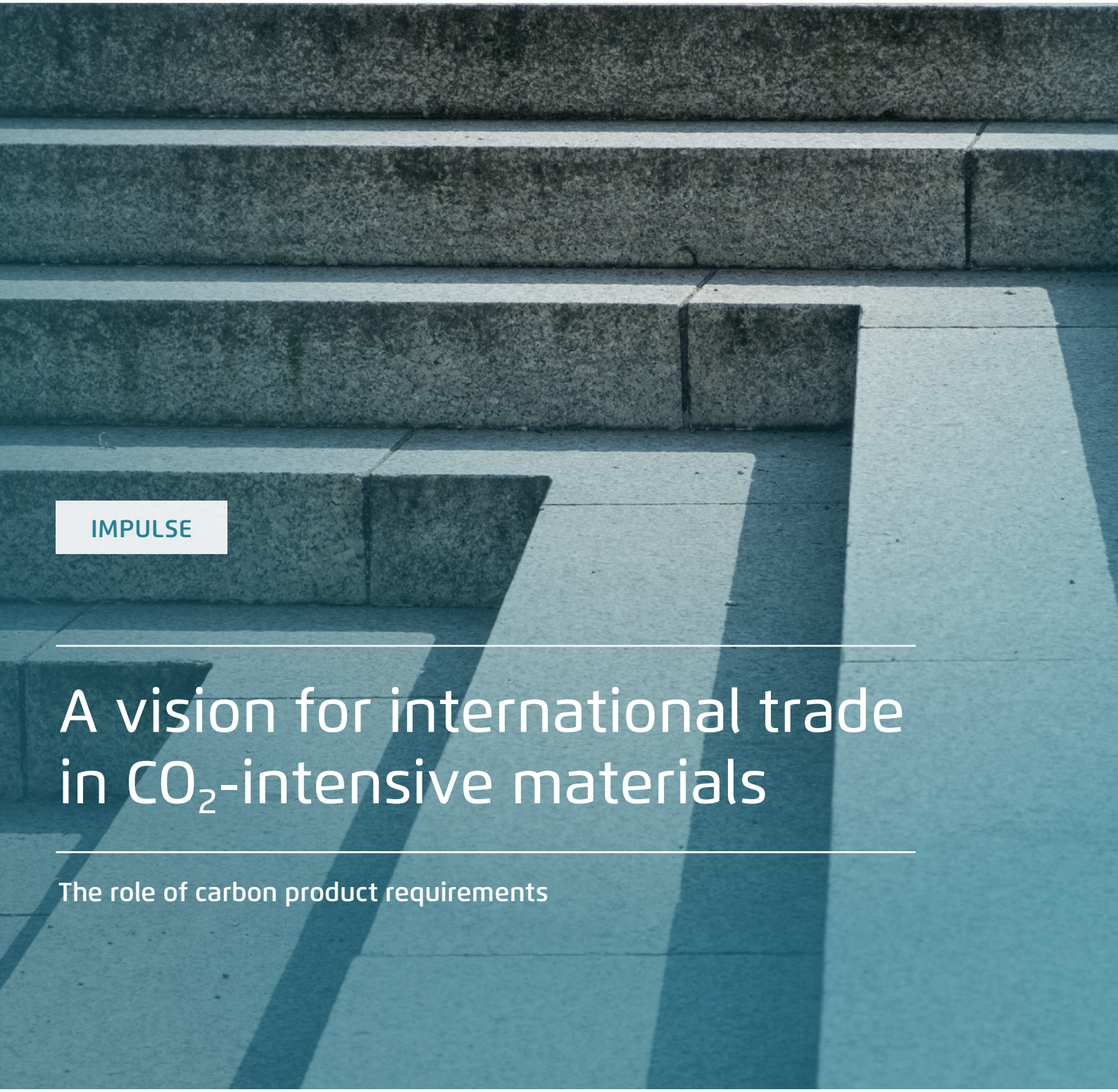
Agora Industry



IMPULSE

A vision for international trade in CO_2-intensive materials

The role of carbon product requirements

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Agora Industry is solely responsible for this impulse and the conclusions and recommendations thereof.

Preface

Dear reader,

Transitioning industrial sectors to net-zero emissions requires a mix of policy instruments, to be designed and implemented still in this decade. The specific policy mix to decarbonise basic materials will vary between jurisdictions: Whereas some governments put the "polluter pays" principle at the center of their decarbonisation strategies, others choose an approach based on subsidies.

For internationally traded goods like steel, aluminium, chemicals and cement, the divergence of policies poses a challenge to coordinate and ramp up ambition among a broader set of countries. Coordination on a common framework is crucial for achieving the speed and scale needed for a global industry transition in line with climate targets.

In this impulse, we propose carbon product requirements for basic materials as an international framework to ensure that emissions-intensive production pathways are phased out at scale. Carbon product requirements can bridge different national decarbonisation strategies and starting points of emerging and developing economies.

Together with international lead markets for low-carbon basic materials, they can provide the regulatory signal to move transition plans into final investment decisions. International forums for industry decarbonisation should kickstart the implementation of such a framework in their work programs.

I wish you pleasant reading!

Yours,
Frank Peter
Director, Agora Industry

Key findings at a glance

1 **Countries implement different policy approaches to transform their energy-intensive industries such as steel, cement and chemicals.** An international framework is needed to bridge those divergent strategies and allow countries to align on common targets. Without such a framework, carbon leakage risk will continue to impede industry decarbonisation and risk carbon lock-in.

2 **Carbon product requirements (CPRs) can be a platform for global collaboration.** CPRs can co-exist with national carbon pricing systems, subsidies and other decarbonisation policies. They can bridge the differences in policy approaches between countries while allowing for joint decarbonisation milestones. The stringency of CPRs can easily be increased over time to ensure that carbon-intensive production pathways are phased out.

3 **CPRs can accommodate different starting points of emerging and developing economies.** Together with a fit-for-purpose financial architecture targeted at decarbonising industry in developing and emerging economies, such a regime can be an attractive proposal to address their significant risk of carbon lock-in. Therefore, efforts to coordinate on common CPRs need to include the largest producer countries of basic materials.

4 **Existing international initiatives should include CPRs in their work programs.** Progress on international emissions measurement standards and labels is an important foundation for CPRs. Existing forums like the Climate Club, Industrial Deep Decarbonization Initiative, G7 and G20 should build on this foundation and work towards phasing out carbon-intensive production through CPRs in parallel to creating global lead markets.

Content

List of abbreviations

Term	Explanation
BF-BOF	Blast Furnace-Basic Oxygen Furnace
CAPEX	Capital Expenditure
CPR	Carbon Product Requirement
CBAM	Carbon Border Adjustment Mechanism
CCfD	Carbon Contracts for Difference
CCUS	Carbon Capture, Utilisation and Storage
CSRD	Corporate Sustainability Reporting Directive
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EITE	Energy-Intensive Trade Exposed (e.g. steel, chemicals)
EPA	Environmental Protection Agency (United States)
ESPR	Eco-Design for Sustainable Products Regulation
EU	European Union
EU-ETS	European Emissions Trading System
GATT	General Agreement on Tariffs and Trade
GSA	Global Arrangement for Sustainable Steel and Aluminu
IDDI	Industrial Deep Decarbonization Initiative
OPEX	Operating Expenses
TBT	Technical Barriers to Trade

1 Introduction

This decade is decisive for industry decarbonisation. Industrial installations have long life cycles and re-investment in conventional, emissions-intensive productive capacity would create carbon lock-in or risk stranded assets. The necessary technologies to achieve deep emissions reductions in energy-intensive, trade-exposed (EITE) industries such as steel, cement, aluminium and chemicals are largely known, but the international framework to create regulatory certainty and investment confidence is still lagging behind.

