

In collaboration with
Climate Finance Asia



Climate and Competitiveness: Border Carbon Adjustments in Action

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Foreword



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The global economy is entering a new chapter in the transition to net zero. Even within a context of geopolitical shifts, carbon-pricing mechanisms continue to expand. Moreover, the novel development of border carbon adjustment policies is reshaping the fundamentals of trade, competitiveness and cooperation.

Unlike previous emissions reduction measures focused primarily on domestic regulation, border carbon adjustments reach across frontiers, making the capacity to manage carbon emissions an important factor of global market access. Their emergence represents a significant intersection of climate and trade policy. At the same time, they do not come without challenges or without controversy – they raise concerns about protectionism, economic equity and the risk of deepening trade divisions. These developments are not only a response to the urgent need to reduce greenhouse gas emissions, they are also signals of how deeply climate policy can become embedded in the fabric of the global economy.

For business leaders, this moment presents both risk and opportunity. Indeed, border carbon adjustments can create new costs and complexities in international supply chains. However, they also hold the potential to accelerate decarbonization and reward first movers and those with proactive strategies. The companies that thrive in this environment will be those that succeed in treating decarbonization not as a compliance burden but as a strategic driver of competitiveness, resilience and long-term value creation.

This white paper provides a timely framework to guide decision-makers through this transformation. Drawing on case studies from emerging economies and lessons from pioneering industries, it highlights practical steps that companies can take today to prepare for a carbon-constrained future. The strategy playbook set out here underscores the importance of planning in integrating carbon pricing, aligning operations and supply chains with low-carbon goals, ensuring compliance across jurisdictions and engaging stakeholders to build systemic resilience.

This project was conducted by the World Economic Forum in collaboration with Climate Finance Asia, a specialized knowledge partner that supported policy research and conceptual development of the strategic playbook, and assisted with engagement and the collection of insights from local experts and institutions across the focus economies.

Navigating the intersection of climate and trade will be one of the defining leadership challenges of this decade. Border carbon adjustments can quickly become a practical reality in the global economy. In light of that, how governments, businesses and investors respond will play a critical role in shaping the trajectory of both competitiveness and climate action. Collaborative action to align policies, markets and corporate strategies could help economic actors use these new carbon-pricing mechanisms as a catalyst to align ambitious climate action with business competitiveness imperatives, ultimately driving sustainable, resilient growth.

Executive summary

The emerging landscape of carbon border adjustments is redefining competitiveness, creating risks and opportunities in trade, strategy and global market positioning.



The introduction of border carbon adjustments (BCAs) as a new feature of the carbon-pricing landscape highlights a fundamental tension between climate and trade. The European Union's Carbon Border Adjustment Mechanism (EU CBAM), for example, is designed primarily to prevent carbon leakage and ensure the equivalent treatment of domestic and imported goods. In doing so, it may enable greater domestic ambition, thereby supporting the objectives of the Paris Agreement; however, it also raises concerns about trade protection, competitiveness and economic growth.

Companies now face the dual challenge of meeting climate goals while maintaining market access and profitability. Policy uncertainty is high, and jurisdictional fracturing seems likely, as each BCA (if/when implemented) may have different scopes, reporting periods and cost calculation methods, creating additional trade barriers and administrative complexity. At the same time, BCAs create novel opportunities to align decarbonization efforts with long-term competitive advantage. For companies,

these mechanisms influence which markets are more advantageous, how supply chains are organized and where capital flows. While BCAs introduce new costs and compliance obligations, they also create opportunities for strategic differentiation, resilience and long-term growth. The scale of the opportunity is substantial.

The World Bank's *State and Trends of Carbon Pricing 2025* report¹ highlights that there are 80 carbon taxes and emissions trading systems (ETSs) in operation worldwide, with five being introduced over the past 12 months, covering 28% of global emissions, with economies representing nearly two-thirds of global economic output having implemented either a carbon tax or an ETS. For carbon-intensive sectors such as steel, cement, mining and energy, early alignment with carbon policies can mitigate risk, unlock emerging green markets, attract low-cost capital and strengthen competitiveness in a volatile global environment, provided that mechanisms like BCAs duly recognize effective carbon prices already paid.

“ The message is clear: proactive alignment could yield a competitive edge.

Meanwhile, climate and trade pressures are intensifying. The EU CBAM will become the first fully implemented BCA as of January 2026, signalling a new era in which carbon competitiveness is enforced at the border. For exporters from emerging economies such as China, Brazil, India and South Africa, this creates both pressure and opportunity: comply and remain cost-competitive in European markets or risk exclusion from high-value markets. The EU CBAM could influence trade patterns, but it may also drive systemic shifts towards cleaner production.

This white paper presents case studies across numerous emissions-intensive sectors from the BASIC group of countries (Brazil, South Africa, India and China) to illustrate how leading companies in emerging markets are already adapting. From Chinese steel and battery manufacturers embedding carbon management into their global strategy, to a Brazilian energy company aligning energy transition pathways with national resource advantages, to Indian and South African companies navigating both domestic carbon policies and international trade risks, the message is clear: proactive alignment could yield a competitive edge.

This white paper offers a strategy playbook for executives, built on a PACE framework (Plan, Achieve, Change, Engage). It highlights the urgent actions CEOs must prioritize:

- **Plan** for the integration of carbon pricing into strategic and financial planning
- **Achieve** compliance with domestic carbon rules and international BCAs
- **Change** operations to reduce greenhouse gas (GHG) emissions and enhance competitiveness
- **Engage** stakeholders to align value chains and support policy objectives

This playbook is designed for CEOs, CFOs, COOs and supply chain, procurement and sustainability officers as well as corporate strategists navigating climate policy, carbon-embedded trading landscapes and investor expectations. It provides actionable guidance relevant to companies for effectively navigating carbon pricing and BCA requirements, including the EU CBAM.

Introduction

CEOs will benefit from a strategic framework to align corporate decisions with carbon policies, trade dynamics and decarbonization imperatives.

The intersection of climate policy, trade dynamics and decarbonization imperatives is increasingly shaping global business strategy. Even amid uneven momentum across geographies, climate-aligned strategies are unlocking new pathways for growth, competitiveness and long-term value beyond compliance. Executives require actionable insights that connect operational decisions to broader geopolitical, trade and competitive contexts.

This white paper is designed to equip CEOs and C-suite leaders, particularly in the BASIC countries (Brazil, South Africa, India and China) and other emerging economies, with a strategic framework for navigating carbon-pricing mechanisms (CPMs) and BCAs. Rather than focusing solely on micro-level operational guidance, it situates corporate decisions within the larger dynamics of global trade, market share and competitive advantage.

The white paper is structured as follows:

Section 1. Overview and industry responses to BCAs: Provides context on the emerging landscape of global BCA and carbon-pricing frameworks, examining trade impacts, carbon

leakage mitigation and corporate strategy; synthesizes insights from case studies and industry discussions, highlighting how companies in emissions-intensive sectors in BASIC countries are responding to BCAs and CPMs more broadly

Section 2. Strategy playbook: Offers actionable guidance for executives, prioritizing short- and long-term interventions, investment strategies and policy engagement to strengthen competitiveness in a decarbonizing global market

Section 3. Recommendations and urgent actions: Provides high-level actions for CEOs to integrate carbon pricing into operations, decarbonize supply chains, leverage green finance and collaborate across sectors, turning regulatory risks into opportunities for resilience and competitive advantage

Collectively, these sections provide a high-level strategic overview of how to navigate evolving carbon regulations while delivering concrete, operationally relevant insights for CEOs and C-suite leaders.



1

Overview and industry responses to BCAs

How are BCAs around the world designed and implemented, and how are companies in emissions-intensive sectors responding?

1.1 Design and implementation of BCAs

Under border carbon adjustments, charges are levied on embedded emissions of imported goods at a carbon price equivalent to what would have been applicable if the goods were produced under the policies of the importing country.^{2,3} BCAs can be structured in different ways, either as border taxes linked to domestic carbon taxes or as certificate systems tied to emissions trading schemes, and different jurisdictions developing BCAs may take divergent approaches. The EU CBAM, the first operational BCA globally, follows the latter approach, requiring importers to purchase certificates priced in line with the EU ETS, ensuring imported goods face similar carbon costs to domestic products.

Critical implementation elements on the ground include the development of rigorous yet pragmatic measurement, reporting and verification (MRV) systems, enforcement mechanisms across customs and climate agencies and phased rollout timelines.⁴ Moreover, accurate MRV necessitates independent verification, with EU regulations mandating that importers have emissions certified by accredited verifiers.^{5,6} Once MRV data is collected, BCAs must be enforced to ensure compliance. Authorities verify whether goods fall within the scope of a BCA using tariff codes and importer registration.⁷

Compliance involves periodic declarations of import volumes and embedded emissions, with importers surrendering certificates or paying carbon dioxide (CO₂) costs. The EU's CBAM (following the Omnibus package⁸) and the UK's CBAM also allow default values as an alternative to actual emissions, although these can entail higher costs than actual emissions as they are based on average emissions intensity by country or region. Penalties for non-compliance are enforced nationally, while verifying overseas data remains challenging.⁹

For companies, these design choices translate into compliance strategies and competitive positioning. Companies in energy-intensive industries face the most immediate reporting and cost pressures but also the greatest incentives to decarbonize, adopt cleaner production methods and/or certify lower emissions intensity. Multinationals with global supply chains are adapting by improving emissions data collection, engaging suppliers to meet uniform benchmarks and using transparency as a signal to investors and consumers. In practice, corporate responses are increasingly going beyond compliance: some companies (see Section 1.5) are adapting to BCAs by adjusting supply chains and exploring opportunities in low-carbon markets.



