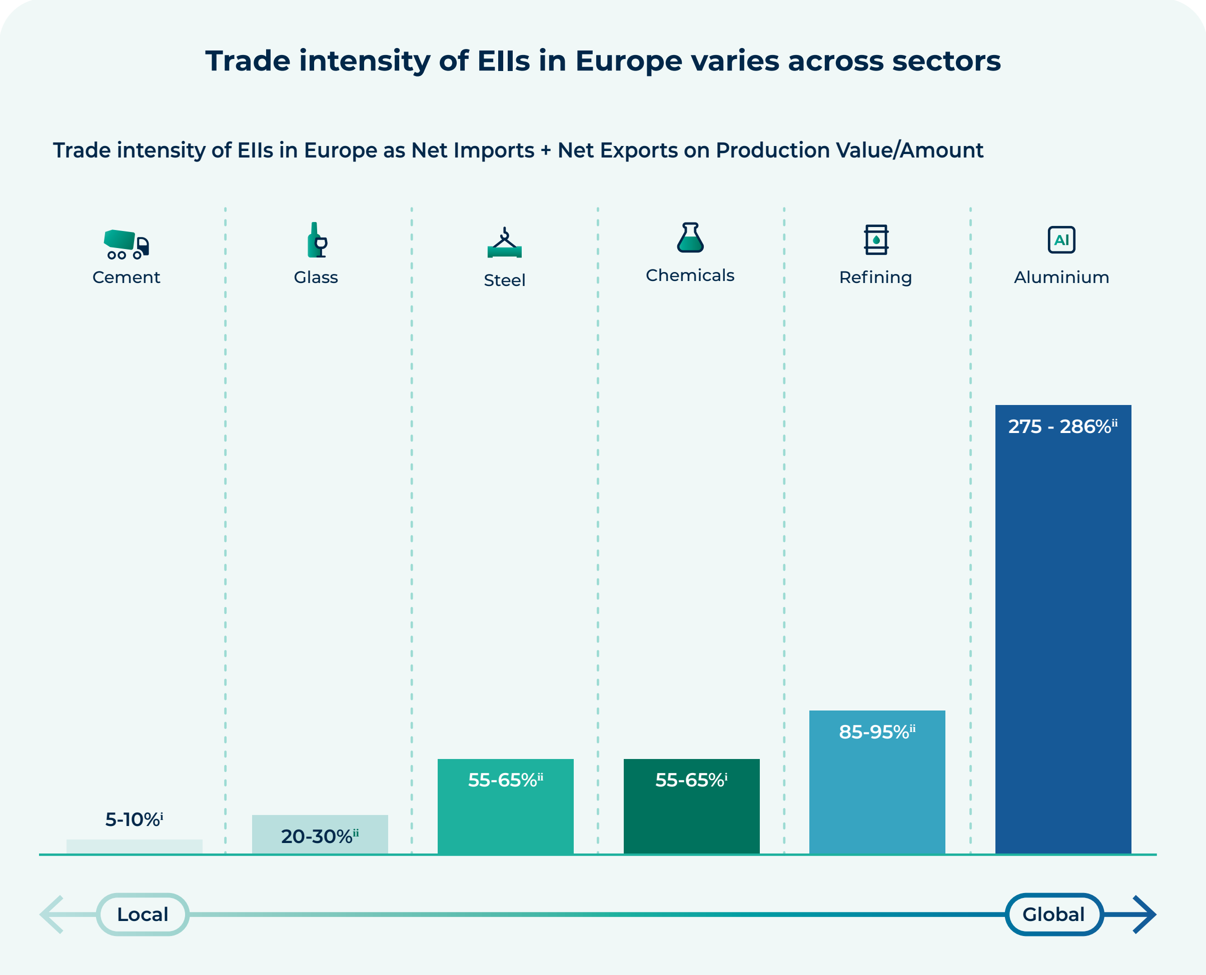


Figure 15: Trade intensity of EIIs (Imports + Exports / Production Value)

i. Trade intensity EIIs using € values for calculation
ii. Trade intensity EIIs using Mt amount for calculation
Trade intensity of EIIs in EU = (EU Imports + EU Exports) / Total EU Turnover or Production
Source: BCG analysis, Comtrade, Glass Alliance Europe, Cefic, IEA, Eurostat, WBMS

Given the interconnectedness of EIIs with their local value chains, we see that this also offers a huge opportunity for emissions reductions along the whole value chain. EIIs reducing their emissions and bringing more green products into the value chain will help their downstream industries reduce their Scope 2 emissions and produce greener products, too.

The automotive industry is an example of an important downstream industry, necessitating the production of steel, chemicals, glass and aluminium to produce vehicles. If those sectors face decreased competitiveness due to high energy prices and decarbonisation efforts, the competitiveness of the European automotive industry would also be negatively impacted. In addition, it is important to note that the switch to electric vehicles, including battery production, puts the automotive industry at a similar level of energy intensity as other EII sectors, such as glass (Automotive: ~5MJ/ € revenue[66] vs glass: ~4MJ/€ revenue). Therefore, many of the needs of EIIs are similar to the ones in electric vehicle production. In the EU, around 13.8 million people work in the automotive sector, representing 6% of total employment and contributing 7% to the EU's GDP.[67] Manufacturing (direct and indirect) accounts for 3.5 million jobs, sales and maintenance for 4.5 million, and transport for 5.1 million. Decreased competitiveness of European EIIs would lead to negative effects on the automotive industry's huge contribution to the economy.

66 Leonid Leiva (Energie Experten), 2020 & Statista.com

67 European Commission, 2023

Key downstream industries of European EIIs

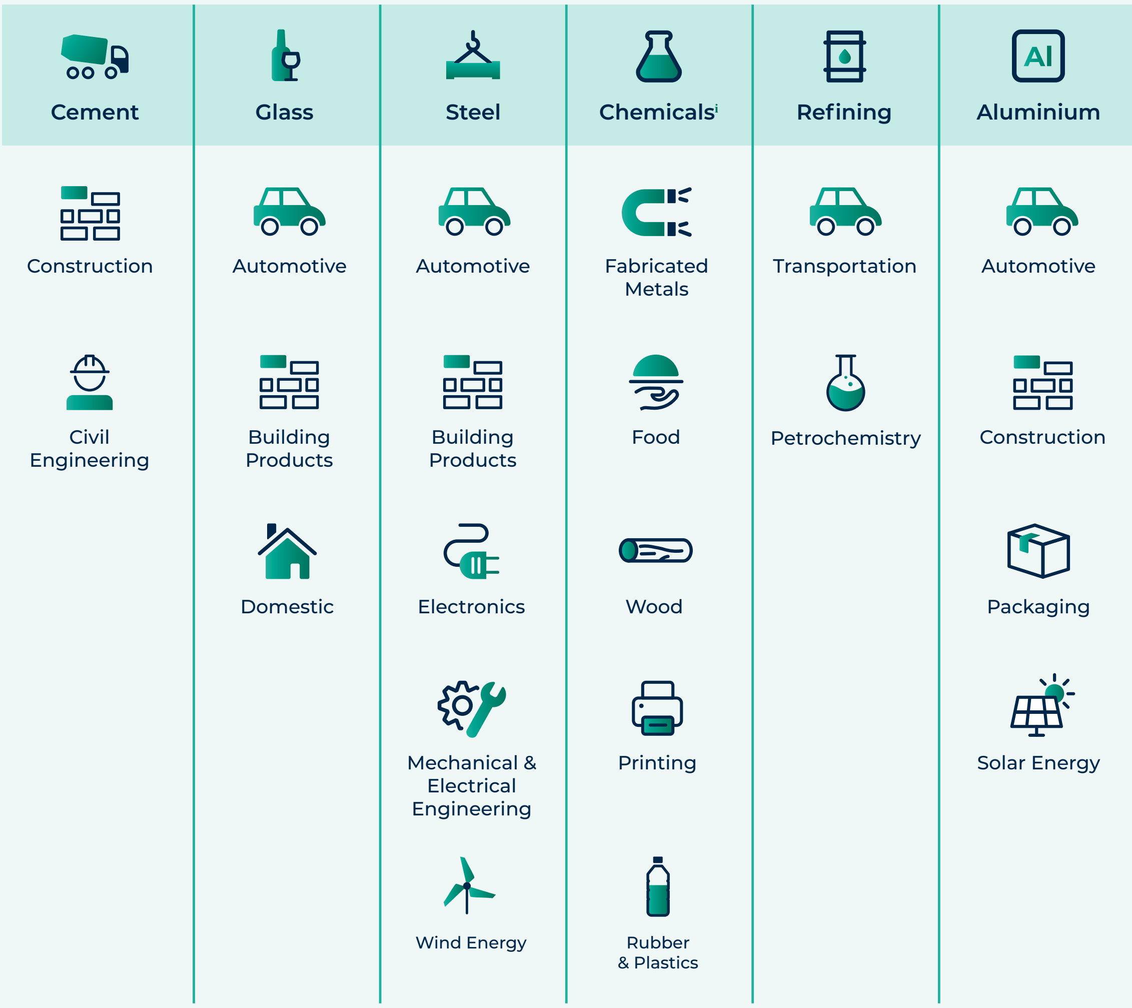


Figure 16: Downstream industries of European EIIs

i. High variance of products in chemicals

Source: BCG analysis, European Commission, Eurostat, European Aluminium

Five underlying factors cause the correlation between the competitiveness of EIIs and the competitiveness of their downstream industries:

1. **Supply chain efficiency and resilience:** Production in Europe increases the reliability of supply and decreases Europe's dependency on other regions for those materials. Additionally, physical proximity enables fast reactions to changes, which is particularly relevant for just-in-time production. With increasingly volatile international markets, resilience of supply chains becomes more and more critical. Proximity between EII production sites and users reduces risks for both sites. An example that illustrates the importance of supply chain efficiency can be found within the steel industry, where high performance steel grade used by the automotive industry can only be produced by some specialised steel manufacturers.

2. **Knowledge and collaboration:** Clusters bring together companies within the same value chain, fostering a collaborative environment where knowledge sharing, information exchange and innovation can thrive. Clusters also include universities and research centres that foster innovation and a skilled workforce. Particularly in chemicals, products that consist of complex chemicals require knowledge sharing and collaboration between the different parts of the value chain.

3. **Enabling circular economy:** Industrial symbiosis is important for future circularity, where different industries use by-products of others. For example:

   - **Glass:** For the renovation of buildings, the glass industry collects back and recycles used glass.

   - **Aluminium:** The aluminium industry collects and recycles large quantities of end-of-life aluminium scrap, particularly from the automotive and buildings sectors, as well as from packaging. The global growth in recycling is expected to outpace growth in primary aluminium production.

   - **Steel:** The steel industry collects back and recycles used steel (scrap).

   - **Chemicals:** Recycling of plastics and recovery of critical raw materials such as lithium, cobalt and nickel provides downstream players with a major and reliable source of materials that are used in the production of products such as batteries.

4. **Shared regulatory factors:** Alignment on regulatory frameworks and environmental standards exists for operations within the same jurisdiction. Therefore, close local collaboration ensures that regulatory factors are taken into consideration from the beginning of the value chain, something which is much more difficult with imported goods. An example of the importance of shared regulatory factors is the chemicals industry. With REACH[68] in Europe, some polymers are forbidden. Consequently, downstream industries of chemicals in Europe are not allowed to use imported chemicals from outside the EU that contain those kinds of polymers.

5. **Transport simplicity:** Transportation is easier for products that are further towards the end in the value chain and therefore further along in production. Transport emits CO_2 and long journeys increase CO_2 emissions, contradicting the net-zero ambitions of European industry. Additionally, dangerous goods are difficult to transport and specific prohibitions often make transport even more complex. Reducing transport distances is essential in this case. An example of this is the chemicals industry, where many chemical products are dangerous goods. In some cases, the strong correlation between the ability of achieving the green transition and EIIs becomes evident: for raw coated glass, which is used in energy efficient windows, transportation is often difficult. Therefore, if the glass industry leaves Europe, the downstream industry to produce energy efficient windows inevitably disappears from Europe.

Figure 17 provides additional examples of important arguments for local value chains across all six EII sectors.

68 Registration, Evaluation, Authorisation and Restriction of Chemicals: REACH addresses the production and use of chemical substances, and their potential impacts on both human health and the environment.

