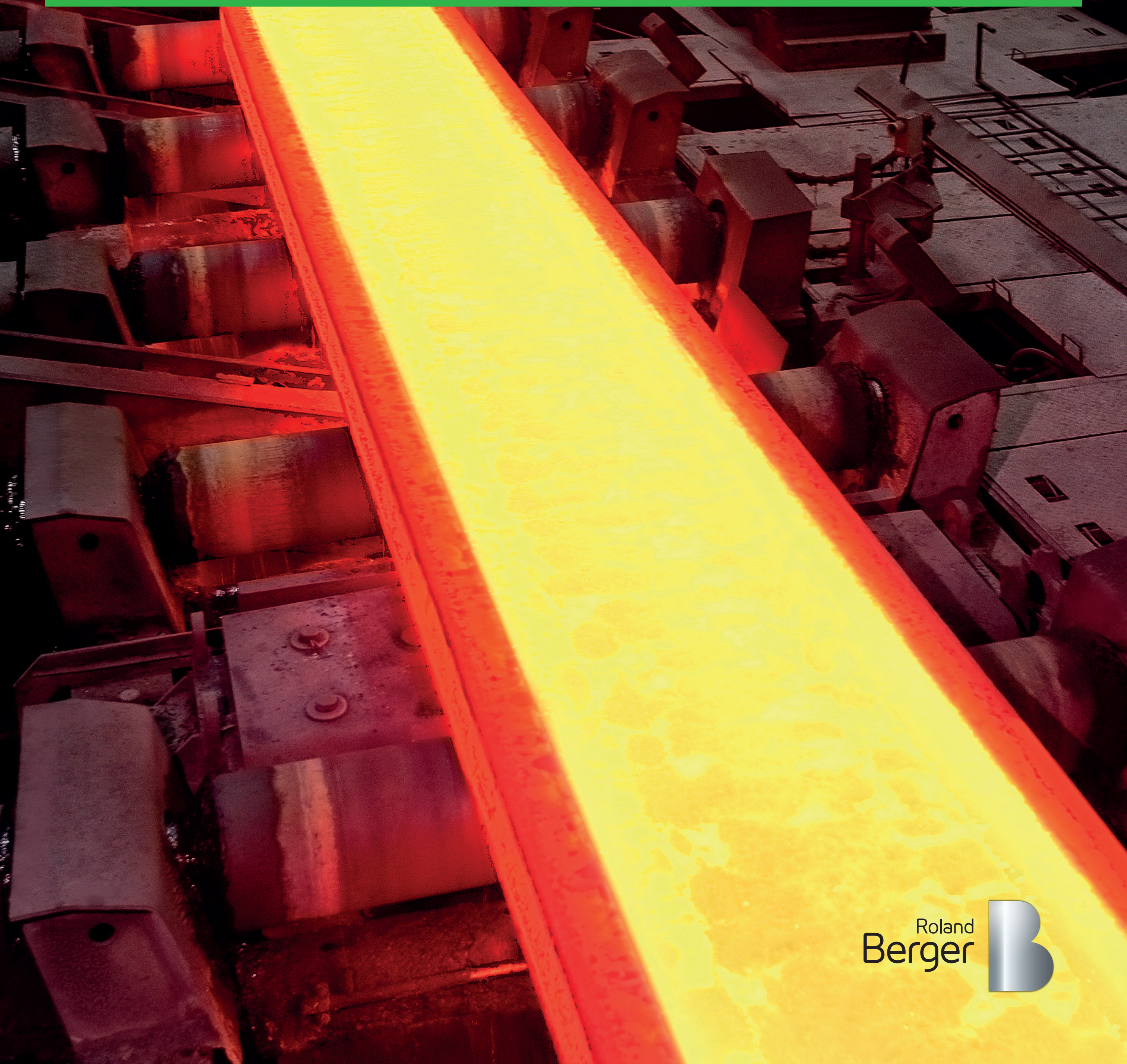
Focus

Roland Berger

Green deal for steel | What will it take and who will pay?



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Green deal for steel / *What will it take and who will pay?*

The European steelmaking industry currently accounts for 5.7% of total EU CO_2 emissions. To meet European Union emissions targets, it must become climate neutral by 2050. An EU interim target means steelmakers need to reduce emissions by 30% by 2030.

Steelmakers have three options: do nothing and continue to face rising EU emissions costs; invest in carbon capture and storage technologies to lower emissions; or transform production to alternative, cleaner steel production processes, such as hydrogen direct reduction of iron (DRI).

We developed a model to assess the costs of each. It found that at least 29 million tonnes of steel production (roughly a third of today's primary route output) would have to be converted to greener production processes to meet the 2030 target. DRI with hydrogen had the lowest minimum capacity conversion share.

The annual additional costs in a scenario that involves converting 29 Mt of capacity to the cheapest hydrogen DRI route are around EUR 17 billion in 2030 (in a high carbon price scenario). These consist of EUR 3.5 billion additional production costs, including a yearly CAPEX share for the converted capacity and EUR 13.5 billion in emissions costs from remaining unconverted capacity.

The cost burden of the transformation will fall to a significant part on taxpayers and customers/end consumers as financing capabilities and margins of steelmakers are low. Steelmakers can access support from the EU's more than EUR 1 trillion climate funds, and pass on a significant share of costs to customers/end consumers by 2030.

We conclude that to facilitate the green transformation of the European primary route industry and meet the 2030 target, steelmakers should opt for DRI furnace technologies, at first using natural gas. We estimate that the transformation will need public CAPEX funding in the double-digit billion range.

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Cover photo Georgy Rozov/EyeEm/Gettyimages

Introduction

Through the UN's Paris Agreement of 2015 and its own Green Deal in 2019, the European Union has committed to becoming climate neutral by 2050. This has a clear implication for the European steel industry – steel production must be climate neutral by 2050.

Today, conventional steel production is one of Europe's biggest sources of CO_2 emissions. According to the European Commission,[1] the bloc's steel industry currently accounts for 221 million tonnes of greenhouse gas emissions – 5.7% of total EU emissions. Energy- and carbon-hungry upstream operations, such as the production of coke and iron, account for the majority of these. Most emissions come from 25 or so integrated steel plants, which use the so-called primary route to make steel from iron ore. According to EUROFER,[2] the European Steel Association, these produce around 60% of Europe's roughly 160 million tonnes of crude steel a year. → A

Primary route processes emit mainly direct greenhouse gases, scope 1 emissions. The secondary route, which produces steel from scrap, emits mainly indirect greenhouse gases, scope 2 emissions. These vary depending on the electricity mix used in the electric arc furnace (EAF). As the biggest emitter, the primary route is the industry's main target to lower emissions, and the route considered in this study.

Several options exist to lower emissions. Roland Berger's The Future of Steelmaking report in 2020 assessed possible decarbonization technologies. It found sufficient mature technologies; a finding borne out by the announcement of numerous construction projects in the EU in the past 12 months.