1.2 Global evolution of BCAs and carbon-pricing frameworks

“ From 2026 onwards, full obligations will take effect in parallel with the gradual phase-out of free carbon allowances for EU industries.

The first major operational BCA, the EU CBAM, has been designed in coordination with the EU ETS to ensure that Paris climate goals¹⁰ and EU economic objectives are met. Importers report embedded emissions of covered products and purchase “CBAM certificates” at a price that mirrors the EU ETS allowances.¹¹ Until the end of 2025, CBAM is in a transitional phase that requires importers to submit quarterly reports on their emissions without incurring a fee, allowing time to establish a rigorous MRV procedure structure. From 2026 onwards, full obligations will take effect in parallel with the gradual phase-out of free carbon allowances for EU industries.¹²

The EU has expressed its intention to expand the CBAM’s scope by 2030 to include all sectors

covered by the EU ETS.¹³ Several countries outside the EU are also exploring BCAs and advancing carbon-pricing initiatives, as summarized in Table 1. The evolution of BCAs remains highly dynamic and context-specific, with emerging frameworks reflecting differing national priorities and creating uncertainty for globally integrated value chains. Further, the introduction of the EU CBAM may create incentives for domestic jurisdictions to strengthen or expand their own carbon-pricing systems in order to preserve competitiveness and ensure domestic revenues are retained rather than flowing abroad, potentially resulting in increased carbon costs for companies across all products, not just those exported to jurisdictions implementing BCAs.

TABLE 1 Global developments in BCAs and carbon-pricing frameworks in BASIC countries

Country	Status/plans on BCA development
Canada	Exploring bilateral solutions (e.g. Joint EU-US Statement on a Global Arrangement on Sustainable Steel and Aluminium ¹⁴) Initiated consultations on a possible BCA to complement domestic carbon pricing ¹⁵ The programme of the 2025 Liberal-led government includes plans for a national BCA ¹⁶
United States	Multiple versions of BCA frameworks have been presented in recent years, with one BCA legislation re-introduced in Congress in April 2025 (Foreign Pollution Fee Act ¹⁷); the FPFA sits with the Congressional Committee on Finance at time of publication
Australia	Safeguard mechanism in place; ongoing review on carbon leakage may lead to BCA development, with unclear timeline ¹⁸
United Kingdom	Adopted a UK CBAM, set for implementation beginning January 2027, with discussions ongoing with the EU about possible links with the EU CBAM ¹⁹
Türkiye	Included provisions for a BCA in its 2025 climate law ²⁰
Japan	Plans to introduce a carbon levy on fossil fuel importers in the financial year 2028–2029 ²¹ Developing carbon markets under the Green Transformation (GX) strategy Has had a carbon tax on fossil fuels since 2012 ²²
Carbon-pricing mechanisms in BASIC countries	
Brazil	Approved a national-level ETS in 2024, with a phase-in period through 2030 ²³
South Africa	Implemented a stand-alone carbon tax in 2019, ²⁴ with a more stringent Phase 2 beginning in 2026 ²⁵
India	Established a national-level ETS (the Carbon Credit Trading Scheme) in 2024, ²⁶ with a gradual phase-in period starting in 2025
China	National ETS covering the power sector operational since 2021; in March 2025, the State Council formally approved the inclusion of the iron and steel, cement and aluminium smelting industries in China’s national ETS ²⁷ The ETS will be expanded gradually across numerous additional emissions-intensive industries by 2030

1.3 Environmental and economic impacts of BCAs

“ A \$1 per tonne of carbon dioxide equivalent increase in carbon prices reduces emissions by 1.3% across steel and cement plants, but carbon leakage through international trade offsets roughly 13% of these domestic reductions.

A BCA distinguishes itself from traditional carbon pricing, which directly increases the cost of emitting and reduces emissions, by extending domestic pricing to trade instead of establishing a new carbon price through taxes or cap-and-trade. The primary environmental rationale for BCAs is the mitigation of emissions leakage.

Evidence from an Organisation for Economic Co-operation and Development (OECD) study²⁸ suggests that for cement and steel plants across 140 countries, a \$1 per tonne of carbon dioxide equivalent (tCO₂e) increase in carbon prices reduces emissions by 1.3%, but carbon leakage through international trade offsets about 13% of this domestic reduction, illustrating how carbon pricing and trade dynamics interact to influence net emissions outcomes.

While carbon taxes and ETS deliver greater direct emissions cuts overall, BCAs reinforce those

reductions at the border. For example, an \$88/tonne CO₂ price in the EU was projected to reduce emissions by 21%. Economically, BCAs can improve the efficiency of emissions reduction by aligning the carbon costs of imports with those of domestic goods. Studies show that BCAs are effective in reducing leakage. With BCAs, leakage falls to 8% on average, compared with a mean value of 12% before BCAs.²⁹

BCAs can influence trade dynamics by harmonizing carbon costs and decreasing trade distortions. An ETS may raise production costs, potentially leading to an increase in carbon-intensive goods from countries with less stringent climate policies.^{30,31} By rebalancing these incentives, BCAs offset competitive disadvantages created by domestic carbon pricing.



1.4 Private-sector strategic responses under different regimes

“ As border carbon policies mature, leading multinationals are forming “BCA-aligned procurement coalitions” to coordinate low-carbon sourcing and streamline emissions accounting across jurisdictions.

Companies may need to review supply chains for BCA-covered products. For example, the EU’s CBAM guidance recommends mapping suppliers of in-scope goods by origin and volume, and tracking embedded CO₂ emissions,^{32,33} leading companies to shift towards lower-carbon suppliers or alternative materials to reduce border fees. Guidance from international institutions emphasizes the value of digital emissions tracking systems, which allow companies to centralize data collection across suppliers and comply with emerging disclosure mandates more efficiently.³⁴ Some may consider rerouting trade or relocating production away from high-carbon jurisdictions, but with multiple economies planning similar BCAs, pure avoidance is likely to be a limited strategy.

As costs increase, this could prompt a strategic reassessment of long-term supplier viability, with emissions transparency becoming an important factor in determining procurement partnerships.

Companies are greening their procurement practices: standard contracts are being updated to include emissions reporting and CBAM-compliance clauses. Thomson Reuters notes the inclusion of clauses requiring suppliers to share embedded emissions data and assume compliance responsibilities.³⁵ As border carbon policies mature, leading multinationals are forming “BCA-aligned procurement coalitions” to coordinate low-carbon sourcing and streamline emissions accounting across jurisdictions.³⁶

“Companies reducing supply chain emissions can significantly increase EBIT by 15 to 50% by 2030.”

Some companies are exploring structured responses that integrate CBAM compliance with broader supply chain and climate strategies. While limited, practices include:

- Mapping suppliers of in-scope goods by origin, volume and embedded emissions
- Transitioning to suppliers of materials with lower carbon footprints; investing in digital MRV systems to centralize emissions data and comply efficiently
- Forming cross-functional CBAM teams supported by governance structures, external consultants or specialized software
- Updating contracts to include emissions reporting and CBAM-compliance clauses
- Applying internal carbon pricing, ideally aligned with the EU CBAM Scope, to stress-test costs and inform operational decisions

During the transition to new systems and processes for collecting and analysing emissions data, companies may use default emissions factors when actual data is unavailable.³⁷ Deloitte notes importers can initially report default values or use alternative monitoring if supplier data is missing. While this provides a short-term compliance pathway, it can create risks in energy-intensive industries, since default values are often higher. This may inflate reported carbon costs, distort competitiveness by making some imports appear more carbon-intensive than they actually are and reduce incentives for suppliers to improve accuracy. Investing in robust MRV systems is essential to avoid such cost penalties and credibility gaps.

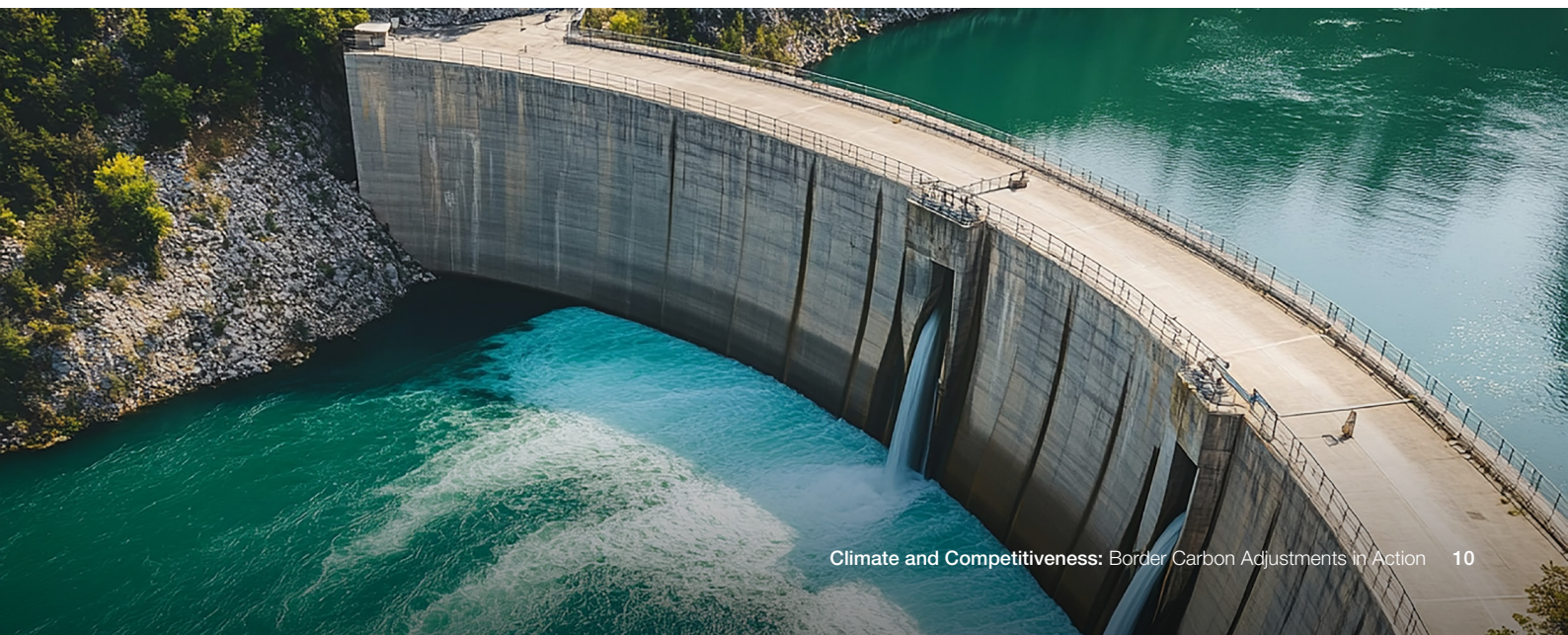
Based on the case studies and focus group meetings organized for this paper, companies have reported forming cross-functional CBAM teams to ensure compliance, supported by transparent governance, external consultants or specialized software. These compliance tools automate data requests from suppliers and implement fall-back strategies, reducing manual errors and associated