From the perspective of EIIs' downstream industries, 5 arguments make a local value chain important

Exemplary Arguments	Cement	Glass	Steel[i]	Chemicals[ii]	Refining	Aluminium
1 Supply chain efficiency and resilience	e.g. secure supply from local plants precondition to avoid plant closures leading to regional construction halts		e.g. secure supply of high performance grades available from limited steel producers critical e.g. for auto	e.g. secure supply of critical chemicals, e.g. for battery production, highly relevant for green transition	e.g. resilient supply chains, preventing price-spikes, critical for socially acceptable diesel and gasoil prices	
2 Knowledge sharing and collaboration		e.g. R&D partnerships on high performance raw coated glass required in energy efficiency windows	e.g. joint development of high performance steel grades, required in automotive industry	e.g. cross-supply chain partnerships to develop specialty chemicals for specific end-uses		e.g. R&D collaborations to create and test low carbon aluminum to reduce carbon footprint of cars
3 Circular economy	e.g. usage of waste from other industries (e.g. steel slag, fly ash), to substitute clinker and reduce CO_2 emissions	e.g. recycling end-of-life consumer products or glass from renovations of buildings as input into glass production	e.g. critical high quality production scrap from auto OEMs in closed loops returned to original steel producer	e.g. recycling of end-of-life consumer products made from plastics and textiles	e.g. utilisation of assets refineries already have to provide a feedstock for producing circular plastic	e.g. recycling of end-of-life vehicles, packaging and construction products
4 Shared regulatory factors	e.g. on marketing and circularity principles, i.e. EU Construction Products Regulation		e.g. on health, safety, environmental protection, i.e. stainless steel subject to REACH[iii]	e.g. on health, safety, environmental protection, i.e. chemicals subject to REACH[iii]	e.g. on GHG intensity, i.e. EU Fuel Quality Directive	e.g. environmental declaration of building products, i.e. EU EDP standards
5 Transport simplicity	e.g. relevance of local supply due to high transportation cost relative to price for cement	e.g. higher risk of breaking during transport for raw coated glass vs finished energy efficiency windows		e.g. higher transport complexity of chemicals classified as dangerous/ environmentally harmful vs finished goods		

Figure 17: Important factors for downstream to produce locally

i. Relevance especially for high-quality grades, e.g. rather automotive than construction industry
ii. High variance of products in chemicals sector
iii. REACH: European Commission: Registration, Evaluation, Authorisation and Restriction of Chemicals
Source: CEMBUREAU, European Commission, BCG analysis

The knock-on effect of EIIs' competitiveness influencing the competitiveness of their downstream industries would materialise in one of two different scenarios:

1. Downstream industries would relocate their production sites to outside Europe, causing job losses and a decrease in the EU's GDP;
2. Downstream industries would remain in Europe but with a considerable competitive disadvantage, dependent on imports for strategic resources, with production only for local demand, also causing job losses and a decrease in the EU's GDP.

In the following Expert Corners, we will elaborate on three examples of the knock-on effect on downstream industries.

EXPERT
CORNER 5

Green steel from outside Europe is putting the supply chain resilience of Europe's green transition at risk

Steel production is crucial for the wind energy industry. Therefore, steel is a key enabler for the European green energy transition – almost 40% of all renewable energy was produced by wind in 2022.[69] The wind industry heavily relies on steel for the manufacturing of wind turbines, tower structures and other critical components: 120-180 tonnes of steel is needed per GW of wind turbine. Steel consumption for wind energy production is estimated to increase by 2.8 Mt per year until 2030.[70]

Taking the offshore wind turbine production in Europe as an example, it becomes clear that a loss of cost-competitiveness will lead to reduced supply chain resilience. Green steel is cheaper to produce outside of Europe without subsidies (same is true for grey steel, see previous chapter). Therefore, the green steel that is needed to produce wind turbines or potentially even the whole wind turbine is imported. This risk will be amplified by the Carbon Border Adjustment Mechanism (CBAM), when steel is already in scope but the down-stream industries, e.g. wind towers built with grey steel abroad, are still excluded. The wind industry is already facing problems from global competition, as recognised by President von der Leyen in her State of the Union Address in which she announced the European Wind Power package.[71]

Europe runs the risk of relying on other countries in its green transition. A disruption of the supply chain could even lead to a slowing-down of the green transition. With green steel production in Europe, the wind industry could ensure a localised and reliable supply chain, reducing dependence on imports and the possibility of supply chain cut-offs. In this way, a robust steel production sector in Europe promotes the localised production of wind turbines and thereby the energy transition towards a greener future.

69 European Commission, 2023

70 Goldman Sachs

71 2023 State of the Union Address by President von der Leyen

EXPERT CORNER 5

Europe may get dependent on other nations for its green transition

Offshore wind turbines are largely made of steel...

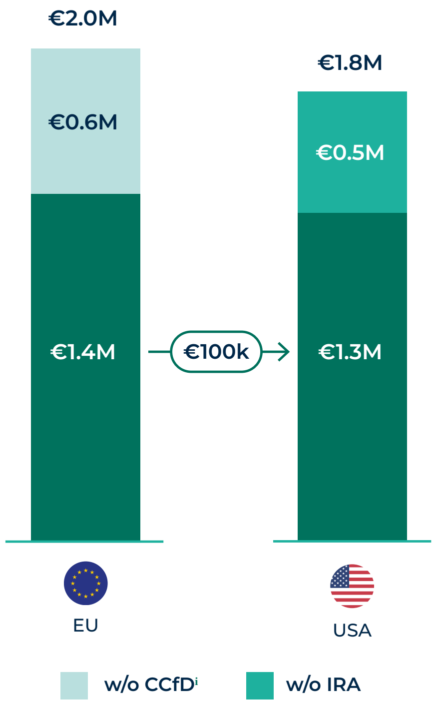
70%

of material used in one offshore wind turbine is steel

...but European green steel will not be cost-competitive...

DRI-EAF Steel | 2030

Estimated cost for one windmill



...making European production dependent on foreign sources

- **~€100k (~4% steel cost) is saved** per offshore wind turbine
- Imports from USA likely to increase **bringing down share of European steel**
- Potential scenario: Wind turbines, as a key technology for the green transition, are **dependent on regions outside of the EU**

Figure 18: European Wind Turbine Production

Source: BCG Analysis, BCG Publication;
i. Assuming a green premium of 0€

EXPERT
CORNER 6

Potential takeovers and relocations in the chemicals industry moving Europe away from reaching sustainability goals

In the chemicals industry, some major European players who are committed to sustainability, for example using biomass fuel, are at risk of being taken over by players in the Middle East that are less concerned about sustainability. Takeovers become more likely due to share price decreases affecting European players in recent years. A takeover would not necessarily lead to production relocations outside of Europe but would seriously impact Europe's sustainability goals.

Also in the chemicals industry, we see negative developments in the polyurethane (PUR) market. PUR has an economic value of close to €60 billion for European construction applications. This not only refers to insulating materials from rigid polyurethane foams, but also various types of building panels and other construction applications that are made from polyurethanes. PUR is also used in the furniture, automotive and footwear sectors. The polyurethane industry generates a substantial contribution to European wealth and job creation. Close to 244,000 companies throughout Europe are creating a value of €255 billion per year.[72] The production and use of polyurethane application ensures the employment of 5.1 million people throughout the EU.[73] Some European TDI (toluene diisocyanate) producers, a compound necessary for the production of PUR, have announced the closure of their plants. Due to this, an important part of the PUR value chain is lost, increasing the dependence on regions outside of Europe for important industries like construction and automotive. Therefore, achieving energy efficiency targets in the building sector would become dependent on imports.

72 European trade association for producers of aromatic diisocyanates and polyols, 2018; Including chemical producers providing basic materials to produce polyurethanes (€7 billion), producers of intermediate products or final PU based applications (€211 billion) and businesses utilising PU based products for their value creation while not ranking amongst chemical or plastics producers (€37 billion) (data for 2018)

73 European trade association for producers of aromatic diisocyanatos and polyols (data for 2018)

EXPERT CORNER 7

The automotive industry is dependent on EIIs

The automotive industry is closely integrated with multiple EII sectors, necessitating the production of steel, chemicals, glass and aluminium to produce vehicles. Automotive manufacturers are today already experiencing decreased competitiveness driven by higher prices from upstream sectors, in addition to the high investments required to decarbonise the transportation sector.

The local automotive industry cooperates closely with EIIs, for example with steel manufacturers or chemical suppliers, e.g. for coatings, plastics, etc. More and more sustainable chemicals such as PUR are used in car production, meaning chemical producers provide car manufacturers with circular materials and promote the green transition.

Additionally, when planning new car models, automotive players discuss quality control, specifications, performance and efficiency with steel producers.

Unfortunately, downstream players can be caught in international trade wars, leading to supply deficiencies that can significantly affect production or profitability. Therefore, ensuring proximity to suppliers develops reliable and efficient supply chains, while collaboration drives innovative, sustainable solutions for vehicle designers and manufacturers.

One example of collaboration between an automotive company and a steel producer is the partnership between ArcelorMittal, a prominent steel producer, and Gestamp, an automotive supplier. The main objective of this partnership is to reduce carbon emissions by producing a specialised, low-emission steel. Both companies have conducted joint testing and validation processes to ensure compliance with the technical requirements outlined by Gestamp. The collaboration primarily focuses on the development and implementation of highly innovative and specialised steel, with additional involvement from research centres.[74] This partnership showcases the mutually beneficial relationship between automotive companies and steel producers, leveraging their combined expertise and cooperation to drive technological advancements and manufacture high-quality, energy-efficient vehicles. Such collaborations hold particular significance for the production of high-margin steel products.

Another example is the cooperation between Ovako and Volvo Group. The partnership identifies synergies between green steel production and transportation with hydrogen trucks, by using the green hydrogen produced as part of Ovako's manufacturing operations to power Volvo Group's fuel cell vehicles. The aim is to look for sustainability in the whole value chain, securing a positive business case in the long-term for the steel industry and the transportation industry, while reaching an acceptable Total Cost of Ownership of the vehicles for end-users.

74 ArcelorMittal, 2023

2.2 EIIs play a crucial role in the European economy by creating jobs, boosting GDP and driving innovation

Not only are EIIs vital for their downstream industries, EIIs also contribute to prosperity in Europe as they create a significant number of jobs, boost GDP and drive innovation. Deindustrialisation of EIIs in Europe would lead to a significant reduction of jobs, a significantly lower GDP, less innovation and thus also less skills and private capital to enable decarbonisation.

Employment: EIIs are major employers. In Europe, these industries employed over 18 million people[75] in 2021, representing almost 10% of the total workforce. While direct employment is already significant, indirect employment is much larger: for example, Oxford Economics estimates direct employment of the steel industry in Europe at 320,000 workers, but the number of employees in direct, indirect and induced channels is almost 200 times larger (62 million), proving that EIIs are closely interlinked with a large number of people across Europe.[76]

Contribution to GDP: EIIs are essential to economic growth across Europe, contributing €3.2 trillion[77] to the EU's GDP in 2022. This is equal to 20% of the EU's total GDP, or the size of the entire Brazilian GDP. When considering gross value-added (GVA) by the steel industry, its impact is noteworthy. Each unit of €1 in direct GVA is accompanied by a multiplier effect of six, thereby substantively bolstering the European economy.[78]

Innovation and Technological Advancement: European EIIs drive innovation and technological advancements. Their Research & Development (R&D) investments were ~€200 billion in 2022.[79] These substantial investments often lead to breakthroughs that benefit other sectors of the economy, spurring productivity improvements and enhancing competitiveness. A large share of the R&D spend is also used to improve the sustainability of EIIs. For example, the European cement industry was able to reduce its emissions per tonne produced by 15% since 1990 using improved thermal efficiency and alternative fuels – despite it being a very hard-to-abate sector given the level of CO_2 released during the chemical reaction of burning clinker.[80]

2.3 European EIIs are at the forefront of the green transition and contribute to global emissions reductions

When industrial production decreases in Europe and increases in regions with more lenient emissions standards, primarily driven by cost considerations, the global carbon emissions output increases. European EIIs have already decreased their GHG (greenhouse gas) emissions by almost 40% between 1990 and 2017,[81] which is why Europe has a lower emissions intensity than the rest of the world for many sectors.

The EU acknowledges that the "[...] risk of carbon leakage may be higher in certain energy-intensive industries",[82] such as aluminium, cement or steel.[83]

The European steel industry has significantly reduced its CO_2 emissions per tonne of steel produced – see Figure 19. EU steel producers emitted ~2 tonnes of CO_2[84] per produced tonne of steel back in 1990. In 2018, one tonne of steel produced only 1.2 tonnes of CO_2.