Incentives also exist. The European Commission has announced an interim reduction target in CO_2 emissions of 55% by 2030, compared to 1990 levels. According to EUROFER,[3] this means the steel industry must reduce CO_2 emissions by around 30% by 2030, compared to current levels.

This raises two important questions: can the target be met, and who will pay for the green transformation?

MEETING THE TARGET

Despite the recent production of first pilot charges, steelmakers all over Europe are only expected to produce their first route-specific green steel on industrial scale by the middle of the 2020s. Pace setters include leading existing integrated steel mills as well as new entrants like H2 Green Steel. Many producers are applying for EU and sometimes additional national funding to help with construction costs.

However, to achieve the CO_2 reduction target, a significantly higher proportion of production capacity will have to be converted. In Chapter 1, we give an estimate of the percentage of production capacity that will have to be converted according to our model and assumptions. We also model the costs of conversion to the most relevant technologies, and compare them with the cost of doing nothing.

MEETING THE COSTS

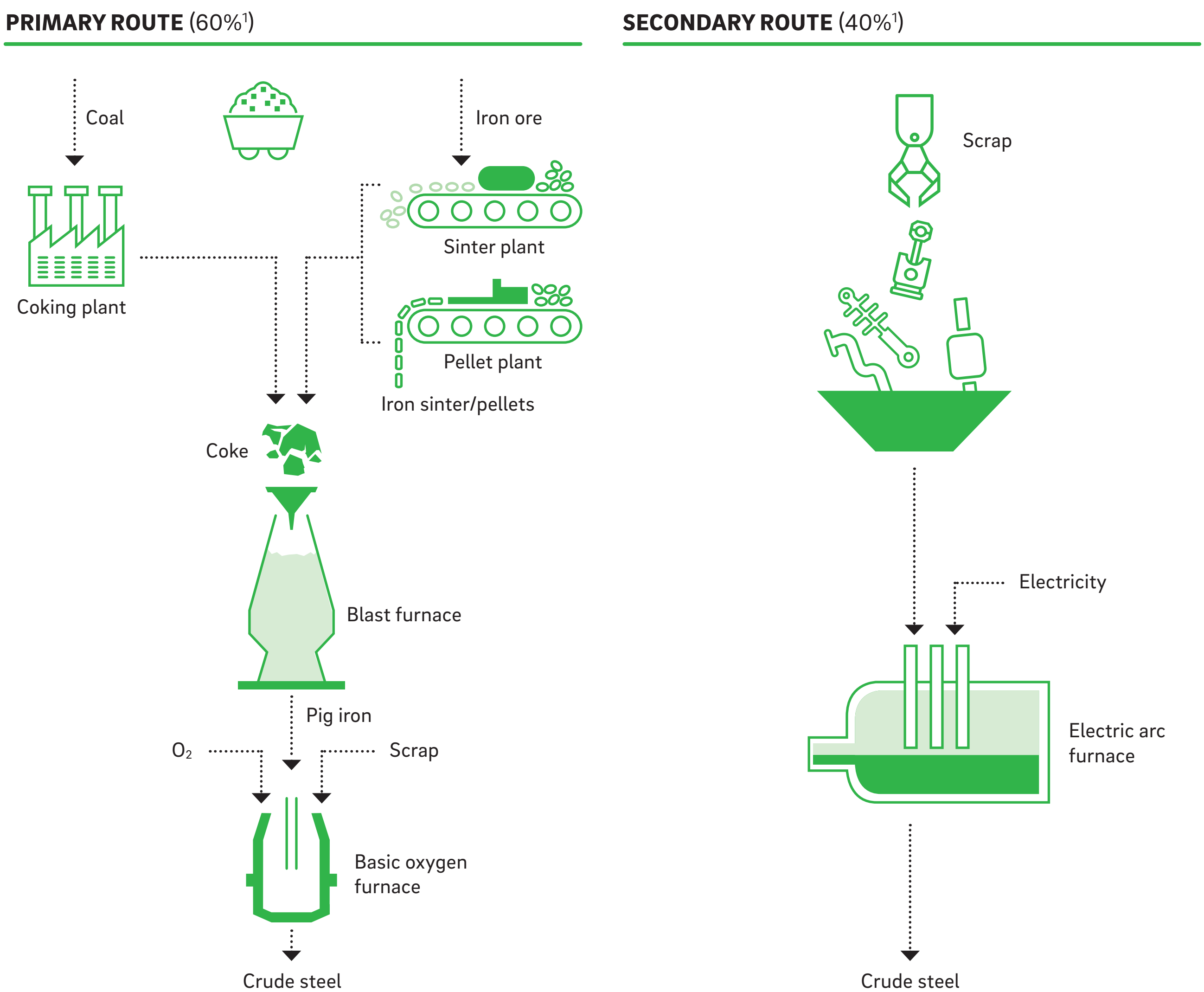
Taxpayers, steelmakers and consumers are all potentially in line to foot the bill for the green steel transformation. But the question of who eventually covers the costs, and/or which areas, is still unanswered. The outcome will have a direct impact on how the transformation should be designed so as not to jeopardize the global competitiveness of European steel producers.

In Chapter 2, we look in detail at the question of who will pay, discussing the most important funding sources and their willingness/ability to cover the costs of the transformation. We also offer a way forward, including recommendations on funding and industrial requirements.

[1] European Commission, Towards competitive and clean European steel, May 2021
[2] EUROFER, European Steel in Figures 2020
[3] EUROFER, Fit for 55 package signals step-change in EU climate policy, July 2021

A: Simplified routes

European steel is produced via one of two methods, with the iron ore-fed primary route the most common



[1] Share of production in Europe

Source: EUROFER, Roland Berger

1 / The price of going green

LOWER-EMISSION STEELMAKING TECHNOLOGIES ARE EXPENSIVE, BUT THE COST OF DOING NOTHING IS HIGHER

Europe's primary route steelmakers face substantial cost increases in the coming years, regardless of their actions in the face of emissions targets. In short, they have three options:

1. They could do nothing and face increasing emission costs, due to, for example, increasing European Union Emissions Trading System (EU ETS) prices for producing steel via the conventional blast furnace/basic oxygen furnace route (BF-BOF).

2. They could invest in carbon capture and storage (CCS) technologies to significantly lower their direct emission costs, involving both capital expenditure (CAPEX) for equipment and operational expenditure (OPEX).