risks.³⁸ To better anticipate carbon costs, companies apply internal carbon pricing in two ways: hypothetically, as a planning and accounting tool, or concretely, by assigning a cost to each unit of emissions. By mapping Scope 3 emissions and integrating carbon tracking into their reporting, businesses can facilitate a smoother transition and reduce uncertainty. As regulatory expectations tighten, these internal systems are evolving from compliance tools into competitive enablers, allowing companies to anticipate cost exposure and differentiate in carbon-sensitive markets.

An additional concern in this transition is the risk of “carbon poverty”, where smaller companies, especially micro, small and medium-sized enterprises (MSMEs) in developing economies, lack the financial or technical capacity to measure and report emissions with the same rigour as multinationals. These companies may face exclusion from international supply chains, reinforcing inequalities. Addressing this requires global cooperation, [public-private partnerships](#), capacity-building and technology transfer, so that all suppliers can participate in low-carbon trade.

The diversity of private-sector responses provides a foundation for shaping carbon strategies. The strategy playbook provided in Section 3 outlines actionable pathways for companies navigating BCA-aligned procurement, risk management and emissions disclosure. Under a BCA, companies respond to border fees by innovating with low-carbon inputs and processes worldwide. Early adopters can gain a competitive advantage; for example, McKinsey, by analysing a European automotive OEM, finds that “companies reducing supply chain emissions can significantly increase EBIT by 15 to 50% by 2030”.³⁹

To understand how major players in carbon-intensive sectors are adapting, in-depth case studies of leading companies in BASIC countries have been conducted, highlighting strategic innovations and operational approaches that illustrate paths towards compliance and competitiveness.



1.5 | How leaders of carbon-intensive industries are responding to BCAs

CASE STUDY 1

China – S Group⁴⁰

Company and sector profile

The steel industry is a cornerstone of China's economic might. It is also a primary source of its GHG emissions, contributing an estimated 1.8 billion tonnes of CO₂, or about 15% of the national total. Domestically, inclusion of the steel sector in China's national ETS forces producers to internalize what was once an externality. Although around 10% of its export volume goes to BCA-regulated markets, S Group's proactive investments highlight both a viable path and critical policy gaps for China's steel sector.

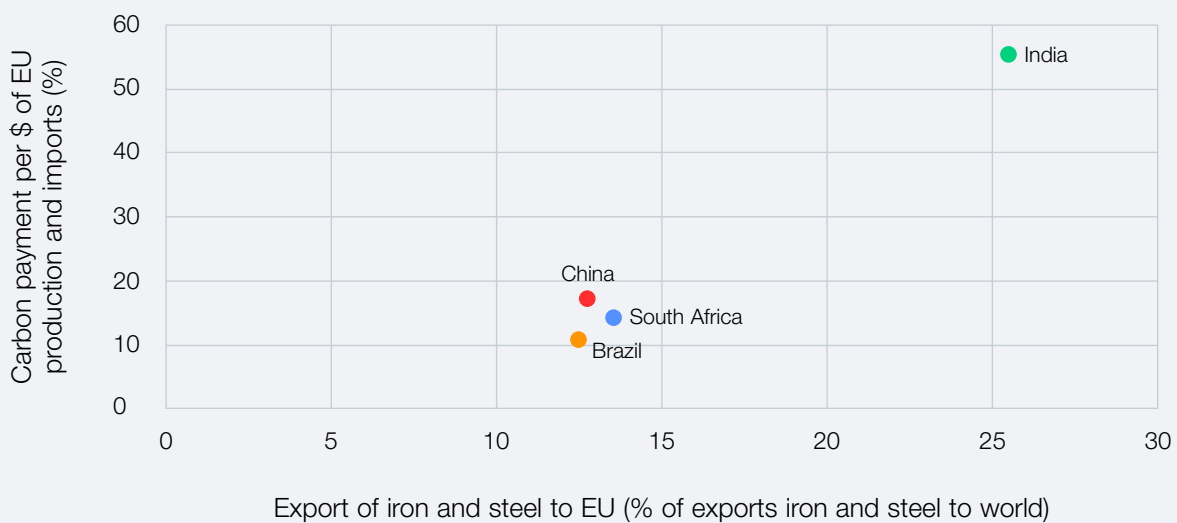
With an annual crude steel output consistently exceeding 1 billion tonnes, China accounts for more than 54% of global production. S Group is a major, publicly listed steel producer with an annual capacity exceeding 30 million tonnes, with 12.9% of its production exported to more than 80 countries and regions. The company's push towards electric arc furnace (EAF) and hydrogen-based production exemplifies the shift to "new quality productive forces", aligning with the national carbon goals and positioning S Group for BCA-regulated markets.

Business exposure and response

Figure 1 compares the EU CBAM trade exposure for the iron and steel sector in the BASIC group of countries using data from the World Bank.⁴¹ The vertical axis shows the carbon payment per dollar of EU production and imports (%) – 17% for China, which is higher than South Africa and Brazil but lower than India. Trade dependence, measured as the share of China's total iron and steel exports destined for the EU, is 13%, higher than Brazil but lower than India and South Africa.

Projections suggest that BCAs could result in a 58% loss of export profits for Chinese steel exporters and a 32% reduction in export volume compared to the business-as-usual scenario.⁴² This represents a significant impact on a high-value business segment, compounded by the added complexity of monitoring, reporting and complying with Scope 1 and 2 emissions requirements.

FIGURE 1 EU CBAM trade exposure (iron and steel) in the BASIC group of countries



Sources: World Bank Group, CBAM Exposure Index

Apart from technological shifts, S Group has adopted a “shadow carbon pricing” mechanism – an internal carbon price of \$20–30 per tonne of CO₂ – to evaluate all new capital expenditure projects. This mechanism creates a financial incentive for lower-carbon choices, supported by a switch to an advanced MRV system.

Views diverge on the optimal pace of transition. **While leaders at large enterprises, such as S Group, view BCAs as a catalyst for modernization, many others advocate for a more gradual, state-supported approach that prioritizes economic stability.**

Key takeaways and potential actions

- **Short term (1–3 years):** Based on these insights, corporates in trade-exposed sectors can consider focusing on building resilience in the short term. This includes investing in best-in-class digital MRV systems and conducting third-party verified life-cycle assessments for key products. Companies can also integrate an internal carbon price into all capital budgeting decisions. For companies exposed to the EU CBAM, the EU ETS price – currently around €80/tCO₂ (as of November 24 2025)⁴³ – can serve as a natural reference point to guide investment and operational decisions.
- **Long term (3–10+ years):** In the medium-to-long term, the strategy must shift to transformation. This involves developing a clear technology roadmap for phasing out legacy assets, scaling up investments in low-carbon technologies such as EAFs and forming research and development consortia for solutions such as hydrogen and carbon capture, usage and storage (CCUS) (see Tables 2 and 3).

TABLE 2 Corporate strategies for managing carbon and BCA exposure

Risk category	Type	Timeline	Severity of impact
BCA carbon costs	Direct	Future	High
MRV admin burden	Direct	Current	Medium
National ETS costs	Direct	Current	High
Scrap metal supply	Indirect	Current	Medium
Clean power access	Indirect	Current	High

TABLE 3 Categories, types and severity of carbon-related risks for trade-exposed companies in the steel industry

Source of risk	Corporate strategy	Policy support needed
Technology and capital	Invest in EAF, H ₂ -DRI, CCUS pilots	Green transition fund and CCfDs for first-of-a-kind projects
Carbon pricing	Internal carbon price	Clear national ETS timeline and predictable price signal
Regulatory complexity	Build internationally aligned MRV system	MRV equivalency protocols with key trading partners
Supply chain	Diversify export markets; develop green products	Build scrap collection infrastructure

Note: H₂-DRI = hydrogen-based direct reduced Iron; CCfD = carbon contract for difference

Company and sector profile

Contemporary Amperex Technology Co., Limited (CATL) is a global leader in the lithium-ion battery sector and green transition. However, its energy-intensive manufacturing and complex global supply chains create significant carbon exposure. Two-thirds of the world's cobalt is mined in the Democratic Republic of the Congo, and nearly two-thirds of nickel originates from Indonesia.⁴⁴ CATL was selected to illustrate how a market leader navigates the pressures of global decarbonization.