In the current, still early phase of the industry transition, large differences are emerging between governments in their choice of national decarbonisation ambition and policy pathway. While some jurisdictions are putting in place stringent frameworks for the decarbonisation of their emissions-intensive industrial sectors, others still allow large investments into carbon-intensive production technologies. Moreover, the types of policies applied by jurisdictions vary greatly.

This divergence in decarbonization pathways risks slowing down the transition: basic materials are internationally traded goods, so that national producers operate in the context of competitive pressure from producers in other jurisdictions, impacting their ability to transition to low-carbon processes. To overcome this impasse, a common framework for policy convergence is needed. At best, such a framework can unlock global decarbonisation ambition beyond OECD countries by accommodating different starting points of emerging and developing economies, reducing carbon leakage risks, scaling demand markets for decarbonised basic materials and providing regulatory certainty to producers and investors.

The purpose of this paper is to propose such a medium-term vision for convergence in industrial decarbonisation policies, namely towards international carbon product requirements (CPRs) for energy-intensive products like steel, cement, aluminium and chemicals. We argue that CPRs can form the basis for a global regime that allows for different national policy mixes but provides a common vision for convergence towards net-zero.

In the next chapters, we discuss the following questions:

→ How do diverging policy approaches impede the global transition to net-zero industry?

→ What are CPRs and how could they be designed for international cooperation on industrial decarbonisation?

→ How would CPRs interact with existing carbon leakage and industrial decarbonisation policies?

→ How could CPRs be implemented as part of a global framework for trade in energy-intensive goods?

2 Divergent approaches towards net-zero industry

We currently see a divergence in the policy approaches that jurisdictions choose to decarbonize their industrial sectors. This divergence occurs along two dimensions: One dimension is the level of ambition of national decarbonisation policies. The other is the specific policy mix chosen by jurisdictions to drive down emissions in their industrial sectors.

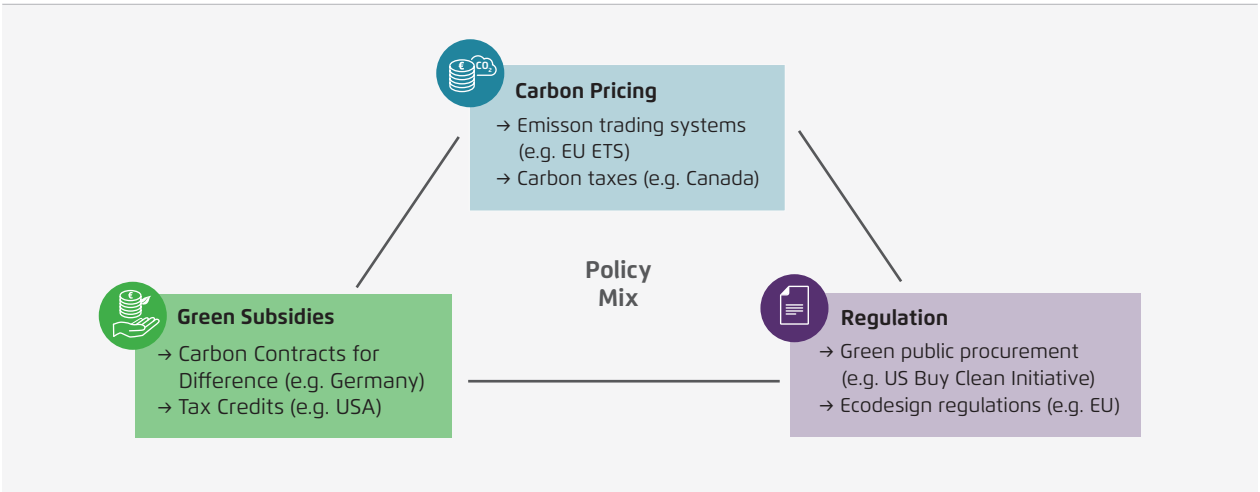
Different policy options exist to reduce industrial emissions. The feasibility of those options is deeply dependent on national politics and the availability and maturity of technologies. Broadly speaking, governments can incentivise the transition to low-carbon production processes by putting a price on emissions through an emissions trading system or a carbon tax. Alternatively, they might choose to incentivise low-carbon production processes through subsidies for clean technologies, e.g. subsidising capital expenditure (CAPEX), operational expenditure (OPEX), or providing tax incentives. Finally, governments might simply regulate emissions intensities.

It is important to note that no jurisdiction purely follows just one of these approaches. Most countries implement a policy mix to achieve their desired outcomes. While the United States places greater emphasis on incentivising clean production through subsidies, its subsidies are also complemented by regulatory changes. Similarly, while the EU has an emissions trading system at the core of its climate policy, it too has sizeable subsidy programmes that support companies in their low-carbon investments.

Since energy-intensive trade-exposed (EITE) sectors like steel, cement, aluminium and chemicals are homogeneous goods that face competitive pressure from international markets, the specific policy mix and level of ambition adopted by one jurisdiction will impact the effectiveness and competitiveness of decarbonisation pathways in other jurisdictions.

In the following, we map out the different approaches to industry decarbonisation and discuss the challenges of divergence for the global industry transition.

Three types of policy approaches to reduce industrial emissions → Fig. 1



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2.1 Putting a price on carbon

The *polluter pays* principle states that those who cause pollution should bear the costs of managing it. In accordance with this, economists view the application of a price to greenhouse gas (GHG) emissions as the first best policy to reduce emissions, because it adjusts market prices to (partially) reflect the true cost of production. The ensuing change in relative prices between high-emission and low-emission technologies shifts decision making towards cleaner production processes. It creates dynamic efficiency by incentivising research and development of new technologies to decrease emissions even further. The polluter pays principle therefore partially corrects for the market failure of negative externalities like carbon emissions. Globally, the polluter pays principle is applied through carbon taxes and emissions trading systems. There are currently over 70 carbon pricing initiatives[1] in place, many of which differ markedly on fundamental regime features such as the price of carbon, the sectors and gases covered, the use of offsets, as well as the competitiveness protections granted.

Jurisdictions where the polluter pays principle leads to stringent pricing face the risk of carbon leakage – a problem almost exclusively associated with EITE sectors like iron and steel, aluminium, chemicals and, to some extent, cement. Carbon leakage occurs when climate policies cause productive capacity shifts to countries with less stringent policies, because production there is cheaper due to lower compliance costs. As a result, emissions simply shift from jurisdictions with high carbon prices to those with lower ones.

As such, carbon leakage is a function of divergent carbon pricing policies. If there were a harmonised global carbon price, carbon leakage could not occur. But, as noted above, existing regimes vary widely and a global harmonisation of carbon pricing is unrealistic for the foreseeable future (even industrialized G7 countries have failed to coordinate on a common approach).

To prevent this carbon leakage, jurisdictions have historically exempted EITE sectors from carbon pricing systems or distributed free emission allowances to these sectors. However, both practices mute the transformation signal of the carbon price. Therefore, the European Union has put in place the Carbon Border Adjustment Mechanism (CBAM), that will apply the same carbon price that EU producers face to imports, starting in 2026, in parallel to phasing out the practice of free allowances. The United Kingdom recently announced a similar measure that will become effective in 2027.