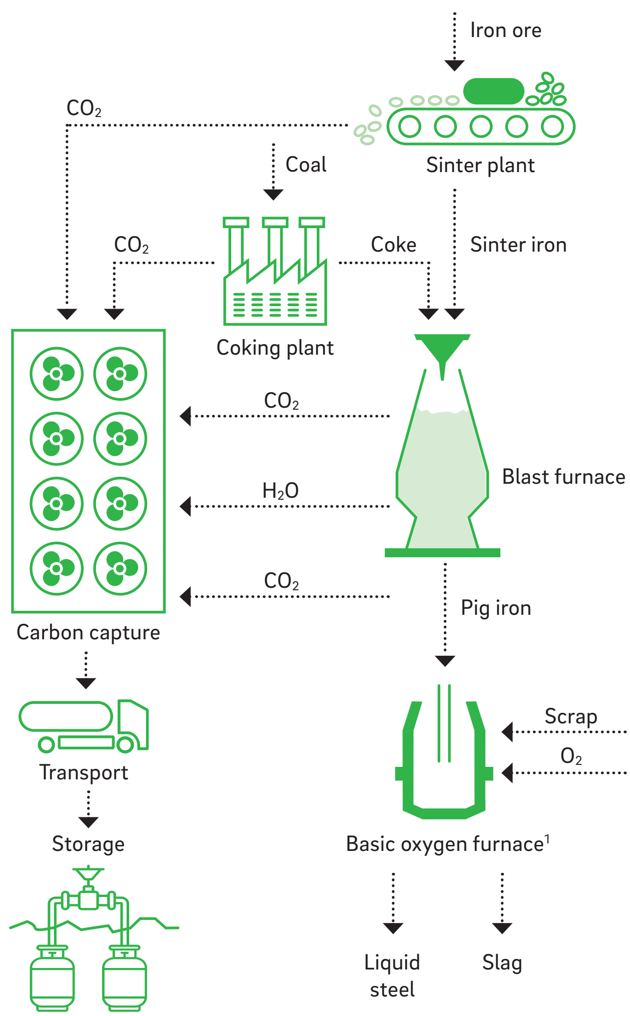
3. They could invest in alternative, cleaner steel production processes, of which direct reduced iron using natural gas or hydrogen as reductant is the only currently mature technology. This would help to reduce or even avoid direct emission costs, but also involve high CAPEX and OPEX for the technology. There are two direct reduced iron (DRI) process routes, one using an electric arc furnace (EAF), and another using a submerged arc furnace (SAF) and an existing BOF. → B

We developed a model to estimate the costs for different routes and technologies, with new routes compared against a "do nothing" approach. It gives scenarios for the approximate additional average cost of making one tonne of crude steel in Europe through the three primary route options above. Cost estimates are for each year up to 2030 (the target year for the 30% reduction in CO_2 emissions) and are in comparison to 2020 costs for the conventional primary route.

B: Decarbonization options

Carbon capture and storage and direct reduction of iron processes are mature technologies

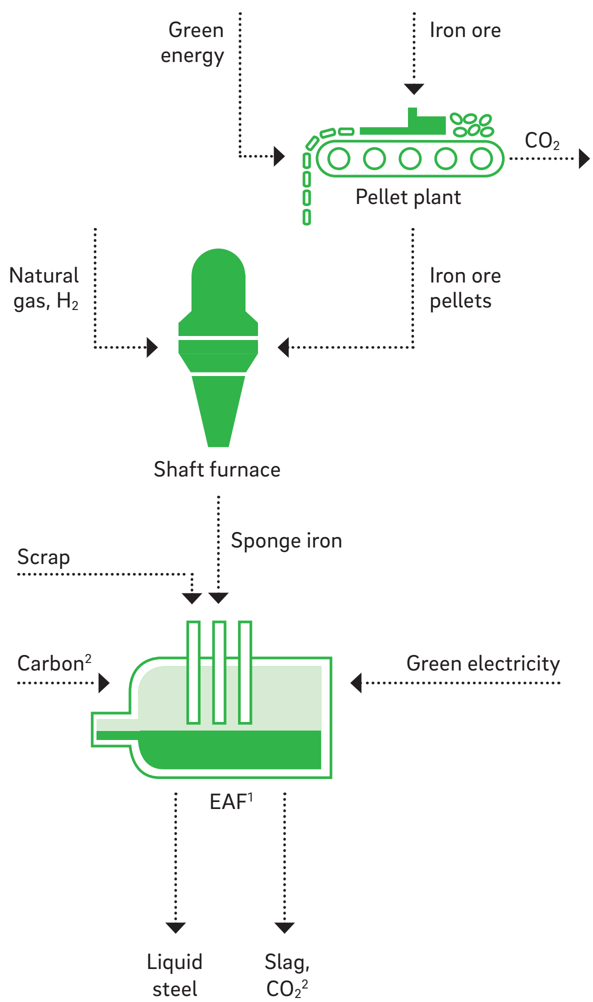
CCS-BF-BOF (CARBON CAPTURE AND STORAGE)



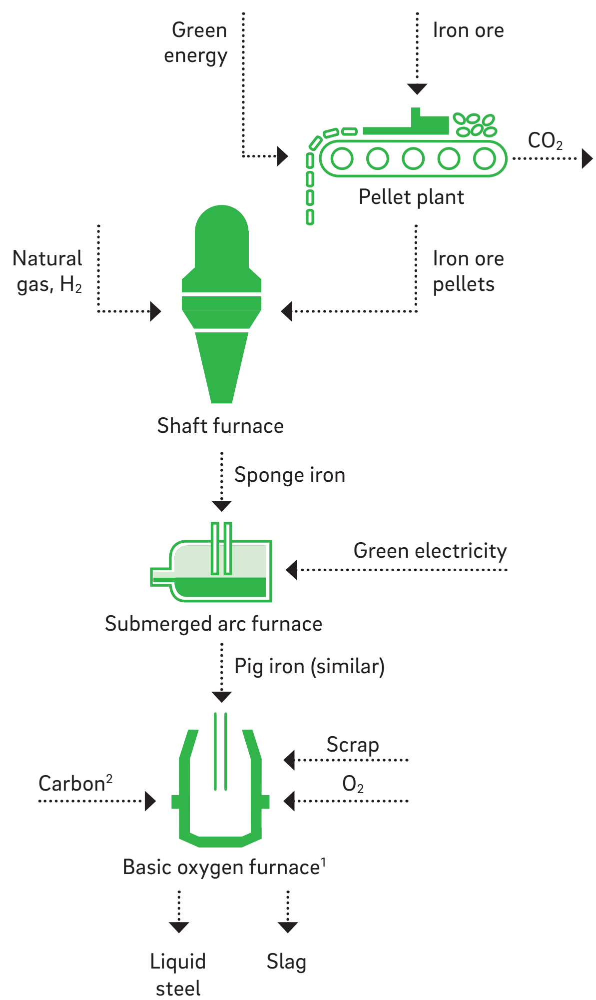
[1] Incl. secondary metallurgy

Source: EUROFER, Roland Berger

DRI-EAF (DIRECT REDUCTION AND EAF)



DRI-SAF-BOF (DIRECT REDUCTION AND SAF/BOF)



[2] Negligible to adjust desired carbon content between 0.002% and 2.14%

METHODOLOGY

Key cost factors

The costs of making one tonne of crude steel via the CCUS or DRI routes is dependent on several key factors. These currently have uncertain forecast reliability as the policy frameworks, prices and associated industries (for example, the hydrogen economy) are still evolving. The most important cost factors are:

- CO_2 emissions costs
- The allocation of free CO_2 allowances, which steelmakers receive under the EU ETS alongside other industries facing tough global competition and the threat of carbon leakage
- The effectiveness of the respective technology and/or reductant at reducing CO_2 emissions
- CAPEX of the respective technology
- OPEX of the respective technology, energy source, reductant: green hydrogen, green electricity, natural gas, green DRI-grade iron ore pellets.