The lithium-ion battery sector is a linchpin of the global energy transition. However, battery production itself has a significant carbon footprint, driven by the carbon intensity of the local electricity grid. The sector faces layered regulations, including BCAs targeting materials and the EU's forthcoming "battery passport",⁴⁵ which will mandate detailed carbon footprint declarations.

Business exposure and response

CATL's primary exposure is indirect. While batteries are not currently covered by the CBAM, key upstream materials, such as aluminium and steel, are. As an importer of Chinese-made components for its European facilities, CATL is responsible for compliance. According to the company's carbon accounting reports, the proportion of its total carbon footprint originating from Scope 3 has shown an upwards trend, accounting for the significant majority of total emissions in recent years. Although precise data on the share of aluminium and steel in the value-added of batteries is limited, their presence in production inputs underscores the indirect exposure risk.

Challenges include complex compliance and difficulties in obtaining accurate emissions data from upstream suppliers. The company emphasizes that BCA policies must be fair and impartial, ensuring a reasonable distribution of carbon responsibility and benefits across the supply chain so that upstream and downstream actors are both incentivized to reduce emissions.

Strategic responses

- **Strong corporate governance:** A dedicated team manages carbon issues with regular oversight from the board and senior management, supported by investment in digital carbon accounting infrastructure.
- **Strategic localization:** Establishing manufacturing bases in key markets such as Germany and Hungary helps avoid potential EU CBAM liabilities on finished goods and reduces transportation emissions.
- **Supply chain decarbonization:** The "CREDIT" programme, a sustainability audit and capacity-building

system, engages CATL's vast network of suppliers on emissions reduction and data reporting.

- **Market-based solutions:** While batteries are not directly covered by the ETS in China, CATL is indirectly exposed through its electricity consumption and upstream suppliers. The company has also participated in the national voluntary carbon market, the China Certified Emission Reduction (CCER) programme.

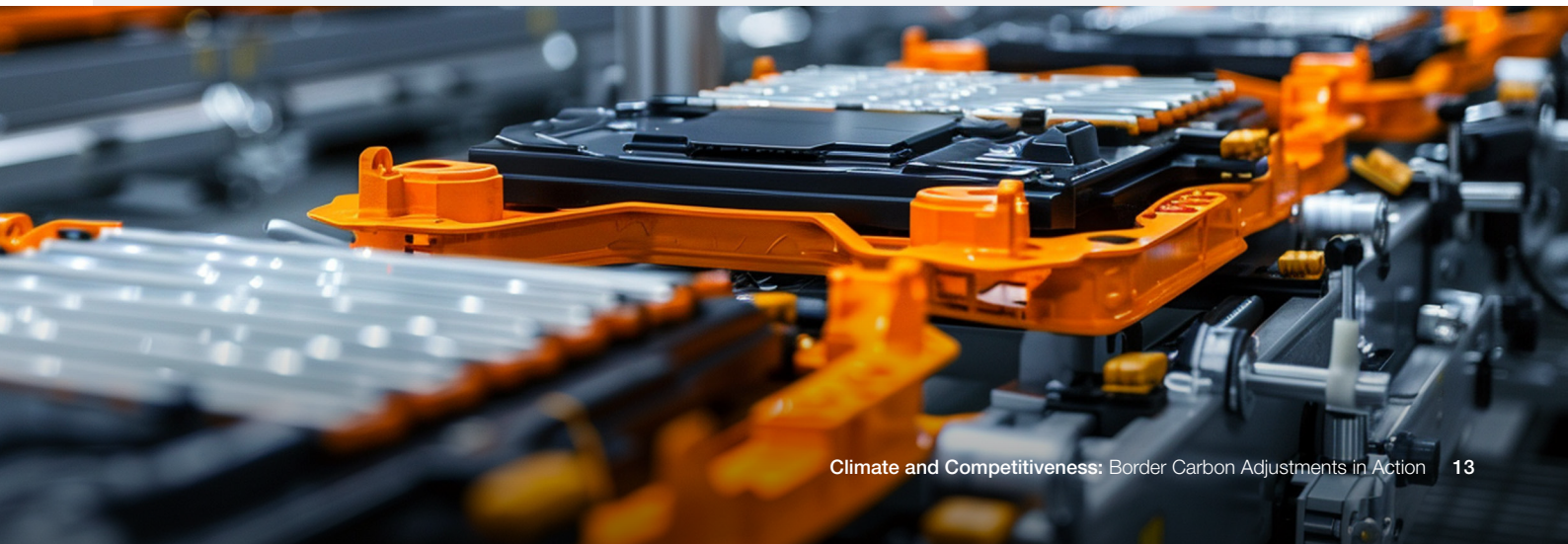


TABLE 4 Key takeaways and potential actions

Timeframe	Type	Timeline
Short term (1–3 years)	Digital infrastructure and accounting	Invest in transparent, auditable digital carbon accounting systems for BCA compliance
	Supplier engagement	Launch capacity-building programmes for suppliers, particularly small and medium-sized enterprises (SMEs), on carbon management and MRV
	Collaboration	Participate in cross-sector dialogues to share best practices and develop common solutions
Long term (3–10+ years)	Financial strategy	Integrate an internal carbon price into investment planning to drive the adoption of low-carbon technologies
	R&D and innovation	Focus research and development (R&D) on developing products with lower embedded carbon to achieve a durable competitive advantage, complemented by zero-carbon facilities powered 100% by off-grid renewable energy sources
	Supply chain strategy	Build resilient, diversified supply chains by sourcing from lower-carbon regions and suppliers



Brazil – Petrobras

Company and sector profile

Petrobras, Brazil's largest corporate and semi-state-owned oil and gas company, dominates national production and refining. As one of the country's top GHG emitters, its exposure to emerging carbon-pricing policies has implications far beyond its corporate strategy. Petrobras's

position is representative of Brazil's industrial landscape: oil and gas are a key element of the country's exports, revenues and energy mix.⁴⁶ How Petrobras navigates carbon pricing and BCAs offers lessons for Brazil's broader economy and other industries.

Business exposure and response

Petrobras's exposure will intensify domestically and internationally. The forthcoming Sistema Brasileiro de Comércio de Emissões (SBCE) will cap emissions from large emitters, including Petrobras's refineries and power plants, creating compliance costs. Internationally, emerging BCA schemes – notably the EU CBAM – signal a new wave of trade-related climate measures. While crude oil and fuels are currently not included in CBAM, they fall under the EU ETS2,⁴⁷ which will apply to fuels of all origins. CBAM could potentially cover refinery-specific emissions, aligning imported refined products with EU carbon pricing.

For Petrobras, this creates short-term indirect risks. Even without immediate coverage, **BCAs reshape global demand patterns, tighten investor expectations and increase scrutiny of emissions intensity.** Over time, the risks are likely to become direct, with potential carbon costs attached to exports.

Petrobras faces structural challenges in aligning with carbon pricing and BCAs. Regulatory uncertainty over the SBCE's final rules complicates planning. Internationally, the absence of

harmonized frameworks creates risks of double compliance if Brazilian carbon pricing is not recognized. High decarbonization costs and limited demand for "low-carbon crude" further reduce incentives to accelerate transformation. Finally, investors increasingly demand robust climate strategies, and weak alignment could elevate Petrobras's capital costs or limit access to environmental, social and governance (ESG) financing.

To prepare, Petrobras has taken notable steps. **It has implemented an internal carbon price to guide investment decisions and created a \$1.3 billion decarbonization fund (2025–2029) to finance emissions reductions. The company is a leader in offshore carbon capture and storage (CCS), aiming to inject 40 million tonnes of CO₂ by 2025.** It has also begun diversifying into biofuels and renewables and recently invested in carbon credits to complement operational reductions.

These actions position Petrobras as a transitional actor among producers in the Global South.

Strategic responses

Petrobras is addressing BCAs and carbon pricing through:

- **Internal carbon pricing:** Applying shadow prices to guide investment decisions.
- **Decarbonization fund:** Financing reductions via a \$1.3 billion fund (2025–2029).
- **CCS:** Scaling offshore CCS with a 40 million tCO₂ target by 2025.

- **Renewables and biofuels:** Investing in cleaner energy alternatives and carbon credit.
- **MRV systems:** Strengthening MRV for compliance and transparency.

These measures help manage risks and position Petrobras for future carbon pricing.

Key takeaways and potential actions

The Petrobras case underscores progress and gaps in Brazil's oil and gas sector. To remain competitive in a context of BCAs, Petrobras and its peers could:

- **Strengthen MRV systems** to meet BCA reporting requirements at facility and export levels.

- **Integrate internal carbon pricing** aligned with international benchmarks into project evaluations.
- **Invest in refinery retrofits** and logistics upgrades to reduce life-cycle emissions.

Company and sector profile

UltraTech Cement, the largest cement producer in India, has been strategically chosen as a case study due to its pan-India presence, high market share (20% market share in India) and leadership in sustainability actions. The company has a consolidated capacity of 192.26 million tonnes per annum of grey cement, including India and overseas. It has

34 integrated manufacturing units, 34 grinding units, one clinkerization unit and 10 bulk packaging terminals. The cement sector is highly energy- and emissions-intensive, contributing significantly to global CO₂ emissions. Reducing these emissions requires fuel alternatives, clinker substitution and energy efficiency measures.

Business exposure and response

Figure 2 illustrates the EU CBAM trade exposure of the cement sector in BASIC countries. The vertical axis shows the carbon payment per dollar of EU production and imports (%) – 64.73% for India, which is higher than Brazil but lower than China and South Africa. Trade dependence, measured as the share of India's total cement exports destined for the EU, is 11.48%, higher than both China and South Africa.