75 Oxford Economics, 2019; Sum of direct employees of energy-intensive manufacturing sectors, minerals and power industries

76 Oxford Economics, 2019

77 For EU in 2022; Source: Oxford Economics

78 Oxford Economics, 2019

79 Oxford Economics

80 See also "ERT Industry4Climate", 2024 and ERT paper "Innovation made in Europe: Setting the foundation for future competitiveness", March 2023

81 European Parliament, 2020

82 European Commission, 2023

83 European Council

84 Scope 1 CO_2 Emissions

Example steel: EU producers with significant carbon efficiency improvement

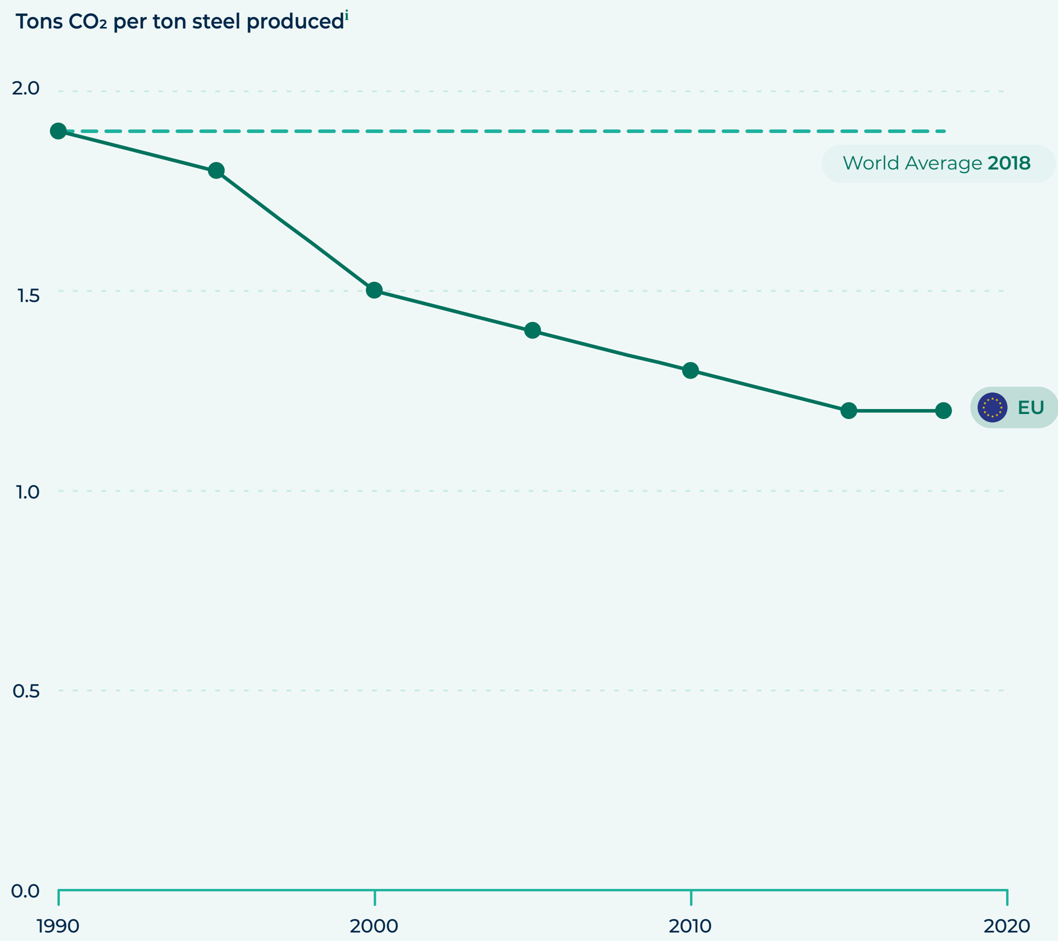


Figure 19: European steel producers become increasingly carbon-efficient

i. Scope 1 CO_2 Emissions (BOF steel)

Source: Bloomberg

A striking example for a disparity arises when comparing the main European aluminium-producing country, Norway, to China. Chinese aluminium emits ~6 times more carbon per tonne of aluminium than Norway[85] (see Figure 20). This is due to the Chinese industry's high reliance on coal as a primary source of electricity generation.[86] To illustrate the significance of the gap between European and Chinese aluminium emissions, let us consider a hypothetical scenario where Norwegian aluminium production matched the higher emission intensity of Chinese aluminium.[87] The resulting additional emissions would amount to an annual figure of ~14MtCO_2. This would increase emissions from the entire country of Norway by almost 50%.

These figures show that the preservation of EIIs within Europe is crucial to ensure the implementation of robust emissions controls. In essence, retaining EIIs within Europe serves as a safeguard to enforce stricter emission standards, mitigating the escalation of global carbon emissions.

85 A&L, 2020

86 Yang, M., 2021

87 Comtrade, BCG analysis

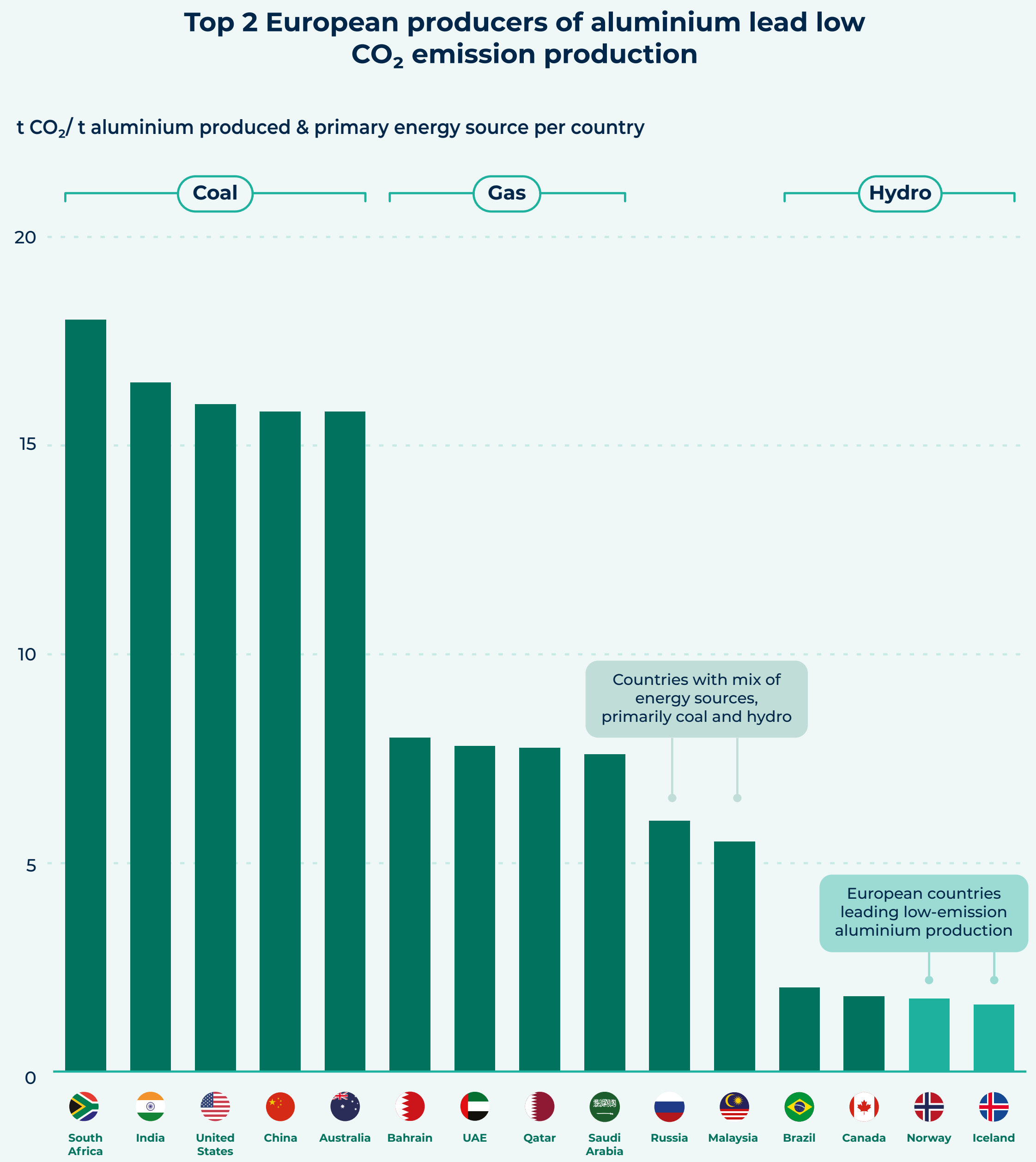


Figure 20: CO_2 emissions per t aluminium production

Source: CRU taken from 'Demand for Green Aluminium Is Growing Worldwide' A&L Feb 2020

European countries that are characterised by a high intensity of trade with third (non-EU) countries, as well as a high intensity of direct and indirect emissions to the GVA they produce, are especially affected by the risk of carbon leakage. Greece's cement industry, for example, has a trade intensity index of 25% compared to the European average of 7%. This means that the risk for carbon leakage is increased,[88] as acknowledged by the European Commission based on their carbon leakage indicator methodology.[89]

88 Foundation for Economic and Industrial Research, 2022

89 EC Impact assessment on the review of the ETS Directive, 2021

2.4 EIIs are vital for preserving the EU's Open Strategic Autonomy and ensuring supply security

"EU strategic autonomy (EU-SA) refers to the capacity of the EU to act autonomously – that is, without being dependent on other countries – in strategically important policy areas. These can range from defence policy to the economy, and the capacity to uphold democratic values. [...] The shock of Russia's invasion of Ukraine brought the debate back to hard realities and the need to react with concrete, practical action."[90] EIIs are crucial for preserving the Open Strategic Autonomy the EU is referring to.

In its classification of dependencies, the EU has classified steel, aluminium and a variety of (chemical) products[91] as part of the energy-intensive ecosystem.[92] Additional offshoring of EIIs would lead to an increased dependency on critical materials, endangering the autonomy of the continent. If downstream companies were reliant mainly on imports, they might be de-prioritised in times of conflict or political instability. In essence, keeping EIIs within Europe decreases the dependency on countries such as China, Vietnam or Brazil, which are the three main import countries for the EU in terms of dependent resources.[93]

This is especially relevant for the agriculture and food processing industry, as EIIs provide fertilisers, pesticides and energy inputs for food production. The availability of these inputs is crucial for sustaining Europe's strategic autonomy in ensuring food security. In 2022, due to high gas prices, European ammonia production was curtailed (see Figure 10) and over half of the continent's consumption had to be covered by imports. In contrast, China is self-sufficient in phosphatic fertilisers[94] and even imposed restrictions on their exports that same year to keep domestic prices down.

90 EU Strategic Autonomy Monitor, European Parliament, 2022 Open Strategic Autonomy: the ability to shape the new system of global economic governance and develop mutually beneficial bilateral relations, while protecting the EU from unfair and abusive practices, including to diversify and solidify global supply chains to enhance resilience to future crises; Source: European Commission

91 Beryllium, cobalt, antimony, lithium, aluminium, tungstates, chromium, nickel, molybdenum, 24 manganese, ferro-alloys, steel, 40 various chemical products; Source: European Commission, 2021

92 European Commission, 2021

93 European Commission

94 OEC, 2023

3. We propose regulatory changes to create a positive business case to accelerate the green transition at scale

Chapter 2 highlighted the essential role EIIs play in shaping and sustaining Europe's economic prosperity. Moreover, it showed the potential consequences that could stem from the reduction of these industries, with implications for downstream sectors and the risk posed to Europe meeting its green transition objectives.

The European Commission has a historic opportunity right now to take action to protect European prosperity for generations to come. This requires a commitment to nurturing and empowering the European industrial sector.

We must acknowledge that the existing regulatory framework was formulated in a markedly different context, one that predates the onset of the COVID-19 pandemic and the escalation of geopolitical events such as the Russian invasion of Ukraine. Consequently, there is an urgent need to update the regulatory landscape so that it can effectively respond to an evolving range of challenges and opportunities.

To ensure the viability of EIIs in Europe and allow them to keep their commitments towards becoming carbon-neutral, ERT proposes regulatory changes in the following three key areas:

1. Ensuring the availability and affordability of low carbon energy and Carbon Capture, Utilisation and Storage (CCUS)
2. Increasing financial attractiveness of decarbonisation
3. Creating a level playing field vs international competition

Regulation for a positive business case of the green transition

Ensure availability and affordability of low carbon energy & CCUS

Ensure availability and affordability of low carbon energy & CCUS

- **A.I** Accelerate permitting and enhance private investment
- **A.II** Adjust market design to match future energy portfolio
- **A. III** Think and plan pan-European

Increase financial attractiveness of decarbonisation for industry

Reduce uncertainties of investment business cases

- **B.I** Increase simplicity and consistency of subsidy allocation
- **B.II** Incentivise innovative technologies which do not yet have a positivebusiness case
- **B.III** Ensure further simplification of permitting process

Create demand for low carbon products

- **B.IV** Increase transparency for customers by communicating PCFs for all products
- **B.V** Establish stable low carbon demand via public procurement
- **B.VI** Incentivise demand for low carbon products

Create a level playing field vs international competition

Shape the CBAM to make it an effective policy

- **C.I** Perform deep effectiveness review before expansion
- **C.II** Diminish risk of import loopholes
- **C.III** Maintain export competitiveness

Optimise global partnerships

- **C.IV** Further prioritise secure and diverse supply chains, e.g. in public procurement
- **C.V** Promote fair competition on trade under the WTO framework and enhance partnerships
- **C.VI** Take a leadership role in orchestrating coordinated global climate action

Figure 21: Overview of policy recommendations

3.1 Ensure availability and affordability of low carbon energy and CCUS

The EU has the potential to set Europe on a pathway towards available and affordable low carbon energy, including low carbon hydrogen, electricity and biofuels, and efficient carbon cycle management.