2.2 Subsidizing low-carbon technologies

Subsidies are justified when market forces alone do not deliver the socially desirable outcome: If the wider social benefit is not priced into an investment or consumption decision, underinvestment or underconsumption will occur from a social welfare perspective. In the green industrial transition, the social benefit of reducing carbon emissions or of advancing the dissemination of technologies that reduce emissions will not enter the cost-benefit analysis of individual investment decisions. Furthermore, many of the required technologies for deep decarbonization of industrial sectors have not been tested at scale, leading to significant investment risk that may require mitigation through subsidy instruments. Therefore, a subsidisation of CAPEX or OPEX can make sense. The same is true for indirect subsidisation by creating lead markets for higher-priced low-carbon goods through green public procurement.

Under a subsidy-based approach, companies do not face the risk of carbon leakage. They can continue the production of emissions-intensive goods or decide to make use of the incentives provided by the government. Achievement of decarbonisation targets is thus directly dependent on subsidy uptake and may need to be accompanied by other policies to ensure the phasing out of conventional production processes.

1 See the World Bank's Carbon Pricing Dashboard for an overview: https://carbonpricingdashboard.worldbank.org (accessed 24 April 2024).

Greater public support for the transition is a welcome development. It provides fiscal forward guidance for the transition, strengthens business cases and accelerates technological progress. However, large subsidies by one jurisdiction might also lead to a race to the top in subsidies with trading partners. This carries at least two significant risks: First, governments might waste scarce fiscal resources earmarked for the green transition to outbid trading partners with the aim of attracting productive capacity and gaining global market share. In this scenario, no new investment is created through subsidisation, only the location of the investment is altered. Second, only few governments have the economic firepower to support a heavy-subsidies approach to decarbonisation which perpetuates global inequities and can undermine the global buy-in and business case for decarbonising industry in emerging and developing economies.

2.3 Regulating embodied emissions

Regulation has not yet played a large role in the deep decarbonisation of energy-intensive basic material sectors. Existing advances to regulate emissions have targeted demand sectors such as the building and construction sector or the automotive sector. For example, the Netherlands have introduced a buildings regulation which sets a carbon cap on embodied emissions in buildings. In California, the *Buy Clean* Initiative has introduced embodied carbon thresholds for purchasers of building and construction products procured by the state government (Climate Change Committee, 2020). Through such nascent regulations of down-stream products, demand for low carbon industrial goods and materials can be created on a clear timeline and decarbonization of production can be incentivized (Frontier Economics, 2022). However, there is not yet regulation in place that directly targets the deep decarbonization of basic material *production*.

In other areas, regulation has a proven track record in bringing down emissions: For example, there is a long history of automobile efficiency standards to reduce environmental impacts of cars. Similarly, the EU's Ecodesign Directive has established a mandatory framework prescribing ecological requirements for energy-related products. This has led to lower energy consumption and thus CO_2 emissions of the covered products. Under the EU Green Deal, the current Ecodesign Directive was replaced by the Ecodesign for Sustainable Products Regulation, which expands the scope beyond the initial set of energy-related products and include new requirements for environmental sustainability and circularity, amongst others. Regulatory stipulations have been shown to be an effective tool for decarbonisation, requiring not only domestic companies, but also imported goods to comply with a certain level of environmental performance.

Cutting emissions through regulation is only possible if the necessary technology for compliance is available at scale. The level and timing of phasing in regulation must take into account current and potential future technological maturity. This is not a simple task, among other things because future technology maturity is not pre-determined, and one of the aims of regulations such as automotive efficiency standards is in fact to drive innovation more quickly than would otherwise be the case. In this paper, we argue that carbon product requirements can be a regulatory approach to phasing out high-emitting industrial goods under a technologically viable schedule and in coordination with trading partners.

2.4 The challenge of diverging policy approaches

The inability of the G7 to coordinate on a stringent agenda for industrial decarbonisation during initial negotiations of the Climate Club showed that agreement on a joint policy approach is difficult to achieve, even among highly developed and structurally similar countries. Since the feasibility of any policy approach is contingent upon winning national majorities, it is perhaps inevitable that differences will remain in the policy mixes chosen to decarbonise industrial installations.

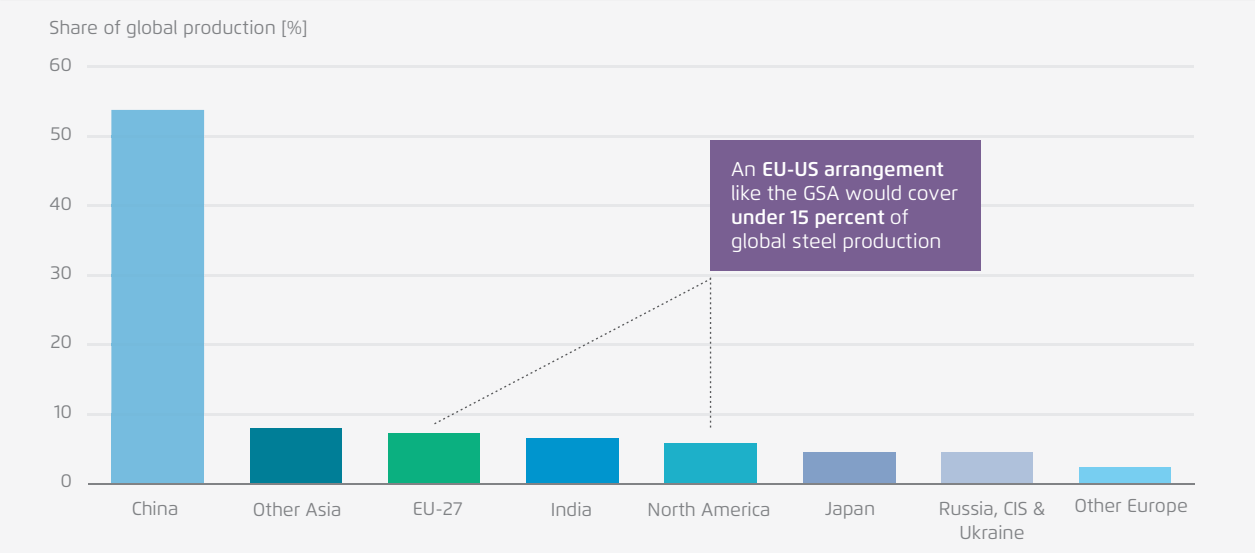
But the current divergence of policy mixes poses challenges for the larger industry transition. The divergence in strategies and pathways makes it difficult for jurisdictions to jointly ramp up ambition by formulating common decarbonisation targets. First, it is currently impossible to synchronize decarbonization ambition between jurisdictions that follow a subsidies-based approach and jurisdictions with a carbon tax or a cap-and-trade system for emissions certificates. There simply is no framework, or common instrument, through which to ensure that countries are jointly converging towards net-zero industry. Second, this challenge is exacerbated by the different starting points of emerging markets and developing economies. There is not yet a platform or mechanism that can accom modate for the different trajectories of emerging and developing economies, acknowledging both their need for industrial development and significant risk of carbon lock-in. But why is this convergence necessary?

Carbon leakage risk is a direct function of differences in policy approaches and ambition. As long as large differences prevail between jurisdictions in their decarbonisation ambition will governments be hesitant to impose strict pricing or regulation on their energy-intensive sectors. There is little support for climate policy in industrial sectors unless it is perceived that others move, too, given that basic materials are price-sensitive and internationally traded. The differences in specific policy mix and decarbonisation ambition can thus undermine the policy effectiveness and buy-in for individual jurisdictions' decarbonisation pathways, leading to a vicious cycle of impeded climate action (Clausing, K. and Wolfram, C., 2023).

Policy action is urgently needed: It is expected that the world will demand the equivalent of another New York City's worth of steel and concrete every month for the next 40 years, with much of this growth occurring in developing and emerging markets (UNIDO, 2021). It is pressing that ambitious transition plans be implemented globally because any new investment in emissions-intensive industrial installation will be operational for at least the next 20 to 30 years, locking in further emissions for the time being.