Key assumptions

To calculate the costs of different transformation routes, we made several assumptions. First, our model assumes that all technologies are already available. The reality is that many projects will not become industrially productive until the middle or late 2020s. Second, our two scenarios were developed based on a high carbon price and a low carbon price, with each having separate assumptions.

The high carbon price scenario assumes:

- An increase in carbon emission costs from around 50 EUR per tonne in 2021 to around 120 EUR/t in 2030
- A decrease of free CO_2 allowances with the start in 2026 of financial adjustments within the Carbon Border Adjustment Mechanism (CBAM), falling to 0% over the following five years. The Carbon Border Adjustment Mechanism is a measure to put a price on indirect CO_2 imports into the EU. It aims to prevent carbon leakage by leveling the playing field between carbon emitters in the EU (who have to pay for their emissions) and their global competitors.

The low carbon price scenario assumes:

- An increase of carbon emission costs from around 50 EUR/t in 2021 to around 80 EUR/t in 2030
- A decrease of free CO_2 allowances with the start in 2026 of financial adjustments within the Carbon Border Adjustment Mechanism (CBAM), falling to 0% over the following ten years (as described in option 4 in the European Commission's CBAM proposal from July 2021).

In addition, both scenarios assume the transformation of an existing steel mill so that it can sell the surplus CO_2 certificates it receives under the EU allowance allocation when it converts to green technologies. This is shown as "negative costs" in the cost curves, with low-emission production technologies benefiting particularly strongly from rising CO_2 prices in the years up to the reduction of the free allowances. Estimated costs can vary depending on the location of the producer or even the steel mill.

TECHNOLOGY COSTS COMPARED

The scenarios

We developed high carbon and low carbon price scenarios (see methodology). → C

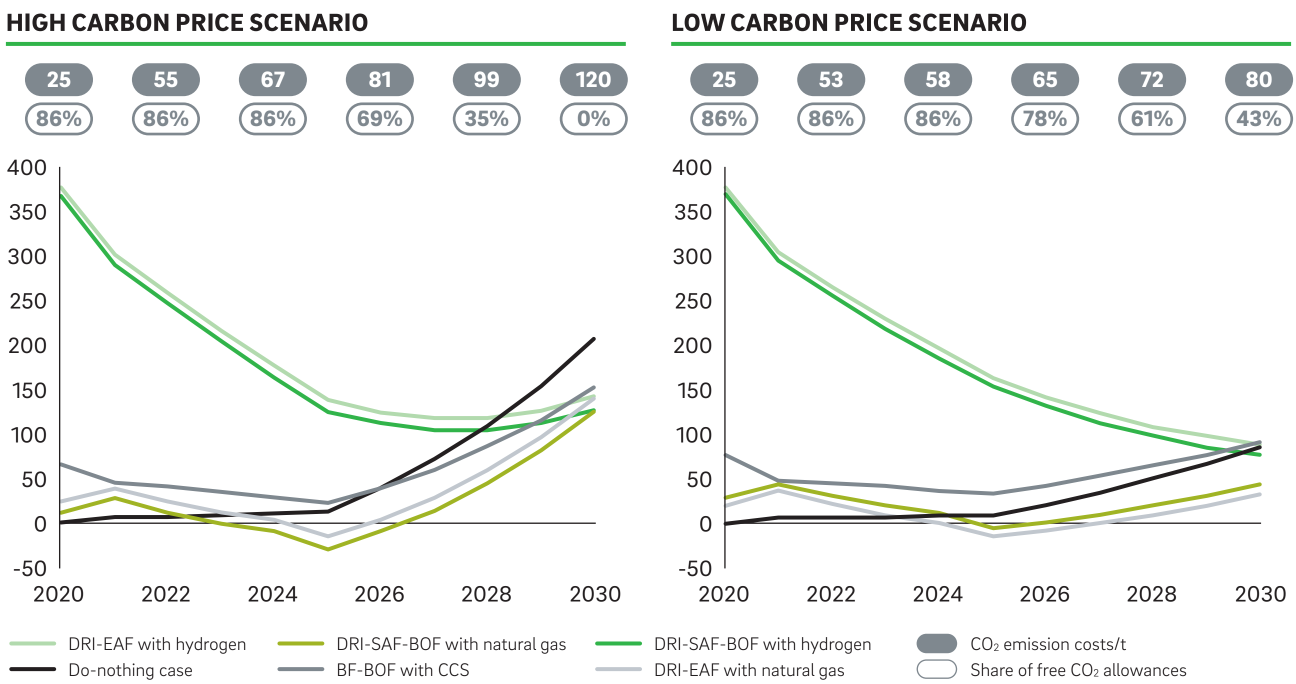
Due to the sharp increase in CO_2 prices during 2021 and an increasing number of studies predicting CO_2 prices well above EUR 100/t in developed countries in 2030 (such as the International Energy Agency's "Net Zero by 2050" report in July 2021), we believe the high carbon price scenario is much more likely.

Both scenarios forecast major intercept points between the first and second half of this decade. At these points, first natural gas direct reduction, and then carbon capture and storage and hydrogen direct reduction, become more economical than conventional steelmaking. The exact timing of these intercept points depends heavily on the key cost factors (see methodology).

The point in time at which the economic viability of individual technologies changes has a big effect on expected CO_2 emissions, as market demand and steel producers are primarily guided by economic viability.