Jean-Pierre Clamadieu
Chairman, ENGIE

"Let's unite as European industry to bring the 'Fit for 55' framework to its successful conclusion, and from there, let's shift our attention and devote all our energy to accelerate its implementation."

Hilde Merete Aasheim
President & CEO, Norsk Hydro

"The main enabler for sustaining the competitiveness of aluminium is affordable, renewable energy. Even in Norway, where we have had renewable energy for decades, we foresee a much tighter electricity market going forward, as other industries and society at large are also decarbonising. The only viable solution for European electro-intensive industry is to further develop collaboration with renewables producers through long-term PPAs (Power Purchase Agreements) at affordable prices and contribute to new renewable power being built. Only this way can we remain competitive and drive both decarbonisation and economic development in Europe."

Jakob Stausholm
CEO, Rio Tinto

"The electrification of the society is one of the most important levers to achieve the European decarbonisation targets. Therefore, providing competitively priced renewable electricity is the key in defending the competitiveness of the European EIIs. There will be little space for manufacturing in societies without a stable grid with sufficient supply of renewables."

Aditya Mittal
CEO, ArcelorMittal

"In Europe, the steel industry has the most ambitious decarbonisation programme of any energy-intensive industry. With these ambitions come certain requirements. We cannot escape the fact that to make low carbon-emissions steel in an internationally competitive way, we need vast amounts of affordable renewable energy. At ArcelorMittal Europe, we partner with energy producers through renewable energy power purchase agreements, but until the issue of energy pricing is addressed – meaning a restoration of the relationship between the cost of producing energy and the price of energy – our decarbonisation programme can never achieve its full potential."

This can be achieved by implementing policy recommendations across three key areas:

1. **Accelerate permitting and enhance private investment:** Accelerating permitting processes is crucial because this is essential in areas requiring new construction or significant modifications of infrastructure. It is particularly important in permitting power grids, which are vital for addressing massive investment needs and reaching climate targets. Additionally, there is a need to expedite permitting of natural gas grids, to support the transition to decentralised and digitalised grids based on renewables, while fostering collaboration between public and private stakeholders in the energy sector.

2. **Adjust market design to match future energy portfolio:** Adjusting market design will address the issue of volatile and high energy prices, enhancing the EU's competitiveness while incentivising the substantial investments required for decarbonised production capacities, security of supply, and efficient energy integration. This is especially important as the use of renewables grows and balancing a weather-dependent renewables system becomes increasingly crucial.

3. **Think and plan pan-European:** Thinking and planning pan-European is crucial because it enables the establishment of a single Energy Union with a unified market, streamlined permitting and tax systems and providing a consistent regulatory framework. This fosters investment and addresses short- and long-term energy transition challenges, while maintaining cohesiveness in the Single Market and enhancing cross-border cooperation.

The ERT publication 'Strengthening the European Energy Infrastructure' expands on these aspects and includes further qualitative and quantitative analysis regarding what is needed to ensure a reliable supply of affordable, low carbon energy.

3.2 Increase financial attractiveness of decarbonisation for industry

European EIIs have set aggressive targets to decarbonise their operations. These often go beyond the net-zero goals set by regulators. As shown previously, significant investment will be necessary to accomplish these targets.

Currently, investment in decarbonising EIIs does not make an attractive business case as, a) the operational costs of low-carbon production are uncertain and likely higher in Europe than in other key regions (see chapter 1.2), and b) real demand for green products remains unclear (see chapter 1.1).

To address these current challenges and increase financial investment in decarbonisation in Europe, we propose regulatory changes across two key areas:

Wael Sawan
CEO, Shell

"Shell aims to be a strong partner in the energy transition. We are investing in flagship projects to advance the decarbonisation of industry and transport, while helping secure today's energy needs. To accelerate decarbonisation at the scale required to deliver the Green Deal, we need business models for profitable clean energy investments. This requires an effective implementation of the 'Fit for 55' package that maximises the value of incentives and ongoing dialogue with industry to improve the competitive environment for the green transition in the EU."

1. Reducing uncertainties of investment business cases

2. Creating demand for low-carbon products

3.2.1 Reduce uncertainties of investment business cases

3.2.1.1 Objectives of regulatory changes proposed

To attract the investments necessary for achieving the decarbonisation of EIIs, there needs to be a positive business case for investing in green technologies in the EU. When compared to other regions, Europe must position itself as an attractive location for (global) companies deciding where to place their green investments, both in terms of business case attractiveness (return on investment) and economic certainty.

3.2.1.2 Comparison with other countries

This section focuses on a comparison of the US's Inflation Reduction Act (IRA) with the EU's Green Deal Industrial Plan (GDIP) that was released on 1 February 2023, regarding the three aspects of financial strength, ease of access and effectiveness.

Financial strength: **Both policies provide significant funding**

Through the IRA, the US has created a very favourable investment environment using OpEx tax credits for green technologies.[95] The EU Green Deal Industrial Plan (GDIP) announced a package of proposals designed to accelerate decarbonisation and attract global green investment. The GDIP builds on established climate policy frameworks (including the Emissions Trading System (ETS), 'Fit for 55' and 'REPowerEU') and touches upon regulation, finance, skills and trade – as well as targeted changes to State aid rules (through the Temporary Crisis and Transition Framework, (TCTF)) and repurposing existing funds to support green investment. The total public funding allocated for EU net-zero policy for 2021-2030 is €548 billion.[96] The IRA combined with the IIJA provides $479 billion[97] (IRA $369 billion and IIJA $110 billion) with the potential to increase significantly due to its tax breaks being uncapped.

Ease-of-access: **The IRA uses a simpler, easy-to-access approach than the GDIP**

When it comes to the accessibility of funds, the divergent approaches of the IRA and GDIP highlight some disadvantages in the EU's set up:

- The IRA is simple, universal, and OpEx focused; the US's offer is simpler than the EU's. For example, the US provides clear and certain uncapped tax credits for CO_2 removal and sequestration.[98] This allows companies to plan and calculate their business cases with certainty. If all the necessary conditions are met, IRA support is granted. The GDIP does not currently match the predictability and simplicity of the IRA.

- The GDIP (and in particular the TCTF) is complex, fragmented, and CapEx focused. The EU has taken a different approach to the US; its ETS and carbon pricing policies are more complex. The revenue from the EU's ETS is allocated directly to the Member States and not to the central budget of the EU, which makes a coordinated spending on clean technologies difficult. The EU generally focuses on investment subsidies (CapEx) rather than production support (OpEx), which requires a case-by-case analysis of investment projects and costs, alongside using more complex, auction-based (and usually capped) mechanisms. In many cases, the amount of funds that will be granted remains unclear until the end of a project's lifetime, making investment decisions of higher risk than in the US. Europe's decentralised nature further increases the complexity, as available financing is mostly delivered by EU Member States through national and regional authorities via various processes and mechanisms. This reduces the ease and certainty of accessing funds. For example, within the Innovation Fund only a certain number of projects or businesses end up receiving financial support, even if many more have met the required conditions (and have spent time and resources completing the application process) – see Figure 24 in the appendix for additional detail.

Effectiveness: **IRA had an impressive start**

The IRA is already implemented while the GDIP still requires agreement and national legislation before the impact can be realised. So far, the IRA has had a strong impact, with $129 billion private

95 Forbes, 2023

96 European Commission, BCG analysis; Sources of public funding earmarked for the EU net-zero policy 2021 – 2030: €376 billion 'REPowerEU', excluding €225 new RRF loans; €8 billion 'InvestEU', only funding ear marked for clean tech included; €38 billion Innovation Fund; €14 billion Horizon Europe & Euratom; €48 billion Modernisation fund; €2 billion LIFE Programme; €62billion Social climate fund

97 US Environmental Protection Agency, US Congressional Budget Office

98 Section 45Q of the Internal Revenue Code, e.g. $85 tax credit for each ton of CO_2 captured via CCUS funding triggered by the legislation since it entered into application on 1 January 2023 – see Figure 25 in the appendix for additional detail.

To narrow the gap between the US's business case and investment attractiveness and Europe's, the below policy recommendations are proposed.

3.2.1.3 Our regulatory proposals

Increase simplicity and consistency of subsidy allocation (B.I)

A simpler and more consistent State aid process allows the EU to offer favourable investment conditions more closely aligned with those offered elsewhere (such as in the US). In comparison to the IRA, the GDIP is complex, fragmented and CapEx focused (see 3.2.1.1 Objectives of regulatory changes proposed). Currently, companies with multiple sites across the EU must negotiate with a range of different national and regional authorities, which can sometimes take inconsistent approaches. An accelerated, simplified and more definite subsidy allocation process increases the attractiveness of private-sector investments in Europe.

The focus must be on simplification and consistency and not an increase in subsidy volume.

ERT RECOMMENDATIONS:

1. **Simplify subsidy allocation system by introducing more EU-level support:** Consider a wider use of EU-level incentive allocation mechanisms. Funds from the ETS are already earmarked for the Innovation Fund, but additional funds can be potentially earmarked. The European Hydrogen Bank (EHB) and the forthcoming EU-wide hydrogen auctions are a positive development; this approach could be extended to other technologies, including other forms of hydrogen production. The current volume of the EHB is not sufficient to cover the wide range of EIIs which will require further investment. Additionally, the EHB can focus on providing support for EIIs, as they have significant CO_2 reduction potential and need low-carbon hydrogen. More information on subsequent rounds of auctions will aid forward planning within European industry. If schemes such as the EHB cannot provide the necessary amount of low-carbon hydrogen for EIIs to fulfil their green transition steps, transition technologies, e.g. H_2 (beyond low-carbon) or gas, are necessary.

2. **Ensure consistency across subsidies on a pan-European level:** Subsidy allocations require a simplified, consistent, EU-wide approach across their mechanisms, in particular for Carbon Contracts for Difference (CCfDs). This is outlined in the Expert Corner below.

Incentivise innovative technologies which do not yet have a positive business case (B.II)

The development of new, low-carbon technologies, such as CCUS, carbon removal technologies (e.g. Direct Air Capture), tends to have a high level of risk involved due to the technological uncertainty for set-up and operations. This makes them often unappealing for private investors. EU support for the investment/development phase of such new technologies, especially at the early stages, will reduce risks and thereby enable the green transition. The EU is already implementing several important initiatives to reduce risks. While this is on the right path, we recommend expanding further on existing measures.

SIEMENS

Jim Hagemann Snabe
Chairman, Siemens

"We need to choose if we want to protect the technologies of the past or accelerate the technologies of the future. The stone age didn't end because we ran out of stones. Likewise, the age of fossil fuels won't end because we run out of oil and coal – but because better technologies were invented. Hence, we should not make policies to make the 'stone makers' happy, but to enable them to switch to and scale up the next technology."

ERT RECOMMENDATIONS:

1. **Improve the framework for low-carbon financing and investment:** Improve the European taxonomy on sustainable finance, as it could provide clarity and transparency about what constitutes sustainable economic activities, particularly regarding climate change mitigation and environmental protection. When updating the existing taxonomy, ambiguities in how to meet criteria need to be minimised to reduce implementation complexity and increase comparability across companies. Additionally, clear frameworks on how to deal with the incorporation of low-carbon technology in production processes are necessary. A clear taxonomy could support the provision of cheaper funds for investments in low-carbon purchases. In turn, investments in low-carbon activities become more attractive long-term. The necessary requirements for reaching the status of low carbon need to be continuously increased to incentivise organisations continuously to reduce CO_2 emissions per product or service.

2. **Enhance Research & Development (R&D) incentives:** Build on existing set-ups, e.g. Horizon Europe or Innovation Fund, to increase funding for R&D initiatives focused on low-carbon technologies. Offer tax incentives, grants and collaboration opportunities for businesses and research institutions engaged in cutting-edge R&D.

3. **Encourage public-private partnerships:** Extend existing offerings to facilitate collaborations between public and private sectors, to share risks and resources in developing and deploying low-carbon technologies. Establish joint investment initiatives that leverage both public and private capital.