A look at the growing share of emerging and developing economies in global production reveals just how critical it is to find a globally scalable solution

Regional share in global crude steel production in 2023 (in percent) → Fig. 2



World Steel Association (2023). CIS = Commonwealth of Independent States, including Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Uzbekistan; GSA= EU-US Global Arrangement on Sustainable Steel and Aluminum

that goes beyond industrialised countries. While G7 countries in 2010 still accounted for 34.3 percent of global GDP and BRICS countries for 26.6 percent, the picture has reversed in 2023: BRICS countries accounted for 32.1 percent of global GDP and G7 countries for 29.9 percent. Looking at the EITE sectors in particular, the G7 share in production has fallen drastically, while the share of China, India and the rest of the world has increased (IEA, 2022). To illustrate, Figure 2 shows that sectoral negotiations under the EU-US Global Arrangement for Sustainable Steel and Aluminium would cover an insufficient share in global production if it were designed in a way that is exclusive of other large producer countries.

Any international framework for policy convergence towards net-zero therefore needs to accommodate not only different national policy mixes, but must also make an attractive offer to emerging and developing economies to join such an effort. Acknowledging this, we argue that a broad set of governments should collaborate on a schedule for common carbon product requirements (CPRs) for basic materials as a key element of international cooperation on industrial decarbonisation. We expand on WTO legality, design features, benefits and governance of such a scheme in the following chapters.

3 Carbon product requirements for energy-intensive materials

No single policy is a silver bullet that can solve all the challenges of industrial decarbonisation, but CPRs could go a long way toward addressing the issues explored above.

First, they would provide protection from carbon leakage for any country that has implemented them. The most likely avenue for implementation of CPRs would be as a condition for sale on the domestic market of the implementing country, but any possible approach would amount to a de facto ban on imports of any goods produced in a manner that is more carbon intensive than the standard. This would effectively prevent the import of carbon-intensive goods from causing leakage from the domestic market. For international legitimacy, the legislating jurisdiction should further place product requirements on all domestic production (i.e. not just products produced for domestic consumption), to avoid resource shuffling of carbon-intensive production for export markets.

If CPRs could be agreed by more than one country as part of cooperative climate ambition, they would also provide protection against leakage into export markets, at least with respect to trade between these agreeing jurisdictions. For this effect to be significant, it would require agreement among a critical mass of importers and exporters of the covered products.

Second, compared to other tools of leakage protection, such as carbon border adjustment and green subsidies for industry, CPRs might be less controversial and politically divisive. As noted above, they can very likely be crafted in ways that are WTO compatible, and they take a form – performance standards as a condition of sale on domestic markets – that is used by most countries in other contexts. They involve neither payments to nor a diversion of investment to the implementing country.

Third, CPRs would provide jurisdiction-wide markets for the low(er)-carbon products of decarbonising producers, even while those producers bore the initial costs of transforming production, learning by doing, and attaining returns to scale.

Fourth, CPRs are amenable to use by countries that are following very different approaches to climate policy and that are starting from very different baselines. In that sense, they provide a realistic compromise for international cooperation to prevent export market-related leakage. This aspect of CPRs – one of the key features that sets them apart from other tools for leakage prevention – is explored further in chapter 4.

Benefits of Carbon Product Requirements

→ Fig. 3

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Fifth, CPRs can easily serve the objective of increasing ambition over time. A schedule of reduced allowable thresholds for GHG intensity is a simple thing to legislate, even if deciding the schedule – which involves estimating future technological progress and cost reductions – would be challenging. Such a schedule would create the kind of regulatory certainty that investors need to make transformative investments in industrial decarbonisation.

3.1 Technical implementation of Carbon Product requirements

Carbon product requirements (CPRs) are a form of regulation whereby the sale of carbon-intensive goods would be banned in legislating jurisdictions. CPRs can be applied at different stages of the value chain, i.e. on primary, intermediary or final products. As discussed above, there are already practice cases of embodied carbon regulation for building materials – which is an example of a product requirement further downstream in the value chain. In the context of energy-intensive goods like iron and steel, aluminium, cement, concrete and chemicals, CPRs would constitute a production-related emissions requirement that goods would need to meet to be allowed to be placed on the market for consumption. The carbon product requirement would be enforced at the point of sale. It would apply equally to imported and domestically produced goods.

Coverage

CPRs should be formulated for a subset of the most energy-intensive basic materials. These products are homogeneous and often internationally traded, exposing them to the risk of carbon leakage.

Selecting products for the application of CPRs is a question of both breadth and depth. The question of breadth refers to the type of basic material to include. Candidate materials could be iron and steel, aluminium, and chemicals like fertiliser and hydrogen due to their energy-intensive production processes and exposure to pressure from international trade.

The question of depth refers to the regulation's coverage along the value chain. One complication is the circumvention potential by foreign exporters who could seek to work around CPRs by processing basic goods to just beyond the level of the regulation's coverage on the value chain. If the CPR standard applied just to basic iron and steel, for example, foreign producers would use their non-compliant basic steel to make steel pipes, and ship those instead. The CPR regulation would have to require the use of compliant inputs in goods far enough down the value chain that the risk of leakage was minimised. The inclusion of precursors and downstream products under the EU CBAM is an instructive example of the trade-off between completeness or leakage protection and administrative pragmatism.

It is worth noting that the larger the set of countries that can agree on CPRs amongst themselves, the lower the risk of circumvention becomes. International collaboration thus raises the question of feasibility: How does ambition in breadth and depth affect the ability of a larger set of countries to coordinate on CPRs for a larger set of products? An effective scheme should therefore prioritise a subset of very energy-intensive internationally traded basic materials and make use of political windows of opportunity, where coordination already exists, like the work programme of the Climate Club or further negotiations between the EU and US following the work under the GSA (with an emphasis to expand membership to more countries).

Technical Requirements

A precondition for setting CPRs at the international level is agreement on product-level emissions measurement and reporting standards (or their interoperability) as well as agreement on the thresholds at which the carbon product requirements apply.

In the steel sector, there are already advanced efforts to arrive at international measurement and reporting standards for the embodied carbon content of a tonne of steel. The International Energy Agency (IEA) has conducted an in-depth analysis of existing

emissions measurement methodologies (IEA, 2023), while the Industrial Deep Decarbonisation Initiative works with governments to standardise emissions measurement and establish green procurement targets. At COP28, 36 key steel producers, industry associations, standard setting bodies, international organisations and initiatives have endorsed the Steel Standards Principles which lay out a framework for common emissions measurement in the steel sector. The German steel industry coordinated on a standardized classification and calculation method under the label *LESS*. Finally, the EU might have a first mover advantage in de facto setting a global standard for emissions reporting in the covered sectors with its Implementing Regulation covering the transitional methodology for reporting embodied emissions for CBAM goods (European Commission, 2023).

Once these standards are in place, thresholds for the CPR as well as a schedule for phasing in these thresholds need to be defined. Under such a scheme, products with actual embodied carbon above the limit value would be effectively banned from being placed on the market. This approach would be technology neutral and can accommodate a ratcheting mechanism that impels technological progress and gradually leads to net zero.

The thresholds under a CPR regime could optionally be based on current efforts to develop a labelling system for the carbon intensity of basic materials such as steel and cement – but could also be set in the absence of a common labelling system (see Box 1).

Timing

Ambitious CPRs cannot be implemented immediately at levels beyond those that existing producers can meet based on their production processes and availability of low-carbon inputs like renewable energy. However, already that the announcement of such CPRs would create a clear vision and targets for the basic material sectors as well as stimulate innovation and send a clear signal to financing institutions.