Although the Indian cement industry has moderate direct exposure to the EU CBAM, indirect exposure through supply chains remains a concern. Analysts expect this indirect exposure of UltraTech to rise over the next three to five years as global supply chains become more carbon-regulated.

In response, UltraTech has taken various measures, including committing to the Science Based Targets initiative (SBTi)⁴⁸ in 2021, enhancing energy efficiency through the implementation of clinker cooling systems and expanding the use of renewable energy sources. As of the 2025 financial year, UltraTech was operating 1,020MW of renewables and 351MW of waste heat recovery systems (WHRS). It also uses alternative fuels such as municipal solid waste and agricultural waste.

The company applies an internal carbon price of \$10 per tonne of CO₂ and is adopting innovative technologies, including Coolbrook's RotoDynamic Heater™ (RDH) and University of California, Los Angeles' (UCLA) ZeroCAL process for low-carbon operations. It has also set targets through the initiatives RE100 and EP100,⁴⁹ and is the first Indian company to issue dollar-denominated sustainability-linked bonds.

To reduce Scope 3 emissions, UltraTech has developed a sustainable supply chain framework that identifies 160 suppliers to apply sustainability criteria for fuel, raw materials and packaging. As of the 2025 financial year, UltraTech has inducted over 600 LNG, CNG and electric trucks into its logistics fleet. Additionally, the company is gradually transitioning its logistics operations towards achieving net-zero emissions. While these actions strengthen overall sustainability performance, they do not directly impact EU CBAM obligations, which primarily focus on Scope 1 and 2 emissions for the cement sector.

Key takeaways and potential actions

UltraTech is an example of how a private-sector entity can navigate the impact of BCAs by devising strategic action plans that include:

- **A sustainable supply chain framework** to minimize the supply chain emissions.

- **Innovative mechanisms**, such as sustainability bonds, that can be adopted to mobilize the necessary finance for sustainability projects.

- **An internal carbon price** to prepare organizations to manage future risks.

South Africa – ARM

Company and sector profile

African Rainbow Minerals (ARM) is one of South Africa's largest diversified mining companies, operating in manganese, iron ore, coal, platinum group metals and nickel. The company plays a pivotal role in South Africa's mining and metals sector while supporting international trade.

Approximately 10–30% of its production is exported to regions where BCAs could apply in the future, including the EU, Canada and Australia. Exports are handled through joint ventures, exposing ARM to both direct and indirect impacts.

Business exposure and response

ARM perceives BCAs as a significant potential future competitiveness risk, citing concerns over rising costs, administrative complexity and potential losses in the export market. BCAs are widely viewed as creating inequities, disproportionately affecting producers in developing regions while providing limited additional global climate benefits. Market bifurcation is anticipated, with high-carbon products potentially redirected to markets without BCA requirements rather than achieving genuine emissions reductions.

In response, ARM's Sustainable Development Department elevates climate and environmental issues to board-level discussions, and the company has committed to net-zero GHG emissions by 2050 through short-, medium- and long-term pathways. Key initiatives include adopting internal carbon pricing to guide investments, accelerating low-carbon technologies and energy efficiency, and planning for Scope 3 emissions reductions throughout the supply chain. These measures demonstrate a structured approach to managing carbon risks and enhancing resilience in carbon-regulated markets.

Key takeaways and potential actions

ARM has integrated carbon considerations into its strategy, committing to net-zero GHG emissions by 2050 and implementing internal carbon pricing, low-carbon technologies, Scope 3 engagement and centralized carbon data systems. However, barriers such as high upfront capital expenditure, limited green finance, policy uncertainty and reliance on coal-based electricity constrain adaptation.

Companies could:

- **Invest in low-carbon technologies and process innovations** to reduce emissions and shift towards lower-carbon products.
- **Engage with suppliers** and customers and address Scope 3 emissions with centralized MRV systems.
- **Plan for financial and operational resilience** in the face of policy uncertainty and evolving BCAs, using scenario planning and strategic alignment with international regulations.
- **Embed carbon considerations into strategy early**, adopting internal carbon pricing to guide investments and operational decisions.



1.6 Wider industry responses to border carbon adjustments

Industries worldwide are grappling with the implications of BCAs. To complement the case studies with broader perspectives, the following analysis distills insights from cross-sector discussions

and workshops, highlighting the systemic challenges and strategic opportunities businesses face as the evolving regulatory landscape reshapes global trade and competitiveness.

Exposure and internal readiness

Exposure to carbon pricing and BCAs is increasing, with the EU's CBAM anticipated to expand to more sectors. Hard-to-abate sectors anticipate rising unit costs alongside declines in exemptions in domestic markets, making early strategic planning for direct abatement and robust accounting essential to avoid escalating compliance costs and margin erosion. Indirect emissions from electricity grids and supply chains add competitiveness risks, especially for exporters.

Without accompanying policy support, BCAs could pose existential threats to smaller corporates with less capacity to rapidly adapt, while larger companies may see them as a catalyst for modernization and consolidation. Downstream users, such as car manufacturers, are concerned about the border charge costs and supply chain disruptions.

Leading companies have developed decarbonization policies, ESG steering committees and carbon management systems, and are investing in low-carbon technologies along the supply chain. For example, a Chinese home-appliance manufacturer mapped emissions across production stages and developed a green value

chain that began with product design. Companies are also developing decarbonization roadmaps aligned with domestic rules and anticipated BCA requirements, increasingly embedding internal carbon pricing to steer capital allocation and product portfolio decisions. However, weak engagement of operational teams, limited cross-functional coordination and insufficient internal audit support often hinder execution of measures. Cross-departmental teams and MRV systems are being introduced to track emissions through production stages and projects, and propose novel approaches to decarbonization. Companies with complex supply chains, such as the battery industry, continue to struggle with obtaining accurate primary data and building consistent, traceable datasets.

Implications

Readiness is uneven. Companies that strengthen MRV, embed internal carbon pricing, invest in green technologies and institutionalize cross-functional governance have an opportunity to contain compliance costs, improve product-level traceability and preserve market access as BCA scopes expand.

BOX 1

The experience of the Alliance of CEO Climate Leaders⁵⁰ illustrates this opportunity: its members have demonstrated that emissions can be decoupled from production growth through strategic, coordinated technology investment and transparent MRV. Representing more than 130 companies with 12 million employees and \$4 trillion in revenues, its members reduced

aggregate emissions by 12% while delivering revenue growth of 20% between 2019 and 2023. By aligning corporate strategies with measurable sectoral targets, the Alliance has shown how executive-level commitment and collaboration can translate ambition into competitiveness, offering a practical model for industries navigating emerging BCA regimes.

“Favourable trade financing support from an international bank under its adaptation and resilience finance framework, enabling the delivery of climate-resilient solar modules to international markets.”

“The high costs place considerable strain on corporate balance sheets, making access to green finance essential. Instruments such as green loans are critical to enable compliance with BCA requirements without compromising competitiveness.”

Strategic concerns, response and supports needed

Compliance complexity and uncertainty

Fragmented regulatory regimes, definitions and standards are raising strategic and administrative complexity and costs. Some jurisdictions allow corporations using eligible carbon offsets to reduce a portion of their domestic carbon pricing, whereas the EU's CBAM does not recognize traditional offsets; there are differences in scope, reporting periods and cost calculation methods between the EU's CBAM and the UK's.

Convergence of international standards would enable fair recognition and incentives for reduction efforts with smooth cross-border compliance. Given the evolving and uncertain market and regulatory landscape, companies are advised to engage in policy development and adopt an adaptive approach to strategy and operations.

Technology constraints

Limited access to mature decarbonization technologies remains a barrier. Breakthroughs in aluminium technologies are in early R&D stages, with uncertain timelines for commercial viability and high associated costs, underscoring the need for sustained innovation and investment. Technology transfer and knowledge-sharing are key to accelerating change.

Financial barriers and incentives

Decarbonization is capital-intensive, requiring long-term capital expenditure planning. Yet internal gatekeepers or clients of green industries often have short payback expectations (two to three years, with a maximum of five), hindering low-carbon investments. Current carbon price levels and existing financial mechanisms do not create a sufficient business case for deep

decarbonization, particularly in commodities where cost competitiveness is critical. Green premiums, industry-specific government aid to cover both capital and operating expenditure for decarbonization and access to affordable renewable energy are essential to enable transformation. Recycling domestic carbon revenues to fund technology upgrades and MRV tools can accelerate the transition.

Enablers

Affordable green finance helps first movers scale retrofits and bring breakthroughs to market. Jinko Solar⁵¹ secured favourable trade financing support from an international bank under its adaptation and resilience finance framework, enabling the delivery of climate-resilient solar modules to international markets. Industries are seeking support from the financial sector through lower interest rates. Financing models, such as energy service contracts, may also unlock investments.

“Decarbonization is not free,” said one chemicals industry participant. “The high costs place considerable strain on corporate balance sheets, making access to green finance essential. Instruments such as green loans are critical to enable compliance with BCA requirements without compromising competitiveness.”

Implications

Companies are implementing near-term measures that focus on efficiency gains and process tweaks to reduce emissions intensity, while preparing for profound structural shifts as regulations tighten. Procurement practice adjustments and supply chain collaborations are also part of risk management responses.



“ Proactive decarbonization can support investor confidence, regulatory goodwill and competitive positioning.

Competitiveness and strategic opportunities

BCAs have not yet caused major competitiveness losses, because mechanisms currently remain in transitional reporting phases. Operational impact is emerging for some industries, but changes remain limited. Companies may be in early stages of adaptation, but proactive readiness is gaining momentum. True impacts on profit margins, pricing power and procurement will become clear once definitive measures take effect.