C: Decarbonization costs

Scenarios for the additional costs of different technologies to 2030, versus a do-nothing case [EUR/tonne crude steel]



Source: Roland Berger

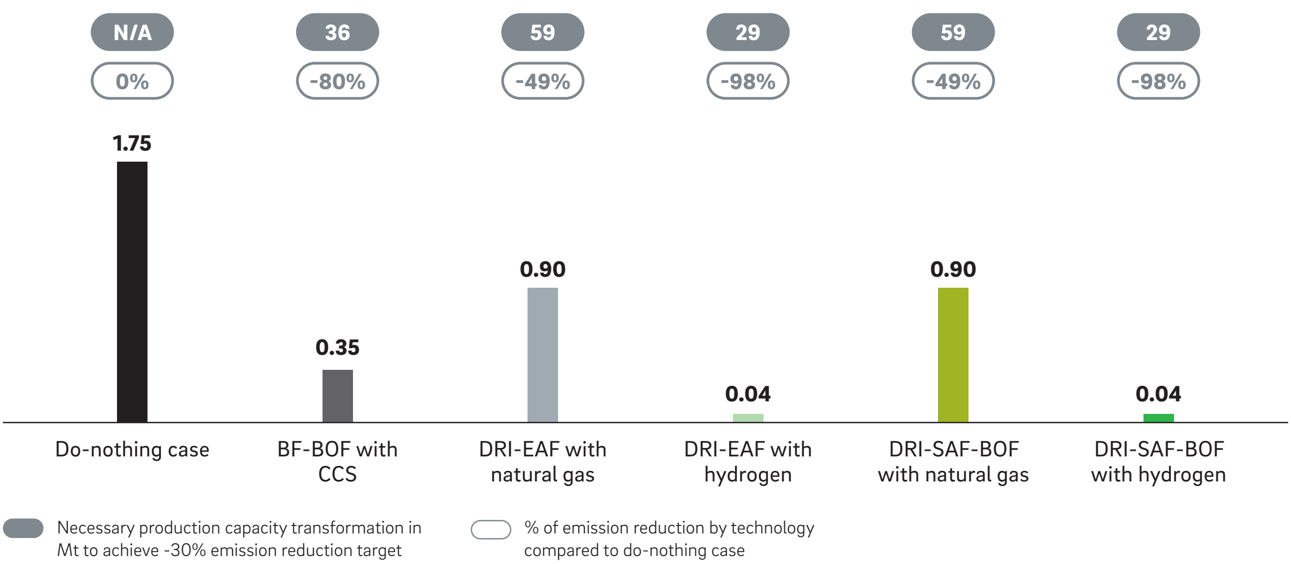
This in turn has a direct influence over the question of whether, when and by what means the European primary steel industry can achieve climate targets.

Production requirements to meet 2030 target
According to EUROFER, European primary steel production capacity currently stands at around 95 million tonnes (Mt) per year. In our model, we assume that the yearly primary steel production stays constant until 2030. By calculating the direct CO_2 emissions of different technologies and reductants, it is possible to extrapolate a figure for the amount of conventional capacity that would need to be converted to one of the new technologies to meet the EU's target of reducing CO_2 emissions by 30% by 2030.

We found that at least 29 Mt (the figure for the two types of direct reduction of iron with hydrogen) would have to be converted. → D

CAPEX and OPEX requirements to meet 2030 target
Using the share of production capacity needed to be converted by 2030, we calculated the approximate capital requirements for the different technologies and reductants. This amounts to the CAPEX that would have to be raised by 2030 (irrespective of OPEX cost factors) to reduce CO_2 emissions by at least 30% by 2030. The often lengthy (more than two years) time lag between CAPEX outlay and a plant coming online

D: Conversion levels
Direct carbon emissions of technologies with capacity that must be transformed to meet 2030 target [t CO_2/t steel]



Source: KTH Royal Institute of Technology; Material Economics; Fachbuch Regenerative Energiesysteme and UBA; Roland Berger highlights the importance of clarifying financing as soon as possible. → E

OPEX costs are another matter. Additional OPEX are to be expected for all transformation paths. The full additional costs, including the CAPEX depreciation portion and CO_2 emission costs, constitute the specific additional costs per tonne of crude steel shown in our two scenarios.

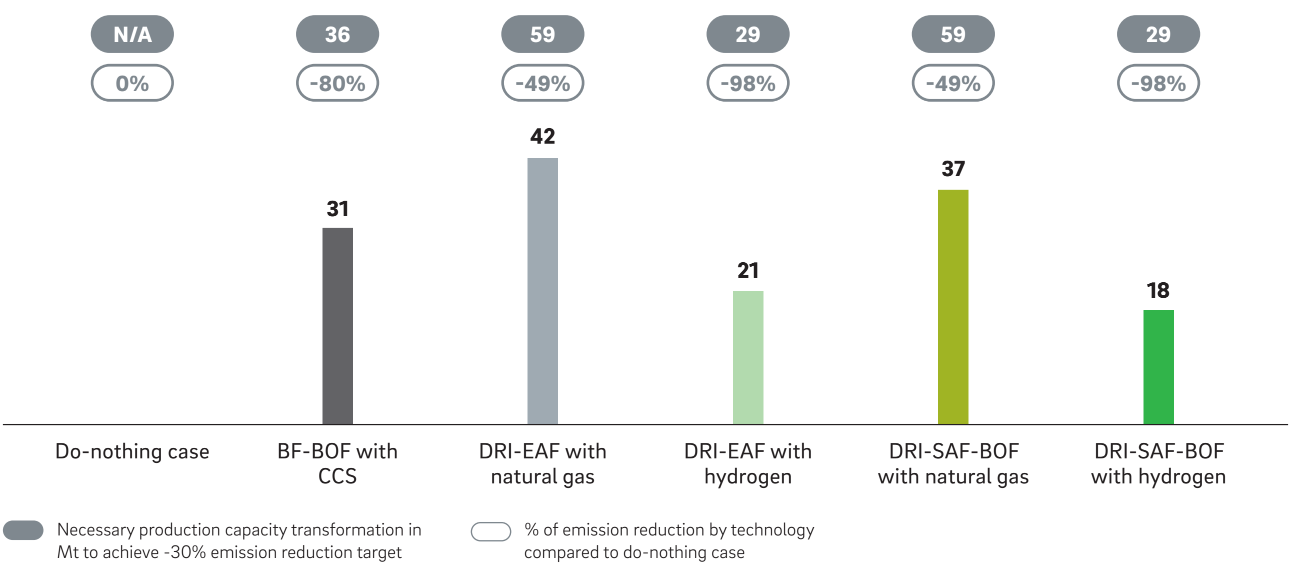
For example, annual additional costs of around EUR 17 billion would be expected in 2030 in the high carbon price scenario if the estimated 29 Mt of production capacity is converted to the hydrogen DRI-SAF-BOF route.

The EUR 17 billion breaks down into two components. The conversion to produce 29 Mt of steel using the hydrogen DRI-SAF-BOF route causes annual additional costs of EUR 3.5 billion, including the CAPEX share, which is amortized over 20 years. The significantly higher share of EUR 13.5 billion would come from the very high CO_2 emission costs of the 66 Mt of unconverted, conventional production capacity.

If we consider the full costs, including the expected politically driven increase in CO_2 emission costs, it makes economic and environmental sense to provide the European primary steel industry with as much funding as possible for a rapid CAPEX transformation of its production plants. This is especially true if CO_2 emission costs are considered as a monetary equivalent of the climate damage caused by CO_2 emissions.