Initially, CPRs could be phased in as reporting obligations (which are required under CBAM as well as under the EU's Construction Products Regulation anyway) and then – with sufficient transition time – translate into CPRs with increasing stringency.

The timing and ratcheting mechanism of CPRs would need to consider the different levels of technological readiness for each basic material value chain. To return to the example of steel, Agora Industry (2023) has shown that a net-zero iron and steel sector and a coal phase-out in steelmaking in the early 2040s are technically possible. Committing to such a decarbonisation pathway by announcing a corresponding CPR would give the necessary regulatory certainty and stimulate the critical investment to meet climate targets in industrial sectors. Moreover, such a ratcheting mechanism lends itself for anchoring decarbonization ambition in the Nationally Determined Contributions (NDCs) of jurisdicitons.

3.2 WTO compatibility

Could such a product-level regulation be designed to comply with international trade rules? So far, the concept of CPRs has not been widely discussed in the literature. Gerres et al. (2021) provide an analysis of CPRs in the basic material sectors with respect to WTO law. In their paper, they analyse the role that CPRs could play in the context of the European industry transition and assess how such an instrument might be evaluated from a WTO legal perspective. While WTO compatibility cannot be fully assumed ex ante, the authors conclude that CPRs can be designed in a way that minimises the risk of violating WTO law. In the following, we briefly summarise key considerations.

Generally, whether a measure that impacts trade can be considered compliant with WTO law depends on its design and implication for trade flows. The relevant WTO agreements in this case are the General Agreement on Tariffs and Trade (GATT) or the Technical Barriers to Trade (TBT) Agreement.

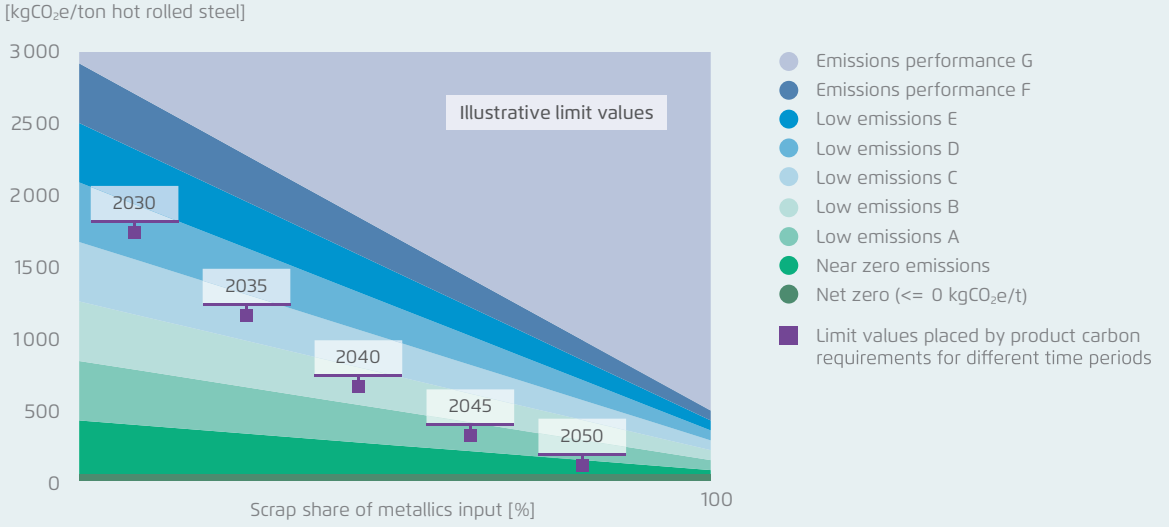
Infobox 1: How carbon product requirements can be implemented on the basis of a steel labelling system

The steel sector is the most advanced in arriving at an international consensus for emission measurement and accounting methodologies for steel products. Different organisations have proposed thresholds to divide emissions intensities into emission grades or "labels" to capture the heterogeneous production routes and final products. The so-called *sliding scale* features different benchmarks as a function of the percentage of scrap steel used in production (see Figure 6). The benchmarks at all levels of scrap use would be made more stringent over time, but the rate of tightening would be higher for processes using less scrap, such that eventually the benchmark converges. This reflects the technological convergence in production routes as the BF-BOF route is phased out.

While CPRs could technically be formulated without agreeing on a labelling system, labels can offer orientation for a ratcheting mechanism and simplify the formulation of a CPR for several steel products. Announcing CPRs for steel products starting from 2035 could provide the necessary regulatory certainty to prevent jurisdictions in relining their BF-BOF routes for another life cycle. In the United States, for example, such plans exist and would therefore prolong conventional steel production well into the 2040s. A CPR from 2035 onwards that would only allow the production and sale of steel emission grades *Low emissions C* and lower on markets of advanced economies could effectively prevent these investments and thereby provide a policy complement to incentive schemes such as carbon pricing and green subsidies.

In 2040, this CPR could then be lowered to grades Low emissions B and below to arrive at the Near-zero emissions grade in 2045 and Net-zero grade in 2050. The ratcheting would reflect the scale and availability of hydrogen or traded green direct-reduced iron (used in steelmaking and is in line with a technically possible coal phase-out in steel between 2040 and 2045, as discussed in Agora (2023a)). To accommodate for different starting points and levels of development, more leeway could be given to developing and emerging markets as discussed in Section 4.2. However, a coal phase-out in steelmaking should not be delayed beyond 2050 in any part of the world.

Illustration of CPR ratcheting mechanism in the steel sector → Fig. 4



Agora Industry (2024) based on Agora Industry (2023)

CPRs would likely fall under the GATT which sets out members' rights and obligations with respect to trade in goods. Under Articles I and III of the GATT, members need to refrain from discriminating among WTO members in their treatment of imports of "like products", and imported products may not be treated differently than like products from domestic production. In the context of the GATT, the key question becomes whether a carbon-intensive tonne of, for example, aluminium is "like" a low-carbon tonne of aluminium. If they were considered "like" products, different treatment would amount to discrimination. Existing emissions standards for vehicles, for example, only refer to the GHG emissions that occur during the use phase of a product, not the production phase.

Considering the current development of green lead markets, both through public procurement and private procurement pledges, it is possible to argue that low-carbon and carbon-intensive products are not seen as "like", competing products by purchasing companies. Instead, low-carbon products are a strategic choice of companies, who are increasingly aiming to decarbonise the carbon footprint of their value chains: The increasing number of memorandums of understanding and supply deals made between car companies and steel companies for the first volumes of low-carbon or "green" steel (see for example Mercedes Group and H2 Green Steel, Volkswagen AG and Salzgitter or Ford and Tata Steel) could be seen as evidence to this. The First Movers Coalition, formed at COP26, groups together big corporates to leverage their collective purchasing power in order to advance green lead markets. The coalition explicitly commits to purchase first volumes of low-carbon material. These facts could be seen as arguments against the likeness of low-carbon and high-carbon products, but they are untested in law.

Second, the GATT specifies rules for the design of the regulation itself. Article XI:1 of the GATT states that no other restrictions or prohibitions other than quantitative measures such as duties, taxes or charges may be placed on imports. This is essentially a ban on bans, and it is unclear how CPRs would be evaluated under this article. If CPRs were found in violation of above Article under the GATT, there remains the possibility to rely on the general exemptions found in GATT Article XX, stating that measures can be justified if they serve specific agreed objectives, including social and environmental objectives. Gerres et al. argue that it is possible to design CPRs in such a way that an Article XX defence would be successful.