Companies that prepared early could gain first-mover advantages, including enhanced reputation, premium market access and resilient supply chains. Investors and clients are increasingly scrutinizing

corporate transition plans, emphasizing executable roadmaps and transparent MRV systems. Therefore, proactive decarbonization can support investor confidence, regulatory goodwill and competitive positioning.

Implications

Viewing BCAs not just as a compliance cost but as a strategic opportunity allows companies to leverage low-carbon products to differentiate themselves in the market, justify premium pricing and protect or expand market share.

BOX 2

A key example of private-sector alignment around deep decarbonization is the First Movers Coalition (FMC).⁵² The FMC brings together more than 90 companies across seven hard-to-abate sectors, using aggregated purchasing commitments to accelerate the commercialization of zero-carbon technologies. By securing demand signals for green steel, cement, shipping and

aviation fuels, FMC members are creating early markets that directly support the decarbonization goals underlying mechanisms such as BCAs. The initiative demonstrates how collective corporate action can complement policy tools by reducing cost barriers and scaling low-carbon supply chains.

“ Economies and businesses with coordinated responses across policy, finance and industries will be better positioned to thrive and succeed in the low-carbon future.

Key takeaways and potential actions

BCAs are accelerating the coupling of climate ambition with trade competitiveness. Companies could:

- **Assess exposure** and align internal systems, such as building decarbonization roadmaps that integrate MRV, internal carbon pricing and cross-functional governance to meet product-level disclosure and traceability requirements.
- **Engage in policy dialogue for harmonization** of fragmented BCA designs to reduce

administrative complexity and trade barriers; this helps achieve coordinated standards externally and corporate scenario planning, with incentives aligned across markets.

- **Strategically frame BCAs as catalysts** for innovation and competitiveness, not as regulatory challenges.

Economies and businesses with coordinated responses across policy, finance and industries will be better positioned to thrive and succeed in the low-carbon future.

2

Strategy playbook

The strategy playbook provides guidance on responding to carbon-pricing policies.



Carbon-pricing policies create new obligations for businesses considered to be key emitting entities, requiring compliance actions, internal resource development and operational changes. Companies outside traditionally high-emitting sectors can also take steps to prepare, particularly where their value chains include carbon-intensive inputs or processes – for example, photovoltaic manufacturers relying on aluminium frames or wind turbine producers dependent on steel and composite materials. Ideally, national policies will help companies become more efficient and competitive while preparing for the impacts of BCAs.

Companies can organize their responses to carbon-pricing policies, including BCAs, using the PACE framework:

1. Plan administration of carbon-pricing policies: Develop internal governance

mechanisms and resources to comply with policies, create strategies, promote strategic forecasting to leverage the dynamic carbon-pricing environment and drive implementation

2. Achieve domestic and international compliance: Take actions required to satisfy regulations under domestic carbon-pricing systems and BCAs, addressing divergences where necessary

3. Change operations to decarbonize: Implement improvements in sourcing, production, delivery and other activities to reduce GHG emissions

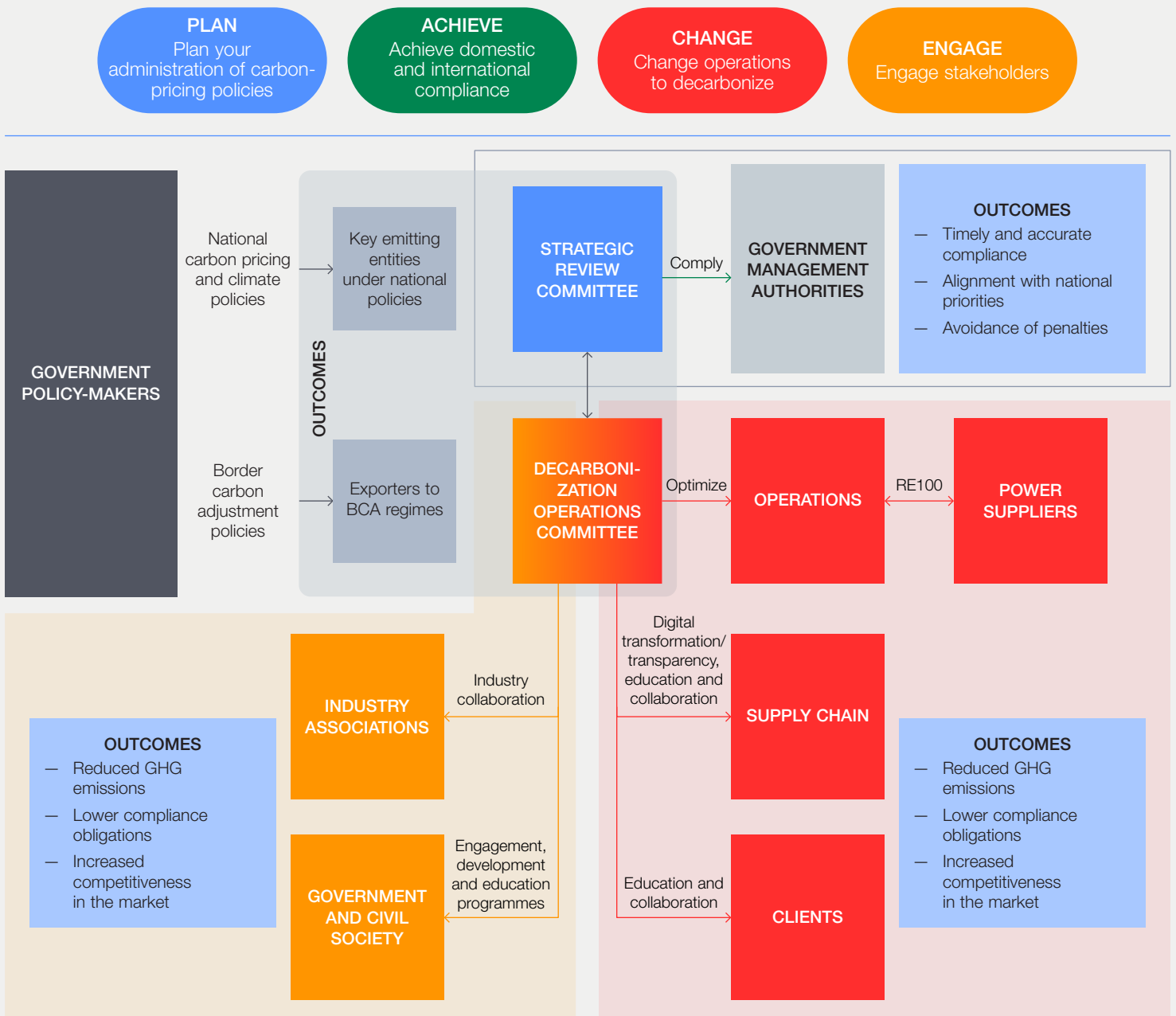
4. Engage stakeholders: Collaborate within the value chain and with policy-makers, civil society and other stakeholders to advance decarbonization

“

For strategic management of risk and opportunities related to BCAs, cross-functional coordination is essential. We have an internal taskforce that includes representatives from sustainability, finance, market analysis, logistics, procurement and public affairs, which not only allows for more effective strategic decisions but also greater efficiency and knowledge-sharing.

Sarah Hay, Climate Policy Lead, Norsk Hydro

FIGURE 2 | The PACE framework and the response landscape



Source: Climate Finance Asia Analysis

2.1 | Plan administration of carbon-pricing policies

Effective strategies are important for internal capacity-building and for the deployment of resources that will drive decarbonization, enabling the leveraging of BCAs for competitiveness.

TABLE 5 | Internal company structures to manage external policy regimes






Basic governance structures		
 <p>Carbon and energy policy management functions</p>	 <p>Cross-functional coordination</p>	 <p>Partner management teams</p>
<p>Establish resources and bodies for managing BCA-specific monitoring, reporting and regulatory interface, instrument management (allowances, certificates), strategy planning and operational excellence</p>	<p>Ensure integration between environmental, legal, finance and operations teams</p>	<p>Establish functional roles to manage relationships with third-party verifiers, carbon and energy-related instrument/traders and advisers, to stay updated on BCA policy changes and ensure compliance</p>
Specific governance structures		
 <p>Strategic review committee (SRC)</p>	 <p>Decarbonization operations committee (DOC)</p>	
<p>Purpose: To direct the strategic review process and authorize major decisions related to BCAs and carbon pricing policies (see Figure 4)</p>	<p>Purpose: To achieve operational transformation by reducing GHG emissions, decreasing fossil-fuel dependency and industrial inputs, thereby reducing exposure to BCA costs and increasing business competitiveness (see Figure 5)</p>	

FIGURE 3 | Strategic review process flowchart

Five-phase process for managing government climate and decarbonization policies through internal strategic bodies