In addition to existing support, ERT recommends adding one extra measure:

4. **Guarantees:** Offer financial guarantees (debt to be repaid if borrower defaults) to incentivise private sector investments in innovative low-carbon technologies. This will help reduce the financial risks associated with these projects, making them more attractive to investors. In turn, financing for low-carbon technologies will become less costly, meaning more companies will be incentivised to take the leap into low-carbon technology development.

EXPERT
CORNER 8

Carbon Contracts for Difference as an opportunity for the EU

Carbon Contracts for Difference (CCfDs) are innovative mechanisms to incentivise industries to reduce emissions and promote a cleaner environment. An initial application of the concept is currently developed and implemented in Germany, France, and The Netherlands. These mechanisms play a vital role in supporting innovative technologies which don't have a positive business case yet. They financially compensate the industry for additional costs to convert their production methods to become low carbon. A CCfD is an auction-based mechanism to select the most cost-effective projects to save carbon emissions.

In the German scheme, CCfDs support industrial projects to reduce emissions, particularly within EIIs operating under the ETS. According to the CCfD concept, EIIs will be compensated by climate protection agreements for a period of 15 years to cover the additional costs (OpEx and CapEx) to convert their production.[99] In a CCfD, a pre-agreed carbon price serves as an incentive for achieving emission reductions compared to conventional technologies over a specified timeframe. If the market's carbon price falls below this pre-set level, the agent receives additional payments from the government, ensuring a stable carbon price signal. This, in turn, reduces financing costs and risks associated with zero-emission investments, making green technologies more attractive for early adopters.

Key advantages of CCfDs include that they reduce the risk associated with innovative investments (on OpEx and CapEx), while the auction mechanism encourages the most cost-efficient path to carbon reduction from a societal perspective.

However, it is important to acknowledge the complexities of CCfDs. The calculation and application process for CCfDs can be data-intensive and occasionally unclear. The application process can also be lengthy and uncertain, and comprehensive monitoring and documentation are essential.

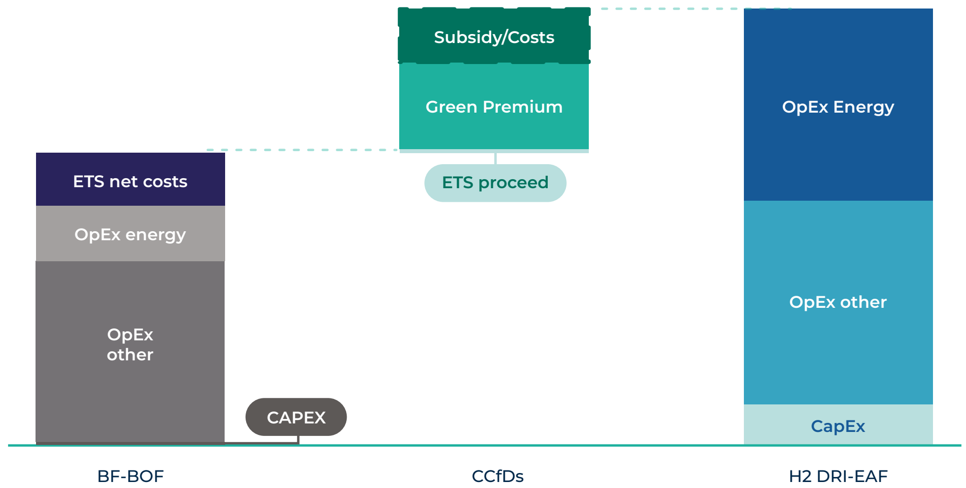
In conclusion, CCfDs are a valuable tool for promoting sustainable practices and supporting green investments. However, addressing their complications, including creating a pan-European framework, minimising the complexity and maximising the predictability of the application process, is crucial to reap their benefits within the EU. As CCfDs are currently only implemented in a few countries, the EU can support knowledge sharing from these countries' CCfD experiences.

99 International Energy Agency, 2023

CCfD funding mechanism: Filling cost gap of ‘green’ vs ‘grey’ tech

Funding logic of CCfDs

Exemplary illustration for grey (BF-BOF) vs green (H2 DRI-EAF) steel



Explanation:
Carbon Contracts for Difference [CCfDs]

Scope

Targeted instrument addressing supply side[ii]

- Energy-intensive industries[iv]
- Large assets (>10kt CO_2 emissions p.a.)
- 'Green' tech-90% GHGi reduction vs 'grey'
- Local content required[iii]
- CapEx & OpEx

Budget

Two-digit billion subsidy volumes in total expected

Mechamism

- 15-year dynamic subsidies to close delta costs of 'Green' tech-90% GHGi reduction vs 'grey' tech
- Competitive tendering across industries, aiming for targeted distribution of funds

Figure 22: CCfD funding mechanism (example Germany)

i. ETS proceeds yet to be finalised, might vary depending on proposal to cover DRI plants by the former hot metal benchmark in ETS phase IV period 2 (2026-2030) as part of EU regulation on ETS free allowances

ii. Main steel customers like automotive and their consumers are willing to pay a green premium of €300-400/t according to recent surveys

iii. Following CCfD regulation subtraction potentially possible, to be decided by regulating authority; KSV [climate protection contracts, i.e. 'Klimaschutzverträge']

Source: German Government; Steel customer survey; Aurora; BCG Analysis

Ensure further simplification of permitting process (B.III)

The proposed Net-Zero Industry Act (NZIA), as part of the EU's GDIP, aims to improve conditions to drive net-zero technology manufacturing investments, such as addressing the challenges of securing the necessary permits. While the inclusion of accelerated timelines and the requirement to establish a national-level permitting 'one-stop-shop' are welcome, the proposal could be even more ambitious.

ERT RECOMMENDATIONS:

1. **Streamline regulatory processes:** Simplify and expedite regulatory approval processes (at EU and Member State level) for all renewable energy and decarbonisation projects. Potentially mimic some of US's IRA set-up to increase ease-of-access for European companies.

2. **Extending faster permitting for other decarbonisation investments:** The NZIA limits maximum timelines to 12 or 18 months for specific investments related to manufacturing net-zero technologies. Other investments (such as decarbonising existing manufacturing facilities) would also benefit from such an approach, as permitting issues often delay such projects.

3. **Bundling permitting, including approvals, in the pan-European 'one-stop-shop':** Ensure the proposed one-stop-shop functions effectively, with the European Commission providing the necessary support for national authorities where needed.

4. **Streamlining/decreasing bureaucratic hurdles via 'presumption of approval':** Consider further ways of streamlining the approvals process for net-zero investments. One option might be a 'presumption of approval' for such projects, with the expectation being that the national and regional authorities will approve such investments unless there is an overwhelming reason not to do so.

5. **Permitting for cluster development:** Simplification of permitting supports the development of clusters. Net Zero Industry Valleys, as designated industrial clusters for the manufacturing and use of net-zero technologies, benefit from dedicated support from authorities. Member States carrying out Strategic Environmental Impact Assessments for Net Zero Industry Valleys, with outcomes applicable to all proponents, accelerate the permitting process – provided the assessments are well designed in consultation with industry and society.

3.2.2 Create demand for low carbon products

3.2.2.1 Objectives of regulatory changes proposed

Creating demand for low carbon products is necessary for the success of the green transition. An increase in demand leads to an improved business case, which attracts much needed investment to attain net-zero goals.

By fostering demand for such products, we do not only reduce greenhouse gas emissions but also stimulate innovation, job creation and economic growth. A shift towards low carbon products also encourages businesses to adopt low carbon practices, invest in renewable energy sources and reduce their carbon footprint.

3.2.2.2 Comparison with other countries

Incentivising demand for low carbon products is still in its early phases across the globe. Examples can be seen in:

- **Building codes:** China and Japan have triggered green demand in the construction sector where they have introduced new building codes. China's General Code for Building Energy Efficiency and Renewable Energy Utilisation requires all new, expanded or renovated buildings to be energy efficient. Japan's revision of its buildings regulations in 2022 requires a zero-energy performance for all new buildings by 2030, and for all existing buildings by 2050.[100] Building codes are also already in place in the EU, e.g. in France buildings need to comply with $kgCO_2e/m^2$ for new constructions that continuously become more stringent (2022-2024: 640 $kgCO_2e/m^2$ à 2031 and beyond: 415 $kgCO_2e/m^2$).[101] Ideally, the EU should strive towards a harmonisation of such building codes.

- **VAT reduction:** Norway for example, exempts zero-emission vehicles from a 25% VAT, which in turn decreases the initial vehicle costs by a considerable margin.[102] This driver (among others) led to ~80% of new vehicle purchases in 2022 being EVs (electric vehicles).[103] With its Climate Action Programme 2030, the German government introduces a VAT reduction on long-distance rail travel (as a low-carbon alternative to planes and/or cars) from 19% to 7%, and therefore focuses on creating demand for greener public transport.[104] These examples prove that VAT reductions serve as a successful incentivisation tool that is becoming more widespread.

- **Low-carbon steel lead markets:** In Germany, the steel sector has adopted a methodology and detailed rule book to develop low carbon steel, which can be the basis for lead markets in this context. This can be copied in other countries and at a European level.

3.2.2.3 Our regulatory proposals

Increase transparency for customers by communicating product carbon footprints for all products (B.IV)

The EU can build a framework that is based on technology neutrality ('no discrimination towards the use of a particular technology') and product lifecycle performance ('CO_2 emissions during entire lifespan of a product'). To support customers in making the right decision, product carbon footprints (PCFs) are a potential tool. They provide customers with clarity on which products are low-carbon and which ones aren't.

Measuring the carbon footprint of all products is important for three reasons:

1. Firstly, the carbon footprint plays a pivotal role in elevating consumer awareness and fostering informed choices, mirroring the efficacy of energy information on food packaging in guiding dietary decisions. By affording consumers access to this critical environmental data, we empower them to make purchasing decisions that align with their ecological values, thereby driving demand for sustainable products and practices in the marketplace.

2. Secondly, the imperative to measure product carbon footprints extends beyond the consumer realm. It serves as a potent incentive for businesses to scrutinise their production processes rigorously and implement sustainable strategies. The transparency it engenders does not only enhance a company's reputation as an eco-conscious entity, but also compels them to reduce their overall environmental impact, thus contributing to the broader sustainability agenda.

3. Thirdly, adopting a comprehensive approach to measuring product carbon footprints reinforces our collective commitment to environmental stewardship. It fosters a society-wide awareness of the environmental consequences of our consumption habits and production processes. This, in turn, prompts individuals, corporations and policymakers to take concerted action toward minimising carbon emissions and mitigating climate change.

ERT RECOMMENDATIONS:

1. **Introduction of low carbon product standards with the use of PCFs:** PCFs can be introduced for all products long-term. The EU can support businesses in measuring their PCF through the

100 International Energy Agency, 2023

101 Bourgeon, F. and Giddings, J., 2021

102 The International Council on Green Transportation, 2018

103 Danylov, O., (2023)

104 German Federal Ministry of Finance (Bundesfinanzministerium), 2023 development of standardised methodologies based on recognised international standards such as ISO 14067. The measuring and publication of PCFs is encouraged, as well as the possibility of making these obligatory in the long-term.

2. **Support digitally-available PCFs:** The proposal of the European Commission to establish a Digital Product Passport is positive, as it supports the development of digital solutions for tracking purposes and reducing the environmental footprint of products. Digitally-available PCFs should be further supported, as they can facilitate the collection of data along the supply chain, additionally being more accurate and dynamic (traditional PCFs use average methodology to calculate PCFs, which is more static).

Establish stable low carbon demand via public procurement (B.V)

Purchases by the EU, national and local governments account for approximately 14% of the EU's GDP. To push the development of green technologies and products, which in turn will increase demand for more low-carbon products, public procurement can be used strategically. To date, most procurement is done by Member States – although often using EU-allocated funds (such as the Cohesion Fund). Pre-requisites for green public procurement include following a product standard framework and building codes.

The European Commission has encouraged low-carbon public procurement on a voluntary basis, including through developing low-carbon criteria for a range of products such as textiles and road construction. More could be achieved, such as by extending the range of product standards containing mandatory circular criteria, as seen in the recent agreement on the EU Battery Passport and current discussions on the Ecodesign for Sustainable Products Regulation. Where Green Public Procurement (GPP) criteria exist, there can be a presumption that these are used where EU funds are being spent. For example, when a new bridge is built, low-carbon cement would be set as a requirement for choosing contractors (while still ensuring low-cost options).

The EU aims to introduce a building code with the forthcoming adoption of EN 197-6 (which will allow the use of up to 35% recycled concrete fines in cement). However, this will be a non-harmonised approach, as each Member State will have to develop its own testing methods to implement this at a national level, which hampers effectiveness, speed of deployment and cross-country optimisation.