E: Capital costs

CAPEX requirements of different technologies with capacity that must be transformed to meet 2030 target [EUR bn]



Source: EU Commission; EUROFER, Roland Berger

2 / Footing the bill

TAXPAYERS AND CUSTOMERS/END CONSUMERS WILL END UP PAYING MUCH OF THE STEEL INDUSTRY'S GREEN TRANSFORMATION COSTS

In the previous chapter, we described the options open to steelmakers to transform and meet the EU's 2030 emissions target, and outlined the potential costs involved. But a key question remains – who will pay for it?

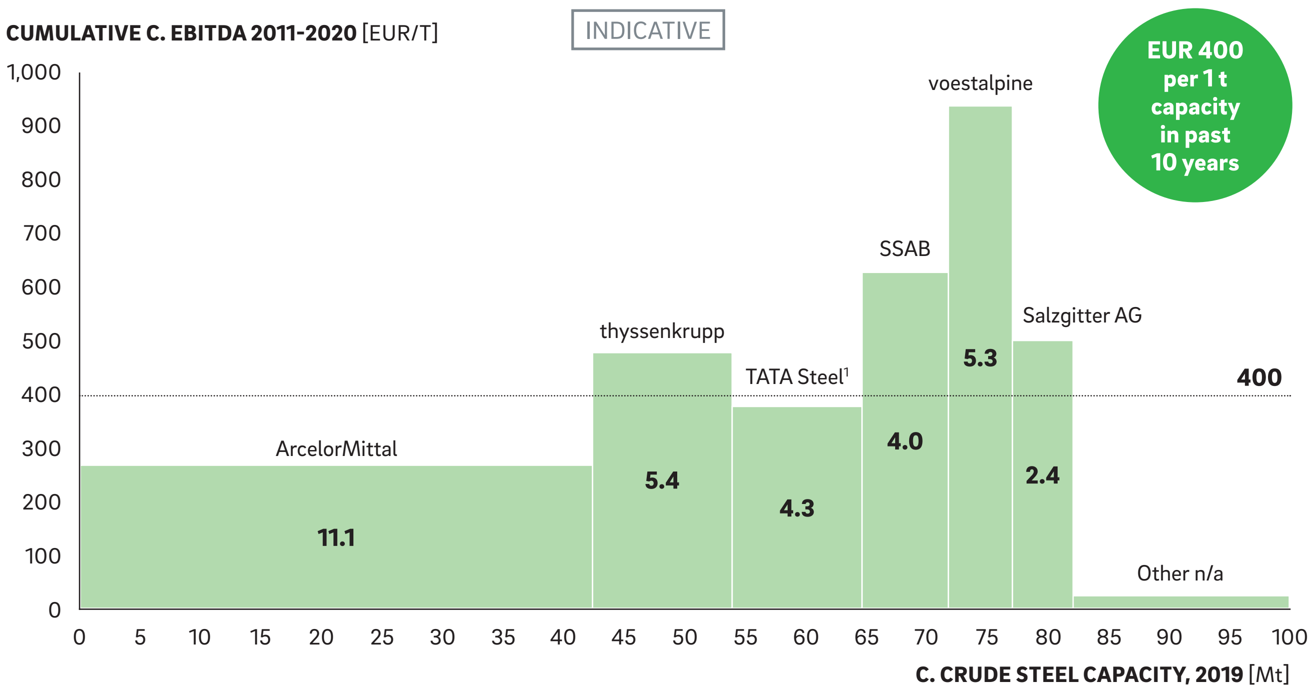
Three groups are likely to have to share the burden. First, the steelmakers, who face the biggest transformation in their history; second, taxpayers, who will contribute via government subsidies; and third, customers and end consumers, who will have to accept higher costs when purchasing steel or steel products due to a lack of alternatives, or who are willing to pay extra for green steel. Below we look at each group in detail.

2.1 STEELMAKERS

As European steelmakers' margins are already low and with the industry struggling due to overcapacities and high exposure to fluctuating raw material costs, we expect that steelmakers will be able to shoulder only a minor share of the total transformation costs.

F: Capacity and earnings

Production capacity and cumulative EBITDA (total and per tonne for 2011-2020) of Europe's top steelmakers



[1] Including Port Talbot   **xx.x** = Cumulative c. EBITDA 2011-2020 [EUR bn]

Source: Company information; CapitalIQ; Roland Berger

Over the past ten years, the large European primary steelmakers earned roughly EUR 400 (EBITDA) on average for each tonne of crude steel capacity. → F

This figure is not a great indicator of future earning power and actual available transformation funds, however. It is not fully available for investments in upstream "green" steelmaking capacity, for example, as it also needs to cover other large positions. These include general re-investments, such as in the full downstream value chain, upgrades in quality and product portfolio, as well as debt and equity financing costs.

As outlined in Chapter 1, green steelmaking technologies are expected to become competitive in this decade or at the beginning of the next. To avoid becoming trapped with uncompetitive conventional steelmaking capacities by missing the transformation, steelmakers should also seek private funding to aid the CAPEX transformation. Banks in Europe provide billions in financing via green bonds, which may be a further option for steelmakers to fund parts of their transformation.

As well as focusing on green transformation cost, steelmakers should also take into account the risk of a slow decline in customers' willingness to pay for conventional steel.

2.2 TAXPAYERS

To help meet their targets, policymakers at EU and member state levels have launched numerous funding programs to support the development of, and conversion to, climate-neutral technologies in the steel industry and primarily focus on CAPEX support.

The European Commission's European Green Deal Investment Plan (EGDIP) aims to mobilize more than EUR 1 trillion in sustainable investments, for example. In addition, around EUR 240 billion[4] of the bloc's post-pandemic NextGenerationEU program funding is dedicated to tackling climate change. Some of these funds, however, specifically the InvestEU program, will be provided by loans leveraging private and public funds. → G

In total, the Green Steel for Europe Consortium[5] estimates that around EUR 2 billion of EU grants (mostly from the European Green Deal) will be available to the steel industry to combat climate change and reduce carbon emissions between 2021 and 2030. The application of the EU's Important Project of Common European Interest (IPCEI) program in the steel sector could contribute another EUR 2 billion, according to the consortium. The sum of both would be far short of the EUR 18 billion CAPEX costs required to transform 29 Mt of production capacity to H_2-DRI-SAF.