CPRs could also fall under the Technical Barriers to Trade (TBT) Agreement, which covers technical regulations, i.e. mandatory standards. Technical regulations are defined as laying down objectively definable characteristics of a product, or the product's processes and production methods (PPM) with which compliance is mandatory. The question becomes, whether GHG intensity can be considered a characteristic (there is no visible, physical difference between low-carbon and carbon-intensive steel), or a PPM. These are still open questions. If GHG intensity were considered neither, then the TBT Agreement would not be an impediment to the design of CPRs. If, however, GHG intensity were considered a PPM, then the legality of CPRs would depend on the interpretation of stipulations under the TBT Agreement.

In conclusion, CPRs would constitute new legal territory under WTO law. There is, however, reason to believe that CPRs could be designed in a WTO-compatible way.

4 Carbon product requirements in the context of diverging decarbonisation policies

Any policy tool aimed at industrial decarbonisation must be ranked on its ability to bring together in common ambition the countries in which production is taking place as well as its ability to bridge different policy approaches. CPRs are compatible with pricing and subsidy-based approaches, and may be designed to accommodate for different starting points.

4.1 CPRs, carbon pricing systems and EU CBAM

CPRs could work concurrently with the EU's ETS and CBAM approach. They would constitute a maximum ceiling of carbon intensity above which no goods could be sold on the EU internal market. Goods above that threshold could hypothetically still be exported, though few if any CBAM-covered installations are solely export focused, and no installation would run two separate production lines – one for exports and one for domestic markets. Compliance with the CPR would not confer any special treatment on installations under the ETS or CBAM regimes; both foreign and domestic producers that complied with CPRs would still need to purchase ETS and CBAM allowances corresponding to the embodied carbon in their goods.

The measurement, reporting and verification requirements of the CBAM would for the most part also work for CPRs, and any CPR regime should be constructed with this aim in mind. In both regimes, producers would need to measure the embodied carbon in covered goods, presumably following identical or compatible protocols, and have them verified, presumably in a single exercise.

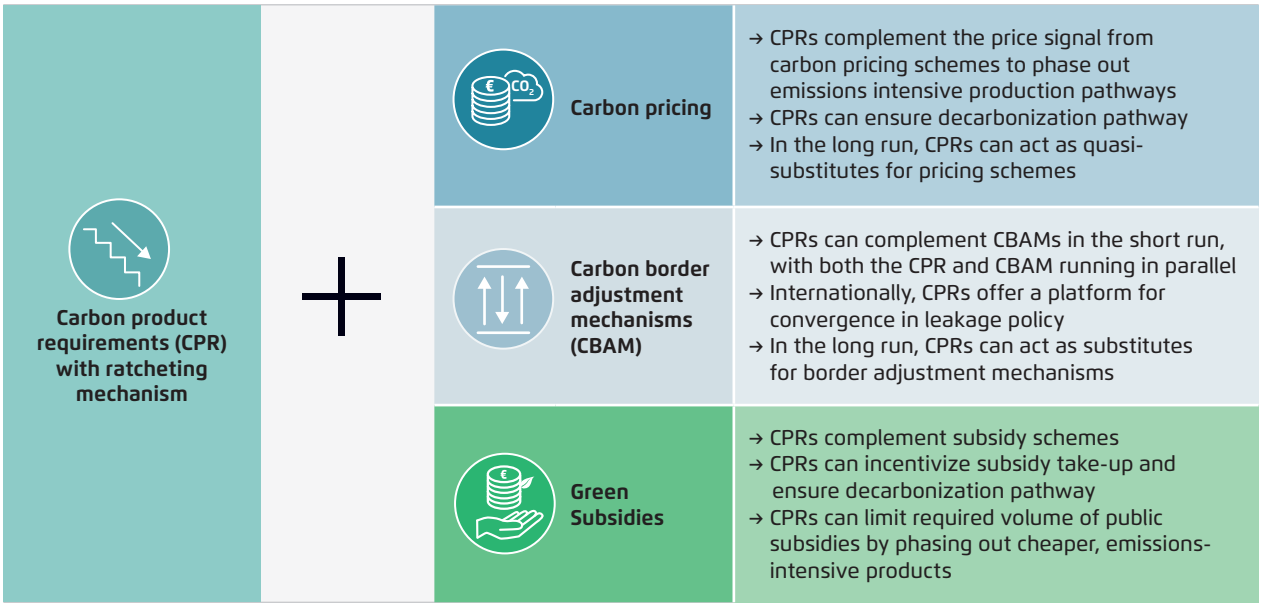
While CPRs and carbon pricing can be complementary in the mid-transition period, CPRs could replace the need for carbon pricing on a sector-by-sector basis in the long run. The point of carbon pricing approaches like the EU ETS is to incentivise low-carbon investments and consumption, with the objective in the case of industry of arriving at net-zero or near-zero levels of emissions. When European industry will have made the necessary transition to that state, there is no further need of the domestic pricing mechanism. But there would still be a need to prevent imported high-carbon goods from undermining that success and a need to prevent new entrants from adopting high-carbon technology. Those needs could be satisfied more easily by CPRs alone than by continued reliance on carbon pricing – the institutional architecture and compliance costs of CPRs being less onerous.

That, however true, is a long-term prospect. The more interesting question is the role of CPRs during the mid-transition. In the same way that CPRs could replace the need for carbon pricing at the net- or near-zero endpoint, it could be argued that they could do the same once the covered sectors are well on track to that end point, with an agreed mandatory trajectory for getting there (e.g. a schedule of increasingly stringent CPRs).

In the extreme case, CPRs could replace carbon pricing as soon as they were introduced, provided they set out an agreed pathway to net- or near-zero emissions. This scenario might not be advisable, if for no other reason than the continuity of existing policies and minimising disruption. But also, the longer the term of transition, the less certain is the feasibility of the pathway set out under a schedule of tightening CPRs. That argues for maintaining the two tools in complement until there is enough certainty about the costs and feasibility of the decarbonisation pathways for the various sectors.

While CPRs would work well in tandem with carbon pricing and CBAM, some policy interactions would need to be anticipated and addressed: if carbon pricing were phased out in favour of CPRs, the revenue from auctioning allowances would be lost, an im-

Compatibility of CPRs with different policy approaches → Fig. 5



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portant source of finance for the transition. Also, if CPRs are successful at driving decarbonisation, other things being equal, they risk lowering carbon market prices by creating more credits for firms beating the benchmarks.

4.2 CPRs and subsidies

CPRs could also work concurrently with a more US-style green industrial policy approach. In such a scenario they would act as complements to the subsidy regime, in contrast to their role with carbon pricing as a quasi-substitute. They would provide a predictable, transparent backstop incentive for decarbonisation, should subsidies and other support prove to be an insufficient incentive for transformation. At the same time, the subsidy regime could be designed in a way that helps producers meet the requirements of the CPRs. The CPR targets would need to be set such that the suite of policy support could make the targets achievable.

In the US, for example, the clean energy subsidies for renewable energies as well as carbon capture and storage under the Inflation Reduction Act have been followed by a set of proposals by the Environmental Protection Agency (EPA) for controls on greenhouse gases from power plants (EPA, 2024). Whereby the subsidies under the IRA provide the carrots that incentivise investment in clean energy technologies, regulatory proposals by the EPA generate pressure for policy uptake.

4.3 CPRs and other policies for decarbonisation

There have been national efforts to create lead markets for low-carbon materials to incentivize decarbonisation. Lead markets can be seen as a special case of CPR: they define ambitious CPRs for specific products or volumes of (public) procurement to create guaranteed demand for the first volumes of decarbonised basic materials.