ERT RECOMMENDATIONS:

1. **Product standard framework and building codes:** Set up a product standard framework and building codes on a pan-European level. An example of how updating building codes can advance the green transition is Holcim Switzerland's development of Susteno cement. Switzerland adapted their building code (with the SIA Code of Practice 2049) to allow the use of new types of mineral components in cements. This was key to giving stakeholders certainty that the new type of cement is safe, appropriately regulated, and meets all quality standards. On that basis, the Holcim Group launched Susteno, the world's first cement that uses fine mixed rubble from demolished buildings as a component (20%), decreasing the CO_2 footprint.

2. **Low-carbon criteria:** Introduce mandatory low-carbon criteria for public procurement, when applying the principle of the MEAT (Most Economic Advantageous Tender) in EU public procurement directives. This can be initialised by the EU, and later become pan-European legislation for Member States.

Incentivise demand for low carbon products (B.VI)

Beyond low carbon public procurement (see above), consumer and customer demand for green products can be further accelerated. Structuring the EU market around CO_2 performance statistics allows EIIs to accelerate the deployment of low carbon and circular solutions, and to specifically promote low carbon solutions. Markets will quickly react by delivering further low-carbon solutions.

ERT RECOMMENDATIONS:

1. **Reduced VAT for low-carbon products:** Support Member States to adapt VAT structures with more favourable tax rates for low-carbon products. This would balance the current significantly higher costs for green products, e.g. green cement is ~€30/t[105] (+~20%[106]) more expensive than regular cement; the difference (in addition to other low-carbon products) would be too high for many customers, e.g. private house builders. A reduced VAT could facilitate that decision by decreasing the gap.

2. **Eco-labels and certifications:** Build on recognisable eco-labels and certifications, EU Ecolabel or EU Ecodesign, for energy-efficient appliances. This will enable consumers to identify and trust low-carbon products. It is important to continuously update the necessary requirements to achieve certain rankings or levels to incentivise companies to make products with an increasingly smaller CO_2 footprint. Otherwise, manufacturers that already have an 'A' will not be interested in improving further. For this, the Germany steel sector methodology and detailed rule book can be used as a basis to develop lead markets. This can be extended to other countries and at European level.

3.3 Create a level playing field vs international competition

The European Green Deal sets the EU a target of reducing greenhouse gas emissions by 55% by 2030 compared to 1990 levels and becoming climate-neutral by 2050. In July 2021, the European Commission made its 'Fit for 55' policy proposals to reach those goals through various measures.[107]

To achieve these goals, we need a level playing field for European EIIs to stay competitive against international players. Regulatory instruments like the Carbon Border Adjustment Mechanism (CBAM) need to be urgently rethought to create an effective policy. International trade partnerships also need to be optimised.

3.3.1 Shape the CBAM to make it an effective policy

3.3.1.1 Objectives of regulatory changes proposed

Producers of imported goods have a competitive advantage over European producers since they are not exposed to pressures from the European energy transition and decarbonisation policies (see chapter 1). This disadvantage is very explicit for sectors covered by the Emission Trading Scheme (ETS). Producers in Europe must pay a significant carbon price compared to international competitors that have lower or no carbon prices. The imbalance will intensify in the future as free allocations will phase out and the carbon price is expected to reach ~€130/tonne by 2030.[108]

The CBAM aims to address the imbalance after the phase out of the free allowances and assure that EII products from outside the EU that get imported into the EU do not have a CO_2 cost advantage versus local EU-based products.

The CBAM is therefore a key component of the EUs climate policy. The CBAM imposes fees on CO_2 emissions associated with imported products covered by the CBAM product scope. It aims at reducing the risk of carbon leakage to countries without CO_2 emissions pricing, as well as balancing CO_2 cost obligations between domestic producers and importers.

In the transitional phase from October 2023 to 2025, specific (base) products of the sectors such as electricity, steel, aluminium, cement, fertilisers and hydrogen are included in the CBAM. In this phase,

105 BCG cement cost model, August 2023

106 Global Product Prices, 2023

107 European Commission, 2023

108 See Figure 05, Eikon, IEA WEO 2022, BCG analysis direct and, for some sectors, indirect emissions will be examined. The obligation for importers is limited to reporting the emissions. Once the permanent system comes into force on 1 January 2026, importers will need to acquire CBAM certificates according to the embedded emissions of their imported products. The price of CBAM certificates will be calculated according to the price of EU ETS allowances. The phasing-out of free allowances under the EU ETS will take place in parallel with the phasing-in of the CBAM from 2026 to 2034, aiming to increase the cost of carbon emissions with a goal of continuously reducing emissions in production and making low-emission production more attractive.[109]

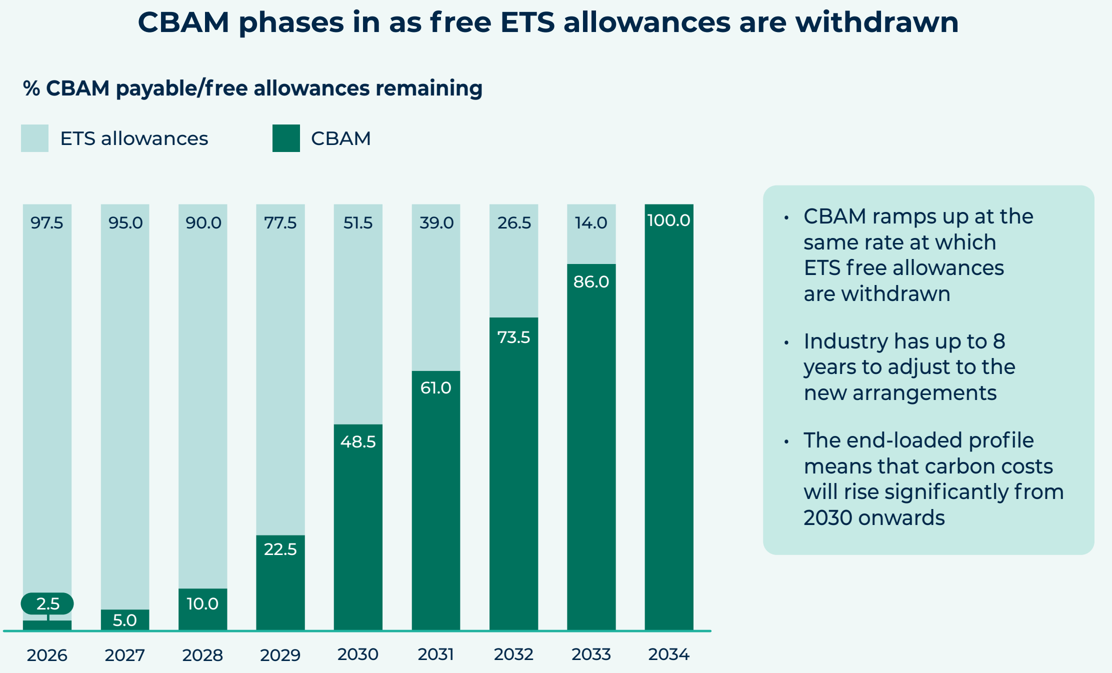


Figure 23: CBAM phases in as free ETS allowances are withdrawn

Source: BCG analysis

CBAM faces three key challenges in its current form that are yet to be solved:

- **CBAM can be too easily circumvented via import loopholes:** Global entities are already strategising to navigate the CBAM. Consider Rusal, the largest non-Chinese aluminium producer, which has adopted a 'resource reshuffling' approach to segregate its low-carbon production for exports to Europe.[110] Chinese companies also engage in this type of behaviour, as some of their smelters run on hydropower. This manoeuvre not only fails to reduce carbon emissions at a global scale – since Rusal and others may merely reclassify their production – but also places European counterparts at a substantial disadvantage, as they must account for CO_2 emissions across their entire production spectrum. Furthermore, some nations may choose to underestimate carbon emissions. Given the impracticality of the EU monitoring and verifying all production facilities outside the EU, it is possible to understate CO_2 emissions. The spectrum of potential circumvention methods is extensive. Effectively countering CBAM circumventions necessitates robust international cooperation that aligns with a common objective: a tangible reduction in CO_2 emissions. While this goal is of paramount importance, other nations may simply see a chance to put their local production at an advantage over Europe's.

109 European Commission, 2023

110 SAFE – Strategic Industrial Materials

- **Risks deindustrialisation of downstream industries:** The CBAM is currently designed to solely focus on base products, e.g. steel, aluminium (including some semi-finished products). Conversely, this means that the downstream value chains do not only lose their competitiveness in terms of exports, but also within Europe, as every third-country producer can import 'grey' products of the value chain that are not covered by CBAM. Products further downstream that require CBAM covered base products for production, e.g. car wheels, trucks, trains, cans or household products, but also chemical products stemming from the ammonia value chain like glues, coating raw materials, process chemicals, food additives, colorants, pigments, crop protection, electronic chemicals and pharmaceuticals can avoid carbon costs if they are produced abroad and then exported to Europe, as they are currently not included in the CBAM. This could lead to the inherent loss of intra-EU and global competitiveness for those products and therefore enhance the deindustrialisation of downstream manufacturing industries, where jobs and additional value arise and supply security is created.

- **Strongly reduces export competitiveness of European EIIs:** As it is currently designed, the CBAM does not offer compensation for the competitiveness of EU producers exporting to countries that have lower or no carbon prices. Currently, this means the entire rest of the world. Consequently, Europe's international trading relationships are affected, at the detriment of companies based in the EU which are export-oriented. As seen in Figure 26, the CBAM is phased in as free allowances are phased out. Following a complete implementation of the CBAM and the complete phase out of free ETS allowances, EU producers will pay carbon costs on their entire production, no matter if the products are consumed within or exported from the EU. EIIs will be unable to be cost competitive with producers from countries with low or no carbon costs. In practice, this means that the market for European industry production shrinks drastically; without exports, EIIs are likely to lose in terms of scale and competitiveness. In steel, for example, the EU exported 19.4 million tonnes in 2021, which equals 13% of the EU production of crude steel (152.6 million tonnes in 2021). A complete drop in exports would therefore imply a market shrinkage of 13%.[111]

While solutions may be found for the above challenges, the CBAM will inevitably become a policy tool that is inherently complex. The CBAM's complexity arises from the need to determine the CO_2 emissions of all production facilities exporting to Europe[112] and from covering tens of thousands of products along the value chain with direct and indirect emissions. Neither are the products covered today, nor is this data available today – neither from the EU or the production facilities themselves. Many production facilities within Europe have difficulties estimating their CO_2 emissions, as calculations are highly complex. Potential simplifications like using national averages / default values are prone to challenges from importers due to facility variations, and relying on self-reported emissions is prone to misconduct.

Aditya Mittal
CEO, ArcelorMittal

"Recently, the first phase of the EU's Carbon Border Adjustment Mechanism came into effect – a welcome step towards fair trade for steel producers. However, in its current form, we fear it is not effective enough. There are some large loopholes that can be exploited by non-EU producers operating with a higher carbon footprint. This is just one example that illustrates the intense challenges we face to produce steel competitively in Europe, today."

Pierre-André de Chalendar
Chairman of the Board of Directors, Saint-Gobain

"CBAM was designed to be WTO compatible but increased competition, especially with the introduction of IRA and growing amount of subsidies in other parts of the world, is bringing new challenges. Therefore, the current set up of CBAM with its loopholes will not be sufficient to maintain a level playing field. Europe needs to rethink its policy pathways to – at the same time – achieve its climate targets, become a true leader in the climate transition, and keep its industrial base."

111 Eurofer, 2022

112 For products included within CBAM scope

Without solving these challenges and keeping complexity low, the CBAM will become a bureaucratic burden and miss its aim of reducing CO_2 emissions. Solving the challenges requires close collaboration amongst the sectors concerned, to ensure that adequate existing standards are used (e.g. on greenhouse gas measurement, monitoring and reporting), digital tools are used to their full potential and all potential circumvention routes are effectively closed. This process is fundamental to ensuring that local European production and exporters to Europe are affected similarly by CO_2 costs. The objective must be to shape the CBAM in a manner that it can become an effective and protecting tool from its transitional phase onwards.

3.3.1.2 Comparison with other countries

When looking at the EU's CBAM, a comparison with other countries only makes sense for countries that have an Emissions Trading System (ETS). China has an ETS which covers power generation. Carbon pricing has played a very limited role, with China's carbon price estimated to be about ten times lower than the current EU ETS price.[113] More importantly, as China's ETS applies to power plants that act in a highly local environment and are not threatened by imports, there is no need for CBAM-like measures.

Other important EU trade partners, such as the US and Canada, are exploring mechanisms to put fees on carbon embedded in imports. Proposals have included a wide range of measures, from a simple tariff on carbon-intensive products to establishing a carbon price and a CBAM-like mechanism, but there are no specific details yet.