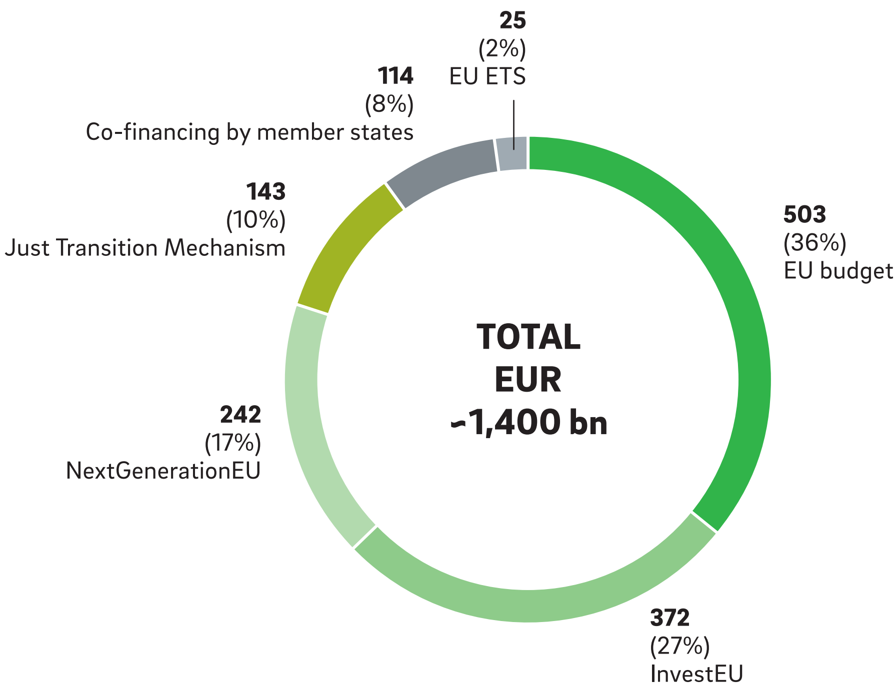
European Green Deal emissions-related funding should further help to close the gap. In today's conventional primary steel production, 1.75 tonnes of CO_2 is emitted for every tonne of steel produced. At 2019 production rates (92 Mt according to EUROFER), this results in direct upstream CO_2 emissions of around 160 Mt per year. This is roughly 4% of total EU greenhouse gas emissions. In a simplified calculation, this would mean the bloc's primary steel industry would have to receive EUR 40 billion (that is, 4%) of European Green Deal funding alone by 2030. Ideally, a similar amount should also go into CAPEX transformation to ensure that if green hydrogen costs remain high, plants can still run on natural gas and meet CO_2 reduction targets in 2030.

Financing from individual EU member states will help to further plug funding gaps. For example, between 2020 and 2023 alone, the German government is supporting the decarbonization of CO_2-intensive industries with EUR 1 billion under its "Decarbonization in Industry" program.

[4] European Commission, The EU's 2021-2027 long-term budget and NextGenerationEU, April 2021

[5] Green Steel for Europe Consortium, Green Steel for Europe report, March 2021

G: European public funds until 2030
Breakdown of sources of EU funding for green transformation of steel [EUR bn]



Source: European Commission

Regulation

In addition to providing funding, policymakers must also create the right regulatory framework conditions to enable the green transformation of European steel producers in the face of intense global competition. The EU's Carbon Border Adjustment Mechanism (CBAM) aims to ensure that European industries, such as steelmaking, are not at a disadvantage compared to non-EU competitors that have lower production costs due to a higher unregulated carbon footprint in their home market. The scheme is planned to be introduced by 2023, and from 2026 will impose a levy on EU importers of non-EU products that do not meet EU regulations. They will pay the same carbon charges EU emitters pay on indirect emissions generated by non-EU importers abroad.[6]

However, the CBAM still faces major challenges. The mechanism must be made WTO compliant, and the question of how indirect CO_2 emissions in imported products are measured is very complex. For example, which CO_2 emissions are included in long, complex and partly non-transparent production and supply chains? For steelmakers, it is particularly relevant whether, for example, only semi-finished and finished steel products are subject to a CO_2 price when imported, or processed material, such as those found in cars, are too.

In addition, to maintain the competitiveness and exportability of European industry and steelmakers in global markets, the CBAM would need to work in both directions. So compensation for CO_2 emissions costs or for the additional production costs of climate-friendly steel must be provided for steel exported from the EU to ensure a level playing field.

2.3 CUSTOMERS AND CONSUMERS

The green transformation of the steel industry will inevitably result in higher costs for customers and end consumers, where the customer is, for example, a carmaker and the end consumer is the buyer of a car.

In general, there are two different types of green steel products, both of which can be sold to customers at a premium. The first, available soon, is statistically green steel. Here, the emissions savings achieved through CO_2 reduction measures, such as using hydrogen in the blast furnace, are calculated and proportionately allocated to coils of the product. This allows climate-conscious customers to order and buy greener coils at extra cost. Another benefit is that because the statistical allocation of CO_2 savings is completely detached from the production of a specific coil, steel producers do not have to focus on specific product groups or customer industries. They could even flexibly sell their CO_2 savings in the form of certificates to the highest bidder. These could conceivably be sold directly to climate-conscious end users, such as car buyers.

The second type of green steel product, available around the middle of the decade, is actual route-specific green steel. This is steel produced via a route that is fully transformed, making it almost completely carbon neutral. As a result, customers have the option to buy actual physical green steel.

There's no getting around the fact that the green transformation of steelmaking will be very expensive for the general public. But while the price may be high, the price of doing nothing is higher.

Will customers pay for green steel?

How much customers and end consumers are willing to pay for climate-neutral steel, and must pay for climate-neutral steel (costs passed on by steelmakers), will depend on several factors.

Factors affecting willingness to pay:

- The development of climate consciousness among end consumers to voluntarily pay extra for climate-neutral

[6] European Commission, Proposal for establishing a carbon border adjustment
[7] Ecosystem Marketplace, State of Voluntary Carbon Markets, December 2020
mechanism, July 2021

products. We expect this to increase significantly over the next few years, especially if carbon footprint labels are introduced. However, using voluntary carbon offset payments (usually EUR 1-5 per tonne of CO_2 emitted[7]) as an indicator of overall willingness to pay premiums for CO_2 emission reductions, current willingness is likely to be low.

- Based on today's primary route steelmaking emissions, the voluntary carbon offset price translates into a premium of less than EUR 10 per tonne of steel. We see this as a lower boundary for the high-volume market.

- Customers' strategies to position as a climate-friendly company. We expect specific industries and niches, for example luxury electric cars, to be far more willing to pay for climate-neutral steel.

- Even for a standard car in the EU, a price rise of just 0.5% would be enough to cover the additional costs of producing its steel parts from climate-neutral steel (based on a cost of around EUR 30,000 and a steel content of around 0.8 tonnes).

Factors affecting how much customers must pay:

- We expect political and public pressure on steel customers to reduce scope 3 emissions (indirect emissions in the value chain) to increase significantly over the coming years. Automotive OEMs, for example, have already started to make scope 3 emissions transparent throughout their supply chain.

- Possibility of customers switching to substitutes. This is low overall.

- Effectiveness of the CBAM. If it does not work, foreign steel producers with lower CO_2 emissions costs will offer better prices and squeeze out EU steelmakers.

- Possibility of non-EU customers switching to cheaper non-climate-neutral steel if there are no sufficient CBAM export compensation payments.