For example, the US General Services Administration has issued CPRs ("low embodied carbon material requirements") for concrete and cement, steel, asphalt and glass that apply to the purchase of materials in 150 government building projects (U.S. General Services Administration, 2023). In May 2024, the German government published a concept note on lead markets for steel, cement and chemicals, which

focuses on the development of standards and highlights the role of public procurement to offtake first volumes of low-carbon materials (Federal Ministry of Economic Affairs and Climate Action, 2024).

The CPRs proposed in this paper do not serve the creation of lead markets (i.e. offtake of the cleanest products) but rather aim to ensure that the highest emitting production volumes are phased out. As such, they can be seen as an effective complement to lead markets by shrinking the serviceable market for emissions-intensive production volumes. CPRs would therefore act as a complement to government procurement of green industrial goods. To be effective, there would need to be an orchestration that would see government procurement standards consistently more stringent than CPRs, rewarding only the best performers. In the long run, CPRs would make green procurement unnecessary, as low-carbon standards across the various sectors become the norm.

CPRs would also be able to work in tandem with carbon contracts for difference (CCfDs). However, if stringent and effective enough, and if they covered enough sectors, they could deflate the price of carbon by eliminating the high-carbon production that is the source of demand for allowances or credits, triggering payouts under those contracts. In the unlikely event that such a thing came to pass, it would rightly be regarded as a success, and would arguably be exactly the type of scenario for which CCfDs are intended – guaranteeing a price of carbon to the best performers in decarbonisation even when everyone has performed so well as to depress the market for allowances.

The key takeaway is not just that CPRs can work well alongside existing domestic approaches to industrial decarbonisation. It is rather that they can provide the basis for international cooperation on industrial decarbonisation by parties that are currently pursuing very different types of policies, without asking any of them to sacrifice their existing policy mix. Given how entrenched those policies tend to be – normally the result of hard-fought political battles and hard-won compromises – that sort of compatibility is a critically valuable quality.

4.4 Accounting for different starting points

Trajectories of convergence

Jurisdictions that pursue industrial decarbonisation are almost always starting from different places in terms of the GHG intensity of current production. For the production of cement, for example, a global benchmarking of GHG emission intensity found a range from over 800 kilograms of CO_2 per tonne of cement in the US to just over 500 in China (Global Efficiency Intelligence, 2019). One of the touted advantages of CPRs is their ability to act as a foundation for international cooperation. But is there a way for such cooperation to exist when countries start at different levels of GHG intensity?

One possibility is *strategic convergence*. The parties could agree to a future end point at which their CPRs will converge in common requirements for maximum GHG intensity. They could then agree on respective pathways to convergence. The simplest would be flatline progressions from present practice through to the target, but many variations are conceivable, for example frontloading commitments for the more GHG-intense jurisdictions to force faster convergence. To be clear: At the early stages of this convergence period, the parties would differ in the standards to which they held domestic and imported goods, but that difference would diminish over time and would eventually disappear.

There are many conceivable variations on strategic convergence, but if the goal is a platform for international cooperation that could bring in many countries, a critically important question is: How would the parties treat each other's goods during the convergence period? Specifically, would they agree that

any good that met the others' standards would be allowed for sale on their market? For the higher-standard country, would this entail a period of time (i.e. up until convergence) when it would accept goods produced at a higher GHG intensity than it mandated for its domestic goods and non-partner imports?

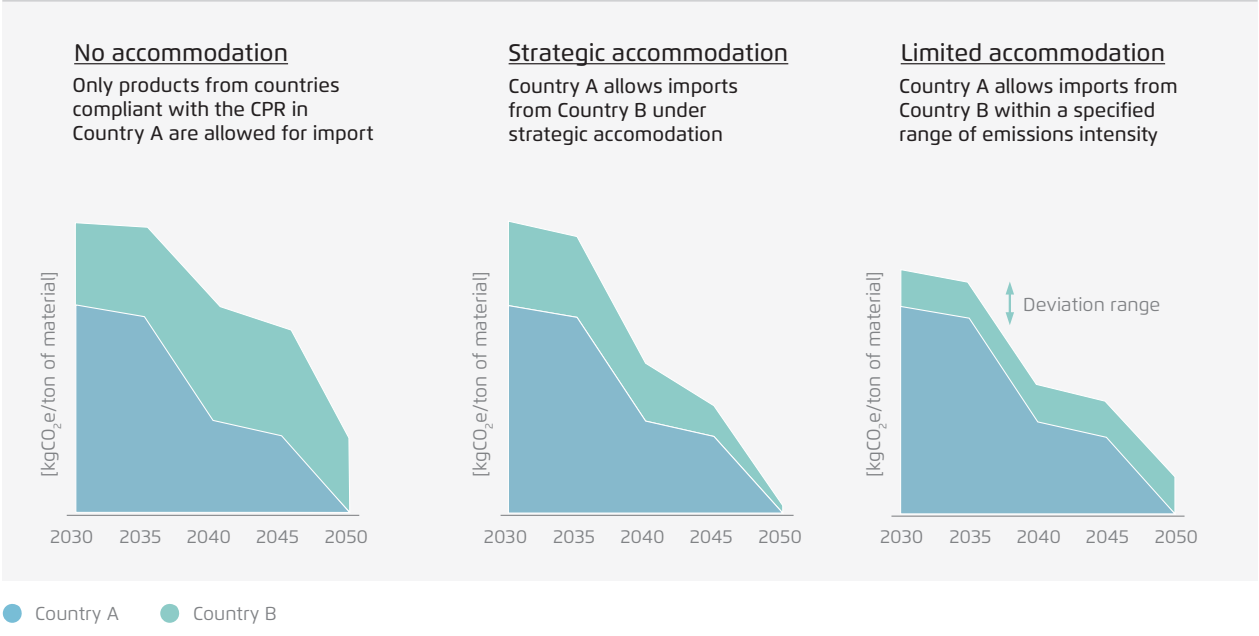
Options of accommodation

The simplest option would be no accommodation for the different trajectories of partner countries: Each national standard would be enforced for all foreign producers, regardless of whether they met their own national standards. For countries with high-GHG producers, however, this option offers no advantage or incentive to join an international agreement on CPRs.

A second option would be *strategic* accommodation: Parties could declare that the goods produced by other countries under such cooperation accords would be granted market access even if they failed to pass threshold tests in the early convergence period, as long as they kept on track with their committed decarbonisation pathway. The key benefit of this option is the powerful incentive it would offer for high-GHG intensity producing countries to accede – a feature too often missing from proposals for carbon clubs and other forms of international cooperation on industrial decarbonisation. The key drawback would be that during those early years of the convergence, the regime might be less effective as a shield against leakage, if one party's more lenient CPR standard afforded its producers a significant cost advantage. If the difference between the partners' starting points was small enough and the convergence trajectory was rapid enough, the costs of this option would be outweighed by the value of bringing more producer countries on board.

Alternatively, parties might wish to grant such accommodation only to those countries that meet certain criteria, such as developing or least developed countries, or to small and medium-sized enterprises from partner countries, or to countries that have had the lowest historical contributions to climate change, or to countries for which the marginal abatement costs in covered sectors is particularly high. Such

Accommodation pathways for CPR convergence of EITE materials → Fig. 6



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options are tangible ways of operationalising the principle of common but differentiated responsibilities and respective capabilities.

A third option (that could be combined with the above) would see higher-standard countries accommodating CPR divergences only within specified limits, such as differences of an agreed percentage range or less, out of concern for the impacts of leakage. In other words, the lower standard partner would only have its lower standards accommodated and its exports accepted once its CPR attained the tolerated level of divergence. This would still involve some risk of leakage, albeit time-limited, and it would be up to policymakers to balance this against other objectives such as incentives for other parties to join, or observance of the principle of common but differentiated responsibility and respective capabilities.