IMPLEMENTATION TIMELINE

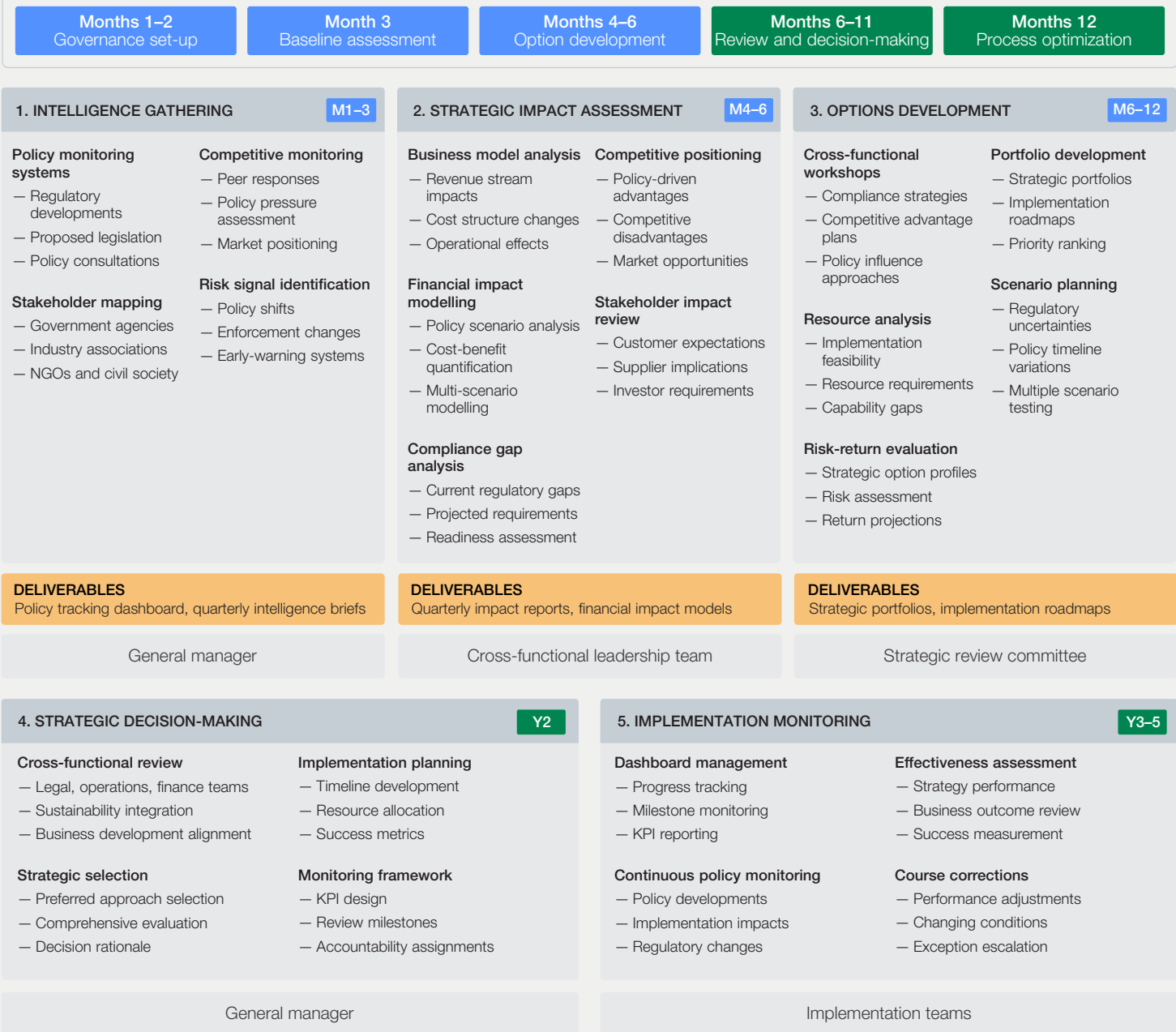


FIGURE 4 | Decarbonization operations process flowchart

Six-phase operational framework for optimal conversion of national climate objectives into concrete, measurable GHG emissions reductions

IMPLEMENTATION TIMELINE

Planning and strategy phases (1–3)

Phase 1: Month 1–3

Phase 2: M4–6

Phase 3: M6–12

Implementation and optimization (4–6)

Phases 4–5: Year 2

Phases 5–6: Y3

Phase 3: M6–12

1. OPERATIONAL REVIEW M1–3		2. IMPACT ASSESSMENT M4–6		3. STRATEGY DEVELOPMENT M6–12	
<p>Current state assessment</p> <ul style="list-style-type: none"> – Fossil fuel dependencies – Carbon intensity analysis – Facility energy audits <p>Process optimization</p> <ul style="list-style-type: none"> – Efficiency retrofits – Low-carbon fuels – Feedstock substitution <p>Energy transition roadmap</p> <ul style="list-style-type: none"> – Electrification options – Renewables procurement – Bio-industrial inputs 	<p>Supply chain and stakeholders</p> <ul style="list-style-type: none"> – Scope 3 mapping – Stakeholder identification – Peer benchmarking <p>Digital monitoring (with the SRC)</p> <ul style="list-style-type: none"> – Scope 1 and 2 GHG tracking – Energy intensity metrics – Fossil fuel input monitoring 	<p>Cost-benefit modelling</p> <ul style="list-style-type: none"> – Alternative energy scenarios – Process efficiency return on investment – Fuel switching economics <p>Risk and technology assessment</p> <ul style="list-style-type: none"> – Fossil-fuel dependency risk – Technology readiness – Feasibility evaluation 	<p>GHG reduction quantification</p> <ul style="list-style-type: none"> – Asset-level potential – National targets alignment <p>Stakeholder impact analysis</p> <ul style="list-style-type: none"> – Workforce skill needs – Community impacts – Just transition principles 	<p>Cross-functional workshops</p> <ul style="list-style-type: none"> – Operational reduction strategies – Technology deployment plans – Supply chain alignment <p>Scenario planning</p> <ul style="list-style-type: none"> – Energy price volatility – Technology timelines – Grid decarbonization rates <p>Resource and risk analysis</p> <ul style="list-style-type: none"> – Capital requirements – Skills and infrastructure – Risk-return analysis 	<p>Implementation planning</p> <ul style="list-style-type: none"> – Portfolio compilation – Priority pathway selection – Detailed implementation plans <p>Team development</p> <ul style="list-style-type: none"> – Training programmes – Low-carbon methods – Technology capabilities
<p>DELIVERABLES Quarterly intelligence briefs, energy transition roadmap</p>		<p>DELIVERABLES Quarterly impact reports, cost-benefit analysis</p>		<p>DELIVERABLES Comprehensive strategy, implementation roadmap</p>	
<p>Head of energy management or environmental health and safety</p>		<p>Cross-functional team (COO/CSO-led)</p>		<p>Decarbonization operations committee</p>	
4. TRANSITION IMPLEMENTATION Y2		5. SUPPLY-CHAIN DECARBONIZATION Y2–3		6. CONTINUOUS IMPROVEMENT Y3–5	
<p>Efficiency and renewables</p> <ul style="list-style-type: none"> – Energy efficiency programmes – Renewable procurement – Energy storage solutions <p>Industrial electrification</p> <ul style="list-style-type: none"> – Replace fossil heating – Electric steam generation – Process electrification <p>Fuel substitution</p> <ul style="list-style-type: none"> – Fuel substitution roadmaps – Heating system transition – Low-carbon feedstocks 	<p>Advanced technologies</p> <ul style="list-style-type: none"> – Green hydrogen programmes – Carbon capture and utilization – Fleet conversion to electric vehicles <p>Partnership and innovation</p> <ul style="list-style-type: none"> – Industrial partnerships – National innovation platforms – Just transition alignment 	<p>Supplier assessment</p> <ul style="list-style-type: none"> – Carbon assessments – High-emissions identification <p>Requirements and policies</p> <ul style="list-style-type: none"> – Decarbonization requirements – Sustainable sourcing policies – Timeline establishment 	<p>Regional optimization</p> <ul style="list-style-type: none"> – Regional supply chains – Transportation reduction – Low-carbon materials <p>Capability-building</p> <ul style="list-style-type: none"> – Supplier programmes – Technology support – Knowledge-sharing 	<p>Energy management systems</p> <ul style="list-style-type: none"> – Real-time monitoring (SRC) – Operational key performance indicators – Quarterly reviews <p>Technology Innovation</p> <ul style="list-style-type: none"> – Emerging technology evaluation – Research partnerships – Pilot programmes 	<p>Policy and market monitoring</p> <ul style="list-style-type: none"> – Grid conditions tracking – Course corrections – Monthly reports
<p>COO or CSO</p>		<p>Chief procurement officer (COO/CSO)⁵³</p>		<p>Implementation teams</p>	

2.2 Achieve domestic and international compliance

Comprehensive domestic carbon pricing and BCA compliance strategies can help organizations meet policy obligations. Companies can comply with their national policy regimes by:

- **Monitoring regulatory status:** Check regularly whether your company meets thresholds and coverage criteria in each jurisdiction
- **Establishing reporting systems, records management and disclosure procedures:** Implement processes to disclose GHG emissions or energy usage reports according to prescribed methodologies for both domestic policies and BCAs; retain records and supporting documentation for required periods for internal compliance reviews or external verification/auditing
- **Managing compliance instruments:** Receive and track allocated instruments and plan for timely compliance
- **Maintaining the registry and managing submissions:** Enter validated data to registries for instrument tracking and compliance demonstration, and submit documentation and payments through designated channels
- **Building capacity and capabilities:** Ensure that personnel understand requirements, prohibited activities and penalty structures, and track policy developments (e.g. a strategic foresight team)

2.3 Change operations to decarbonize – and engage stakeholders

Companies can develop meaningful strategies to drive operational excellence while simultaneously reducing GHG emissions and BCA policy exposure.

Achieving GHG emissions reductions within companies is the most impactful way to reduce exposure to carbon-pricing policies, including but not limited to BCAs. Companies should start by establishing a baseline with carbon accounting and setting ambitious targets via the GHG Protocol⁶⁴ and Science Based Targets or similar methodologies.

These targets should align with industry pathways and policy obligations, and be supported by an aligned business strategy. While companies can offset existing emissions with credits or implement CCUS, these are stopgap solutions.

The following actions enable companies to reduce compliance obligations and gain competitive advantages by leveraging BCAs through robust decarbonization actions.