- The extent to which steelmakers with higher margins or lower green transformation and production costs take advantage and push other steelmakers out of the market, or at least gain market share by not increasing prices in line with increasing productions costs. For example, new player H_2 Green Steel, based in Sweden, is planning to leverage the cheaper green energy available in the Nordic countries.

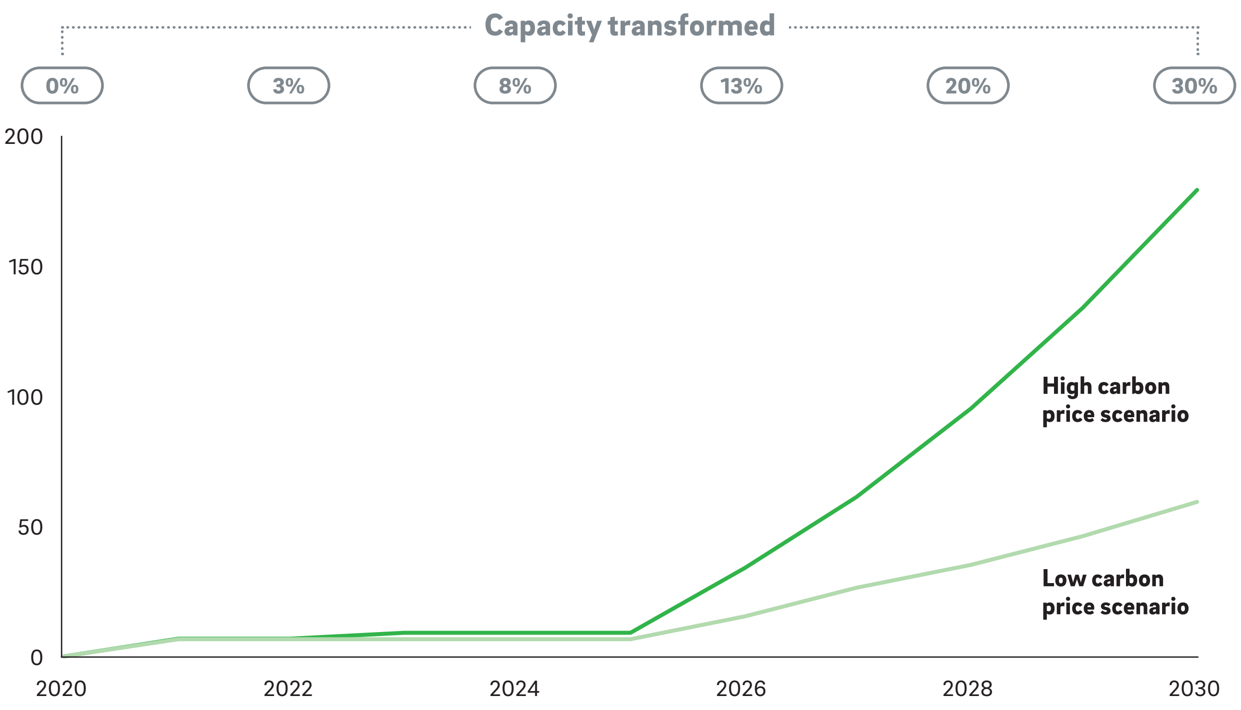
- Increase in price of conventionally produced steel due to increasing emission costs.

What level of additional costs can be passed on to customers?

With these factors in mind, we made an assumption-based calculation to give a rough idea of the share of additional costs of green steel that can be passed down the value chain. Assumptions include an effective CBAM, few substitution possibilities (including no substitution by shifting more steel production to the secondary route) and an unchanged power ratio between steelmakers and customers.

First, we estimated the production capacity transformed each year until 2030. Then, based on the respective shares of the "do nothing" case and the most favorable "green steelmaking" case, we calculated the average minimum additional costs per tonne of steel for each year. The result is that in both the high and low carbon price scenarios, steelmakers can expect to pass on a significantly higher share of additional production costs starting in 2026. This is the year the number of free allowances start to decrease, and carbon costs start to show their full impact. → H

H: Sharing the burden
Indicative higher limits of the share of costs that steelmakers can pass on to customers based on average minimum additional costs per tonne of steel from production mix [EUR/t]



Source: Ecosystem Marketplace; ICCT; World Steel Association; Statista; Roland Berger

The resultant cost curves should be considered upper limits due to the strict model assumptions and the fact that costs covered by subsidies cannot be passed down the value chain.

We expect that passing on additional CO_2 emissions costs from conventional steelmaking will be much harder. This is especially true if there is a sharp increase in CO_2-emission costs, which quickly makes green steelmaking more economical than conventional steelmaking. There is therefore a risk that steelmakers who fail to convert their capacity early might face existential EBIT declines.

Conclusion: A way forward

It's clear that time is of the essence when it comes to the green transformation of EU primary steel production. Lengthy subsidy processes and long lead-in times for planning and construction mean the industry needs to shift up a gear to meet the target of a 30% reduction in CO_2 emissions compared to today's level.

FUNDING RECOMMENDATIONS

Current funding amounts and discussed timeframes for the introduction of the CBAM, especially if there are long transition phases in which free allowances are still available, will make it very tough to achieve the target.

The steel industry does not have the financial power to carry out the green transformation alone. A significant share will have to be borne by taxpayers and customers/consumers. How much will it cost them? According to our calculations, a rapid green transformation of the EU primary steel industry will require government CAPEX funding in the double-digit billion range. At the same time, they will also need to introduce an effective CBAM and adequately increase the costs for CO_2 emissions. This should include a swift reduction of free allowances to 0% to ensure the CO_2 reduction target is met.

INDUSTRY RECOMMENDATIONS

Besides funding, meeting the 2030 target will also require operational and structural changes. Primarily, due to uncertain forecast reliability of green hydrogen and CO_2 emissions prices, steelmakers should opt for fuel-flexible DRI furnace technologies. These allow blending of and flexible switching between natural gas and green hydrogen reductants. It also makes sense to transform a significant part of steel capacity during the transition period so that plants can use natural gas in direct reduction while hydrogen prices remain high (or green hydrogen is unavailable in the required quantities) and still meet the 2030 target.

Finally, in order to ensure climate-neutral primary steel production in the long term, the development of a competitive green hydrogen industry must start now. In conclusion, there's no getting around the fact that the green transformation of steelmaking will be very expensive for the general public, either through tax-funded subsidies or increasing product prices. But while the price may be high, the price of doing nothing is higher. According to the majority of research, the costs associated with climate change caused by human emissions are likely to be many times higher still.

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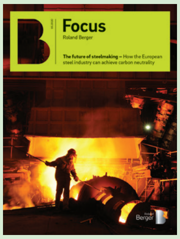
Roland Berger Focus / **The future of steelmaking**



Our new publication on the economic and regulatory implications of the green steel transformation builds on our 2020 publication "**The future of steelmaking** – How the European steel industry can achieve carbon neutrality" where we discussed the availability and advantages of decarbonization technologies for the industry

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