It is worth recalling that the most likely form of international cooperation on CPRs would also retain existing policies for leakage prevention. The risk of leakage implied by strategic accommodation would likely be moderated by those policies. For example, even if the EU did accept imports of aluminium that were produced at GHG intensities above those specified in the CPR, those imports would still require CBAM allowances in proportion to their embodied carbon. Similarly, US producers would still be protected to some extent by the fiscal support offered under the Inflation Reduction Act.

In order to draw in many countries, the variations discussed above would ideally be codified, using objective criteria, with the aim of constituting rules that could be applied not just between founding parties, but also to any party wishing to join the effort.

One drawback to the strategic accommodation option is that it might complicate a GATT defence. It was noted above that implementing countries might defend against discrimination charges by arguing that high-carbon steel and low-carbon goods are not "like". But if that were successful, then allowing imports of high-carbon steel from some countries – i.e. those in the process of convergence – but not other countries would amount to a violation of the GATT's most-favoured nation principle. Such a violation would then have to be saved under the GATT Article XX exceptions (see discussion above).

5 Governance of a global system of CPRs

How might one move towards common CPRs at the international level that would involve a critical mass of countries? What would be in it for jurisdictions signing up to the agenda? What governance framework would make this attractive for emerging and developing economies?

Recent years have seen a growing understanding that the challenge of decarbonising industry globally in the narrowing window for staying within climate targets critically requires international collaboration for speed, scale and cost efficiency. Different initiatives like the COP26 Breakthrough Agenda, the Industrial Deep Decarbonisation Initiative and the Climate Club have emerged, convening governments with the aim of advancing the industry transition. While these initiatives are advancing the industry transition in important ways, by connecting key actors as well as facilitating the sharing of knowledge and collaboration on important questions of technical implementation, they are not yet positioned to truly create policy convergence and, most importantly, to avoid further investments into emissions-intensive productive capacity. What is still missing is a common international vision for pace and policy convergence of the transition and a platform through which this vision could be materialised.

In this paper, we have argued that a framework for CPRs could provide such a vision for convergence. The question thus becomes how a critical mass of countries could buy into common CPRs – and what would be in it for them.

The benefit to industrialised jurisdictions is clear: Most jurisdictions have climate targets that will require reducing emissions from industry significantly by 2030 already and reaching net zero by mid-century. Under common CPRs, participating jurisdictions would retain access to each other's markets through compliance with embodied emissions thresholds. At the same time, CPRs reduce the carbon leakage risk on the domestic market and, if taken up by enough large producers of basic materials, they can also protect against export leakage. Servicable markets would be scaled by the implementing jurisdictions, thereby strengthening the business case for the transition.

These benefits, and ultimately the success of this agenda, depend on the ability to attract a large number of countries to this effort, with a particular focus on emerging markets and developing economies that will see the largest growth in industrial production and demand in the future.

Why would emerging markets and developing economies join the agenda? They could benefit from strategic convergence under such a scheme if there was strategic accommodation for their different starting points in emissions reductions. An attractive design element and a means to garner broad participation would be allowing for different levels of GHG intensity and accepting imports of goods that meet the standards of foreign CPR trajectories, with the express intent to close those differences over time.

A global CPR system needs to be accompanied by mechanisms to finance and facilitate the transition of the basic material sectors in fiscally constrained jurisdictions – an area that still receives too little financing and political attention. The principle of common but differentiated responsibility should be a primary focus in this regard. Those who were first in the race to industrialise, who are responsible for a large part of historical GHG emissions, and who became wealthier as a result of this industrialisation, cannot dictate stringent standards for production without some form of assistance to help ensure that those standards can be met by everyone. The more effective such financial and capacity building support, the more incentive there will be for participation from emerging and developing countries, and the greater the effect for climate action and protection from carbon leakage.

Launching the debate on CPRs

As discussed above, several initiatives have been launched to advance important areas of collaboration of the industry transition. Discussions on the role of CPRs should be taken up by all of these forums to build widespread buy-in for such an agenda.

The Climate Club that was recently formally launched at COP28 is perhaps the most promising venue to launch discussions on CPRs for basic material sectors: The high-level intergovernmental forum currently has a membership of 41 countries[2]. It has developed a work programme with a focus on industrial decarbonisation that includes coordination on market promotion and strategic dialogues on carbon leakage.

This forum is therefore a natural candidate to host discussions on CPRs for basic materials, both in terms of the sectoral fit and the desirable breadth of the membership base with varying degrees of industrialisation.

By allowing for strategic accommodation of different starting points under a common CPR agenda, such an agenda would still live up to the Climate Club's mission statement to be an open and inclusive club for industry decarbonisation.

Brazil's G20 presidency and next year's COP30 presidency would also be suitable forums to launch a discussion on such an agenda and work towards embedding first CPRs for 2035 in the next round of NDCs.

Collaborating on CPRs would also be a natural candidate for the work plan of the Clean Energy Ministerial Industrial Deep Decarbonization Initiative (IDDI). While the initiative currently works towards establishing ambitious public and private sector procurement targets among its members, CPRs could complement these green procurement pledges with a commitment to phase out the most emissions-intensive production.

Finally, policy convergence might realistically start among smaller sets of trading partners. A EU-US steel club like the one discussed under the EU-US GSA would, however, only cover 13 percent of global steel production. We argue that the negotiations could still be a window of opportunity to establish CPRs as a platform for agreement between the two sides that could move the global discussion towards a ban on sales for the most emissions-intensive products (see also E3G, 2023). Such an agreement would need to feature a clear pathway towards including more large producer countries in the agreement as well as including and accommodating emerging and developing economies' needs.

2 Membership count at the time of writing in August 2024. See https://climate-club.org for current membership count.

6 Conclusion

In this paper, we argue that CPRs can act as a point of policy convergence in the decarbonisation of energy-intensive, trade-exposed sectors. Such a point of convergence serves several purposes. First, it offers a platform for international cooperation that is viable even for countries with different policy approaches and starting points. CPRs can enable governments to jointly set milestones for decarbonization, thereby filling an important policy gap in the face of looming re-investment cycles and corresponding risk for carbon lock-in. Second, it sets a time horizon for compliance, thereby informing investment decisions and sending a strong signal for innovation and investment activities through regulatory clarity. Third, given a critical mass of countries passing such carbon product requirements, industrial installations with clean processes will face a reduced risk of carbon leakage. Fourth, countries with such regulation in place will create growing markets for the offtake of lower-carbon basic materials, complementing nascent efforts for creating green lead markets.

The implementation of CPRs needs to expand along four axes: one, the types of goods to include, two, the timing of increasing stringency of the requirements, three, the number of trade partners to coordinate with and, finally, the rules for strategic accommodation. Existing international forums provide important groundwork to develop the supporting methodology for emissions measurement, accounting and reporting frameworks as well as offering a platform for dialogue on CPRs.

Much progress remains to be made on advancing deep decarbonisation of energy-intensive sectors in emerging markets and developing countries to avoid risking carbon lock-in and help these countries leapfrog onto a clean development path. Progress in this area is pivotal for economic inclusiveness, just transition and avoiding carbon lock-in. A global CPR system that accommodates differences in starting points requires in parallel solutions that facilitate access to financing for the industry transition in these countries.

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Agora Industry develops scientifically sound and politically feasible concepts for successful pathways to a climate-neutral industry – in Germany, Europe and internationally. The organisation which is part of the Agora Think Tanks works independently of economic and partisan interests. Its only commitment is to climate action.

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