3.3.1.3 Our regulatory proposals

To make the CBAM an effective instrument and create a level playing field against international competition, we propose the following four actions:

Perform a deep effectiveness review before expansion (C.I)

Conducting the planned in-depth effectiveness review before proposing any possible expansion of the CBAM scope in 2026 is absolutely crucial to ensure the policy's efficiency and address potential shortcomings before broader implementation. However, the review needs to go beyond a simple check, and be conducted in close cooperation with European industry to provide differentiated assessment on the impact across sectors. If the review shows that additional time is required for adaptation, a pacing of the ETS free allowance phase out needs to be considered.

ERT RECOMMENDATIONS:

1. **Detailed review of CBAM effectiveness:** Use the transition phase to review the functioning of the CBAM before making decisions on CBAM expansion. This must be done in collaboration with European industry, including EIIs, so that no companies nor sectors within Europe will be affected unfairly. Specifically, the review should address the identified key challenges while making sure that the overall complexity of the regulation is minimised:

   - **Import loopholes:** Ensure that import loopholes are closed (see C.II for further information).

   - **Export competitiveness:** Ensure that European EIIs are not put at a significant disadvantage compared to their international counterparts (see C.III for more information).

   - **Administrative simplification:** Identify potential bureaucratic hurdles that make the introduction of the CBAM impossible due to the high level of complexity. While the previous points are important, ensuring simplification is key to making the CBAM a success.

2. **Moving CBAM into implementation, beyond the current pilot phase, should be dependent on results from the deep review planned for 2025:** If the detailed review shows that additional time is required to counteract identified challenges of the mechanism, as highlighted also in

113 Agora Energiewende, 2022

this document, a pacing of the ETS free allowance phase out needs to be considered. Indeed, if shortcomings remain, the introduction of the CBAM, and thereby the withdrawal of ETS free allowances, should not be rushed, to avoid the adverse side effects. The reduction of ETS free allowances may still be prolonged, to avoid unnecessarily damaging European industry with an instrument that is not yet comprehensively mature for implementation.

Diminish risk of import loopholes (C.II)

As it is currently designed, the CBAM has potential loopholes for CO_2-heavy imports. One example is a resource shuffle where players exporting products to Europe can simply split off their lower-carbon production from higher-carbon assets. In this way, they continue exporting to Europe using their lower-carbon production without having to reduce any of their emissions. Movements like this can already be seen at the largest non-Chinese aluminium giant, Rusal.[114]

Another example is misleading circular legislation: the CBAM assigns zero embedded carbon emissions and costs to imported aluminium based on remelted aluminium scrap. Unfortunately, this applies to both end-of-life scrap that has been recycled (such as old cans, window frames and car parts), and industrial process scrap. Treating these two types of aluminium scrap the same creates a loophole in the CBAM and reduces incentives for true circularity. It means that imported aluminium based on remelted industrial scrap avoids paying for the emissions of making the aluminium. European primary aluminium producers, on the other hand, must pay for these carbon emissions through the EU-ETS. The CBAM therefore creates a direct disadvantage for European production of aluminium.[115] It also incentivises the deliberate creation of large amounts of additional industrial aluminium scrap outside Europe, for the sole purpose of remelting it and importing it into the EU, thereby circumventing the CBAM. Considering that more than 25% of all aluminium at some point becomes industrial scrap somewhere in the value chain, that practically all this scrap is remelted and reused, and that the global volume of aluminium re-melted industrial scrap far exceeds the EU's aluminium demand, this loophole risks undermining the whole purpose of the CBAM.[116] It also allows for large scale greenwashing of carbon intensive imports, while undermining EU efforts regarding increased circularity for end-of-life products and scrap. Potential solutions could involve assigning the same embedded emissions to re-melted industrial scrap as for primary aluminium, and zero emissions only to remelted end-of-life aluminium scrap.

Hilde Merete Aasheim
President and CEO, Norsk Hydro

"This loophole [selling remelted offcuts of aluminium as zero carbon products] enables the widespread greenwashing of imported aluminium products and undermines the effectiveness of the CBAM in preventing carbon leakage."

ERT RECOMMENDATIONS:

We propose to adapt the CBAM to minimise the risk for potential loopholes.

- **Methodology:** The methodology on which and how emissions are calculated needs to be defined as soon as possible to make the CBAM an effective tool from the beginning. It is important to find an approach that equals the carbon cost burden of imported products with those produced in Europe, including coming up with a robust method for calculating scrap emissions. One key lever to ensure a working methodology is digitisation (see Expert Corner 9 on digitisation). It may be used especially in the following three areas:
- **Emission calculation:** A software solution that can calculate carbon emissions according to the

114 SAFE – Strategic Industrial Materials, 2023

115 Norsk Hydro, 2023

116 Cullen, J. and Ellwood, J., 2013

EU's approved methodology and allow each company in the value chain to securely upload their respective information. The software then could calculate the CO_2 emissions of the imported product and determine the number of CBAM certificates the importer is obligated to acquire. Besides the timely development of an effective, thorough, and uniform EU methodology, advancing digital infrastructure and supporting the development of efficient software is crucial to make the CBAM an effective tool.

- **Monitoring and evaluation:** Simplify the monitoring, reporting and verification process for importers and third country producers by allowing greater use of tech-based solutions, avoiding duplication by linking to existing supply chain management and enterprise systems.

- **Default levy:** Set up a significant default levy to counteract potential circumvention of the CBAM for carbon-intensive imports.

Maintain export competitiveness (C.III)

As presently structured, the CBAM fails to ensure the competitiveness of European EIIs, both export competitiveness as well as intra-EU competitiveness, vs players based in countries with lower or non-existent carbon prices. Consequently, this situation poses a threat to the EU's international trade relationships. The current CBAM is introduced gradually as free allowances are phased out, ultimately resulting in EU producers bearing carbon costs for their entire production, regardless of whether the good is covered by a CBAM or not and whether the goods are destined for consumption within the EU or exportation. This scenario may render EIIs in Europe unable to compete effectively against producers from nations with minimal or no carbon-related expenses and could lead to the inherent loss of intra-EU as well as global competitiveness and therefore enhance the deindustrialisation of both EIIs and downstream manufacturing industries, where jobs and additional value arise, and supply security is created.

ERT RECOMMENDATIONS:

1. **Export adjustments:** Adjusting the CBAM for exports while considering the carbon leakage risk of the whole value chain of each product and considering the possibility of compensation in certain sectors when exporting to specific countries.

2. **Structural solution:** While it is sensitive to design a solution that is compatible with World Trade Organisation (WTO) rules, it is essential to develop a structural solution to preserve the competitiveness of EU exports. This will incentivise EU-based EIIs that export to non-EU countries to keep production on the continent, thereby minimising the risk of carbon leakage through moving production outside the EU.

3. **Exception for power and trade intensive industries:** For power and trade intensive sectors, it is essential to continue the CO_2 compensation on power pricing. Any extension of the CBAM to indirect emissions[117] can be considered only based on the findings of the sector-specific deep effectiveness review, only once the EU's electricity system is almost completely decarbonised.

4. **Carbon clubs:** Prospectively, free trade agreements for CO_2 emissions, or structures such as a 'carbon club', which might follow the idea of the Climate Club established by the G7 in 2022,[118] could be possible if other trade partners introduce EU ETS and CBAM-like measures. This would lead to a stronger international dialogue on reaching global climate goals. Effective design of a global arrangement on steel and aluminium as negotiated by the US and the EU would be a step in the right direction.

117 Indirect emissions or Scope 2 emissions are emissions associated with the generation of electricity purchased for industrial production process that occur physically at the facility where the electricity is generated and are accounted for indirect emissions of an industrial product because they are the result of the installation's energy use. Indirect emission cost is a price effect of CO_2 in the electricity market and is not an indication of the actual indirect emissions in the production process, but a result of the marginal price setting mechanism as inherit part of EU electricity market design and says nothing about a company's individual efforts toward green electricity consumption

118 European Parliament, 2023

EXPERT CORNER 9

Leveraging digitisation to enable the green transition

Enabling the use of digital tools and databases is a key prerequisite to manage the complexity of CBAM. The ERT has identified five significant trends in the application of digital technologies to the green transition:

1. Data sharing in trusted business networks can drive transparency around the carbon footprint of business activities, and consequently emissions reduction throughout the supply chain.

2. Upgrading ICT infrastructure boosts resource efficiency and is the basis for applications that can substitute for emission-generating activities.

3. Digital technologies are critical for sustainable transport management, including enhanced traffic planning and the expansion of electric vehicle use.

4. Digital technologies play an essential role in managing the energy grid, distributing energy resources and enhancing flexibility, whilst increasing the grid's hosting capacity with the necessary speed.

5. Digital twins offer significant opportunities to improve efficiency (including waste and emissions reductions) thanks to simulation across many sectors.

There is a clear opportunity not only to use digital technologies to accelerate the green transition, but also to ensure European competitiveness. European businesses which utilise digital technologies to fuel their green ambitions, enabled by a supportive policy environment, will remain at the forefront of competition globally. Indeed, digitally-enabled green business models developed in Europe will be able to be exported globally. With this in mind, ERT has also identified four key issues to be addressed to support the rapid deployment of relevant technologies:

1. A lack of clear standards in the areas of data interoperability, sustainability reporting and measuring the environmental impact of digital technologies slows down the expansion of business networks and reduces our ability to make data-informed green decisions, meaning that stakeholders are less informed regarding the environmental impact of technologies.

2. The EU sustainable finance taxonomy does not adequately incentivise investment in the twin transition, due to the lack of acknowledgement of digital technologies.

3. With our use of data sets to continue to expand, and digital technologies forming an increasing part of our energy ecosystem, robust cybersecurity will need to stay at the front of policymakers' and business leaders' minds.

4. Investment in skills remains siloed between digital and green skills of the European workforce, failing to prepare individuals to combine both skill sets.

For further information, please refer to ERT's publication on 'Towards an EU Action Plan for a Digitally Enabled Green Transition'.[119]

119 ERT Expert Paper "Towards an EU Action Plan for a Digitally Enabled Green Transition", 2022

3.3.2 Optimise global partnerships

3.3.2.1 Objectives of regulatory changes proposed

A rules-based multilateral framework and global cooperation is advantageous for global trade as it establishes a structured and equitable set of regulations, fostering predictability and mitigating uncertainty. This incentivises international collaboration, which is advantageous for the export-focused EU.

However, other countries are introducing expansive unfair or protectionist industrial and trade policies that tilt the balance against European players. Due to this, Europe needs to advocate for global cooperation and partnership, while also considering WTO-conform trade defence measures where appropriate. The EU applies trade defence measures, such as the anti-dumping and anti-subsidy regulations, and it has recently designed the foreign subsidies regulation.

3.3.2.2 Comparison with other countries

Trade integration has slowed over the past decade. Increasingly, expansive industrial and trade policies by big global players and important EU trade partners such as the US or China have led to the rise of protectionism. This has the potential to harm global trade activity long-term; it is questionable whether measures such as localisation requirements (e.g. the US's 'Build America Buy America')[120] and extensive subsidies (e.g. > 90% of aluminium's global $70 billion subsidies are provided by the Chinese government)[121] conform with WTO trade policy. Such measures imply a disadvantage to trade partners who are reliant on exporting to these countries. To remain competitive within international trade, we need to protect or better support European industry in the light of the protectionist reflexes of others.

1. For **China**, international trade is crucial for economic growth and a major source of technological progress and development. China is the world's second-largest economy by GDP, the world's largest exporter, and ranks second among the world's largest importers. China's industry has moved from assembling foreign inputs to increasingly relying on domestic inputs.[122] To further support this, there are numerous measures that aid domestic industries, such as tax benefits (especially for innovation), government guidance investment funds, and subsidies.[123] One problem with extreme subsidies can be overcapacity. An example where this occurred is the Chinese aluminium industry: from 2013 to 2017, the global aluminium industry received almost $70 billion in various government supports, with over 90% of the total subsidy funds allocated to Chinese companies, which contributed to overcapacity and a hardened global trade playing field.[124] A similar problem occurred in the steel and chemicals industries (e.g. Glycol). Although China is a member of the WTO, it employs controversial measures targeting foreign companies, such as restrictions on foreign investment, import barriers, price control, intellectual property protection and currency positioning. Despite easing equity restrictions in recent years, other remaining barriers include licensing approval processes and security reviews, which can hinder foreign investors from entering Chinese markets.[125]

2. **US:** US trade policy has grown more protectionist since 2018, leading to a trade dispute with China and friction with other major economies.[126] Though trade flows between China and the US are the biggest in the world, the trade relationship between the world's largest economies is now characterised by ongoing challenges. As the world's largest economy by GDP, the US is working to return to leadership in multilateral trade forums. After protectionist threats by the US Administration, an implementation of tariffs on Chinese solar panels and washing machines occurred in January 2018, followed by tariffs of 25% on imports of steel and 10% on imports of

120 U.S. Department of Commerce, 1978

121 OECD

122 Luo, H. and Qu, X., 2023

123 The Economicst Intelligence Unit, 2021

124 OECD

125 The Economist Intelligence Unit, 2021

126 Steinberg, D. and Tan, Y., 2023

aluminium for a wide range of countries in March 2018. By June 2018, the tariffs on steel and aluminium were also applied to the EU, resulting in retaliatory measures when the EU in turn imposed a 25% duty on different US products.[127] The recent introduction of the IRA also comes with various implications on foreign economies (see chapter 3.2.1).

While EIIs are all affected by trade policies, EIIs with higher trade volumes, such as aluminium and steel, are especially affected. As we have seen in past chapters, trade of EIIs is increasing overall and, therefore, the importance of an international level playing field of trade has become significantly more important. Creating it is a key task for the EU. This is why an effective design of a global arrangement on steel and aluminium as negotiated by the US and the EU would be a step in the right direction.

3.3.2.3 Our regulatory proposals

Further prioritise secure and diverse supply chains e.g. in public procurement (C.IV)

To create a level playing field for businesses across Europe, EU law sets out specific rules, including rules for public procurement. For public procurement in lower value dimensions, national rules apply, but they must also respect the general principles of EU law. Whilst specific localisation requirements are not in accordance with WTO rules, a certain degree of geographic prioritisation is necessary in the context of supply chain resilience and risk management.

Since 2017, the EU has had a public procurement strategy, which includes the following six policy priorities:

- Ensuring wider uptake of innovative, green and social procurement
- Professionalising public buyers
- Increasing access to procurement markets
- Improving transparency, integrity and data
- Boosting the digital transformation of procurement
- Cooperating to procure together[128]

ERT RECOMMENDATIONS:

Secure and diversify supply chains: In response to increasing disruptions in recent years, EU strategy needs to include secure and diverse supply chains that support both the goal of decarbonisation in accordance with the European Green Deal, and resilience in the case of geopolitical disputes or events of global proportion. EIIs play an important role in both these issues. Therefore, we recommend an extension of the European public procurement strategy towards supply chain security and resilience, in accordance with sector and risk management experts, as the sixth policy priority “Cooperating to procure together” emphasises.

Promote fair competition on trade under the WTO framework and enhance partnerships (C.V)

A rules-based multilateral framework is advantageous for global trade as it establishes a structured and equitable set of regulations, fostering predictability and mitigating uncertainty, thereby incentivising international collaboration, which is advantageous for the export-focused EU. Trade defence mechanisms are predominantly governed by WTO agreements. These are designed to be applied in the long-term and offer very limited to no flexibility in their interpretation. A reform of the

127 European Central Bank, 2019

128 European Commission, 2017

WTO and the commitment of countries to strengthen the multilateral system are essential to clarify current issues such as dispute settlement procedure, a comprehensive set of global trade rules, and clear rules for cross-border data traffic (digital trade). As the objective is to protect European industry from unfair or protectionist trade and industrial policies, more use can be made of these existing trade defence mechanisms to maintain EU industry's competitiveness on the global market. This is in line with the European Commission's ambition to "take a more assertive stance in defending its interests against unfair trade practices".[129]

The EU experiences unfair practices in two main areas:

1. **Dumping:** Dumping is when foreign firms dump products at artificially low prices in the European market. This could be because countries unfairly subsidise products, or companies have overproduced and are now selling the products at reduced prices in other markets.

2. **Unfair subsidies:** Unfair subsidies happen when a government provides financial assistance to its companies to produce or export goods at artificially low prices. The subsidies must be specific i.e. given to a particular company, group of companies, sector or region. Subsidies may also be given to third countries, e.g. China provides subsidies to Chinese-owned companies in Egypt.

While the EU is already actively prioritising the establishment of a level playing field in international trade, a more assertive stance needs to be taken to not be left behind in global trade.

ERT RECOMMENDATIONS:

1. **Multilateral trading system:** Strengthen the multilateral trading system through WTO reform, as this allows businesses to diversify their supply chains across the widest possible range of countries. A rules-based multilateral trading system is also a key driver of growth and prosperity – and creates stability. Open and fair global trade and an international level playing field are crucial to stimulate competition and to enable better prices and solutions. In the meantime, the WTO is the backbone of the global trading system and aims to be a guarantor for stability in trade relations. Reform of the WTO can include re-establishing the dispute settlement system, modernising WTO rules, and facilitating plurilateral negotiations, such as updating the WTO pharmaceutical agreement, expanding global participation in the information technology agreement, finalising WTO e-commerce negotiations, and reviving negotiations on trade in environmental goods.[130] This multilateral trading system should be seen as beneficial by all members as this is the only way for it to be strong and lasting.

2. **Strategically apply trade defence measures when justified:** Defend European industry from unfair practices by introducing trade defence measures that rebalance unfair practices, e.g. anti-dumping duties. Counteracting unfair measures by other countries always needs to consider unwanted repercussions, e.g. resource limitations. Therefore, keeping them in mind when deciding on measures is of utmost importance. An example of when anti-dumping duties can be implemented is the case of stainless-steel fittings from China and Taiwan; the policy was renewed in April 2023 and extended to include Malaysia in March 2023. An anti-circumvention investigation had found that some Chinese producers were circumventing EU anti-dumping measures via companies in Malaysia, which were importing the main parts needed to produce stainless steel fittings from China, processing them, and subsequently exporting to the EU without paying any anti-dumping duties. The extended anti-dumping duties range from 5.1% to 12.1% for Taiwan and from 30.7% to 64.9% for China. The duty rate extended to imports from Malaysia is 64.9%, with two genuine Malaysian producers being exempt from the measures.[131]

3. **Anti-subsidy tools:** Make effective use of anti-subsidy tools, such as the new foreign subsidy regulation that was implemented in 2023.[132] This regulation addresses when subsidies by

129 European Commission, 2021

130 ERT paper "Making Open Strategic Autonomy work – European Trade in a Geopolitical World", 2021

131 European Commission, 2023

132 European Commission, 2023

governments outside the EU are providing recipients that are active in the EU with an unfair advantage to offer low prices, acquire companies or obtain public procurement contracts. The foreign subsidy regulation provides the power to impose measures to redress their effects: *"The Commission should have the power to examine any foreign subsidy, to the extent it is in the scope of this Regulation, in any sector of the economy on its own initiative, relying thereby on information from all available sources. To ensure effective control, in the specific case of large concentrations (mergers and acquisitions) and public procurement procedures above certain thresholds, the Commission should have the power to review foreign subsidies based on a prior notification by the undertaking to the Commission."*[133] Whilst there is little experience so far, due to the recent implementation of the regulation, continuous analysis and revision will make it as effective as possible from the beginning.

Take a leadership role in orchestrating coordinated global climate action (C.VI)

The previously discussed European policies will have an impact on the world. For example, the CBAM directly impacts non-EU producers for imports into the EU due to the requirements for emission measurement and documentation and by posing strategic questions on how to serve the EU market in the future. In addition to that, the policies also have a broader impact, as global regulators may react to them when considering introducing their own climate regulations.

Beyond that impact, Europe can take an even more proactive role in global climate action by advocating for a coordinated approach and increased global cooperation.

ERT RECOMMENDATIONS:

1. **Global standards:** Currently, different methodological requirements to report GHG emissions are imposed on companies operating internationally, some of which contradict each other. This requires an enormous effort from companies to comply with all the different requirements. Thus, promoting global climate standards, e.g. for global carbon reporting and joint principles for green subsidies, becomes essential. Global alignment on climate regulation will reduce complexity for global companies and trade. In addition, a worldwide framework for green subsidies can avoid a subsidy race which would contribute to increased global imbalance and tensions.

2. **Open 'climate clubs':** Advocate for openness of 'climate clubs' and CO_2 free trade agreements. Partnerships to cooperate on climate change-related measures can help to promote pan-regional standards and reduce the complexity of global trade if other partners introduce EU ETS and CBAM-like measures. While these clubs might be launched by a limited number of countries, such as the G7 Climate Club, or initially focused on specific sectors, e.g. the Global Arrangement on Sustainable Steel and Aluminium (GSA), the intention should be to design them as inclusively as possible to allow further members to join.

3. **Green development programs:** Align development assistance programmes with decarbonisation objectives, creating opportunities for low-income economies to become competitive in the future global net-zero economy.

133 Official Journal of the European Union, 2022

4. Appendix

4.1 Abbreviations

BCG	Boston Consulting Group
BF-BOF	Blast Furnace-Basic Oxygen Furnace
CAGR	Compound annual growth rate
CapEx	Capital expenditure
CBAM	Carbon Border Adjustment Mechanism
CCfD	Carbon Contract for Difference
CCUS	Carbon Capture, Utilisation and Storage
CO_2	Carbon Dioxide
DRI-EAF	Direct Reduced Iron-Electric Arc Furnace
EHB	European Hydrogen Bank
EIIs	Energy-intensive industries
ERT	European Round Table for Industry
ETS	Emissions Trading System
EU	European Union
EU-SA	European Union Strategic Autonomy
EUR	Euro
FDI	Foreign Direct Investment
G7	Group of 7
GDIP	Green Deal Industrial Plan
GDP	Gross domestic product
GHG	Greenhouse gas
GVA	Gross value-added
GW	Gigawatt
H_2	Molecular hydrogen gas
HH1	Holland Hydrogen 1
HRC	Hot-rolled coil
IEA	International Energy Agency
IRA	Inflation Reduction Act
MWh	Megawatt-hour
NZIA	Net Zero Industry Act
OCI	Oriental Chemical Industries
OpEx	Operating expenditure
PCF	Product carbon footprint
PPA	Power Purchase Agreement
PVC	Polyvinyl chloride
PUR	Polyurethane
R&D	Research & Development
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RED	Renewable Energy Directive
t	Tonne
TDI	Toluene diisocyanate
UAE	United Arab Emirates
US	United States
VAT	Value added tax
WTO	World Trade Organisation

4.2 Definitions

Power = electricity or electrons

VRE (Variable Renewable Energy) = Wind and Sun

Renewable power = VRE + Hydro + Power from biogas or other green feedstock

Zero carbon power = Renewable power and nuclear power

Low carbon gases = Green H_2, blue H_2, pink H_2, biomethan

Low carbon fuels = Ammonia, Synthetic Fuels

Energy = Power, gas, liquid, solid carrier

Fossil energy = Natural gas, oil, coal

4.3 List of Figures

4.4 List of Expert Corners

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4.6 IRA and GDIP in comparison

GDIP lacking behind IRA in simplicity and OPEX coverage

	Inflation Reduction Act	Green Deal Industrial Plan
Framework	**Tax-based incentives to promote investments and stronger uptake of green technologies** **Investment tax credit:** • Reduces the federal income tax liability for a percentage of the cost of a qualified system that is installed during the tax year. **Production tax credit:** • For electricity generated for the first 10 years of a qualifying system's operation. It reduces the owner's federal income tax liability and is adjusted annually for inflation. **Funding:** • For energy efficiency, advanced manufacturing production **OPEX & CAPEX (without limitation of total funding)**	**Capacity targets for green technology deployment, EU commitments broken down to national laws** **Member states funds:** • e.g. German CCD; provided by Member States governments to national companies **EU funds provided Member states:** • e.g. REPower EU; European funds provided to Member States to accelerate green transition **EU funds allocated at EU level:** • e.g. Innovation Fund; European funding with a focus on low-carbon technologies **Lacking OPEX support & market ramp-up instruments**
Permitting	**Long permitting processes (up to 4 years)**	**Long and complex permitting on national level (up to 10 years)**

Figure 24: Framework and Permitting of IRA and GDIP

IRA positively impacting investments while GDIP still requires agreement from member states

	Inflation Reduction Act	Green Deal Industrial Plan
Effectiveness	**IRA impact already showing off with increased investments, market growth and exports** • US has become an attractive green market for non-US players with ~$1.3 trillion deployed in next 10 years from private and public sources • Combined annual rate of private investment ($129 billion) generated by federal funding • US domestic market increased from ~590 billion to ~$830 billion • US cumulative exports. increased from $120 billion to $135 billion	**GDIP is a proposal that requires agreement, legislation & national action for key elements before funding and other impact are felt** • REPowerEU however incentivised cleantech investments before GDIP announcement in various Member States

Figure 25: Effectiveness of IRA and GDIP

Source: Foregin Direct Investments, Renewables Now, TES Hydrogen for Life, Povaris, DW, BCG analysis

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