Operational strategies

TABLE 6 Operational excellence

POWER	
 <p>Renewable energy systems and storage</p>	<p>Install solar panels, wind turbines and other renewable systems with storage to optimize use; alternatively, where available (e.g. China), secure a green power direct connection (GPDC) to solar and wind resources via dedicated lines, providing CBAM-compliant, verifiable green power</p>
 <p>Corporate PPAs</p>	<p>Assess Scope 2 emissions across facilities and production tiers to identify sites with the highest carbon intensity to prioritize for renewable PPAs; negotiate long-term power purchase agreements with renewable energy developers in order to directly reduce the emissions intensity of production and demonstrate verifiable decarbonization of electricity inputs – two important factors in BCA exposure</p>
PROCESS	
 <p>Advanced technology adoption and process optimization⁵⁵</p>	<p>Deploy new clean production technologies, energy efficiency systems, emissions-reduction equipment, lean manufacturing and advanced process control systems, including digital emissions monitoring solutions that can simplify disclosure under BCAs and national policies</p>
 <p>Comprehensive energy audits and smart manufacturing⁵⁶</p>	<p>Systematic identification and implementation of energy efficiency options, internet of things deployment, data analytics and AI solutions for real-time optimization can advance achievement of BCA and national policy emissions reductions and energy efficiency targets</p>
ENVIRONMENT	
 <p>Waste-to-value and circular economy⁵⁷</p>	<p>Convert waste streams into revenue sources through circular economy approaches, design products for recyclability and reuse, and minimize waste generation to reduce embedded emissions from procurement and processing of new raw materials or manufactured goods</p>
 <p>Green product development and service model innovation</p>	<p>Create product lines designed for environmental performance and develop service-based business models that optimize resource use, which are ideal for business sales into any markets under carbon pricing policies</p>
 <p>Impact measurement and sustainability-linked financing</p>	<p>Develop systems for measuring environmental impact and negotiate loans with interest rates tied to sustainability performance, which can supplement emissions disclosures under carbon-pricing policies</p>

FINANCE



Internal carbon pricing (ICP) and investment decision framework

Establish sufficiently high, company-wide carbon-pricing mechanisms to internalize carbon costs in investment decisions, operational planning and performance evaluation, creating incentives for emissions reductions across business units that can strengthen the organization's posture on compliance



Green bond issuance and ESG optimization

Improve ESG ratings to access sustainability-focused capital, and issue green bonds for environmental projects or negotiate loans with interest rates tied to sustainability performance to fund decarbonization activities, which can reduce exposure to BCA and national policies

R&D



R&D investment and patent development⁵⁸

Establish clean-technology research centres, partner with universities and create intellectual property for licensing and competitive protection



Demonstration projects

Build showcase facilities that demonstrate advanced environmental performance and emissions-reduction capabilities that reduce policy exposure

Stakeholder engagement strategies

TABLE 7

Stakeholder engagement

WORKFORCE



Employee engagement and training programmes

Create company-wide efficiency and sustainability improvement programmes that engage employees in emissions-reduction efforts

SUPPLIERS



Supplier sustainability and local sourcing programmes

Implement comprehensive environmental standards for suppliers and prioritize local suppliers to reduce transport emissions; utilize vetted networks of low-carbon material, like the First Suppliers Hub, to complement these efforts, and source from suppliers that meet recognized decarbonization thresholds to strengthen sustainability and reduce BCA exposure across the value chain



Supply chain digitalization and collaborative innovation

Use digital solutions for supply chain transparency and partner with suppliers on joint sustainability projects

GOVERNMENT



Community partnership and government collaboration

Lead community development programmes and participate constructively in policy development processes and regulatory consultations

PARTNERSHIPS



Partnership ecosystems development

Build partnerships with complementary companies to create comprehensive, sustainable solutions; participation in coalitions such as the First Movers Coalition, for example, can enhance corporate credibility and investor confidence by aligning private procurement with public climate goals – such engagement helps companies demonstrate proactive alignment with the global transition, mitigating future trade and policy risks



Academic collaboration and research partnerships

Partner with universities and research institutions on sustainability R&D



Industry initiative leadership and NGO partnerships

Drive industry sustainability initiatives, participate in standards development and collaborate with environmental organizations

CERTIFICATIONS



Market education and certification programmes





Invest in educating customers about the benefits of sustainable products and obtain third-party certifications that validate environmental claims

Industry strategy matrix

Many of these operations and stakeholder strategies are applicable in multiple industries. Other operational and stakeholder strategies are more industry-specific, as outlined in Table 8.

TABLE 8 **BCA-oriented decarbonization strategies industry matrix**

Industry	Operational strategies	Stakeholder engagement strategies	Applicable countries	Applicable to CBAM?
 Aluminium	<ul style="list-style-type: none"> – Reduced fossil fuel dependence – Waste-to-value programmes 	<ul style="list-style-type: none"> – Collaborative supplier innovation – Academic sustainability R&D 	All BASICs	Yes
 Cement	<ul style="list-style-type: none"> – Impact measurement/reporting systems – Local sourcing optimization 	<ul style="list-style-type: none"> – Transport emissions reduction focus 	All BASICs	Yes
 Chemicals	<ul style="list-style-type: none"> – Cutting-edge clean production tech – Green product development 	<ul style="list-style-type: none"> – Market education on sustainable chemicals – University research partnerships 	All BASICs (India chlor-alkali and fertilizer; China in the future)	Planned (2030)
 Fertilizers	<ul style="list-style-type: none"> – Smart manufacturing implementation 	<ul style="list-style-type: none"> – Agricultural community partnerships – Food security government collaboration 	All BASICs	Yes
 Mining	<ul style="list-style-type: none"> – Advanced extraction technology – Mine site renewables – Site rehabilitation 	<ul style="list-style-type: none"> – Indigenous rights collaboration – International standards compliance 	Brazil, South Africa	Varies
 Petrochemicals	<ul style="list-style-type: none"> – Internal clean-technology research centres – Patent development – Products designed for recyclability 	<ul style="list-style-type: none"> – Intellectual property (IP) licensing opportunities – Partnership ecosystems – Service model innovation 	All BASICs (China in the future)	Planned (2030)
 Pulp and paper	<ul style="list-style-type: none"> – Waste stream revenue conversion – Company-wide improvement programmes 	<ul style="list-style-type: none"> – Local sourcing prioritization – Recyclability design focus 	India, China (future)	No
 Secondary agriculture and food processing	<ul style="list-style-type: none"> – Processing facility efficiency – Sustainable packaging development 	<ul style="list-style-type: none"> – Deforestation-free supply chains – Sourcing from sustainable farm operations 	Brazil, India (sugar)	No

 Steel and iron	<ul style="list-style-type: none"> – Latest clean production technologies – Lean manufacturing integration 	<ul style="list-style-type: none"> – Voluntary industry standards leadership – Joint supplier sustainability projects 	All BASICs	Yes
 Textiles	<ul style="list-style-type: none"> – Water/chemical efficiency – Circular textile recycling design 	<ul style="list-style-type: none"> – Sustainable cotton/fibre sourcing – Brand partnerships for sustainable fashion – Consumer education 	Brazil, India, South Africa	No
 Thermal power	<ul style="list-style-type: none"> – Clean energy technology R&D – Smart energy management 	<ul style="list-style-type: none"> – Technology licensing revenue – ESG investor engagement – Renewable energy developer partnerships 	All BASICs	No
 Transport	<ul style="list-style-type: none"> – Fleet electrification – Alternative fuel development – Smart logistics optimization 	<ul style="list-style-type: none"> – Charging infrastructure partnerships – Transport policy collaboration – Supply chain decarbonization 	Brazil, India, South Africa	No



The implementation of market mechanisms underscores the need for robust GHG accounting systems capable of meeting regulatory requirements. As part of our journey, Vale has invested in data science and integration, supporting importers and engaging suppliers to ensure compliance. Looking ahead, global alignment and recognition for renewable electricity consumption and regional decarbonization strategies, such as using biofuels and biomaterials, will be critical to building resilient, sustainable trade systems. Further policies are also needed to integrate carbon capture, both geo- and nature-based, to carbon border adjustments.

Grazielle Parenti, Executive Vice-President of Sustainability, Vale

Localization strategies for BCAs

Exporters can make two strategic responses to reduce their obligations under BCAs and national carbon pricing policies through localizing their production and value chains.

Localizing production

By situating manufacturing bases in countries that have implemented BCA regimes, companies can:

- Reduce transportation GHG emissions from imports and, where the necessary resources are available, via local supply chains
- Access cleaner energy sources where available
- Enhance stakeholder and policy alignment by localizing value chains and supporting domestic job creation

Localizing sourcing and procurement

Manufacturing and processing companies are highly dependent on supply chains to reduce GHG emissions. Transport emissions are easiest to reduce by localizing supply chains, and further reductions can be achieved by implementing supply chain carbon profiling, using digital platforms and designing selection processes that reward low-carbon suppliers. Localized sourcing can also improve traceability and data integrity, and can make emissions tracking, auditing and certification easier.

2.4 Financial considerations

Companies have the option to harness powerful approaches to financing, including quantifying decision-making and accessing transformative capital.

Beyond the PACE framework, it is worth focusing on two key financial considerations: cost-benefit analyses and the development of government-supported and sustainable financing strategies.

BCA-oriented cost-benefit analysis

Companies should evaluate how technologies and projects deliver emissions reductions and carbon cost savings, calculating abatement cost per tonne of CO₂e versus potential for total tonnes of CO₂e reduced for different projects (a marginal abatement cost curve [MACC]).

Corporations should structure cost-benefit analyses by setting GHG baselines across operations and value chains and measure Scope 1, 2 and 3 emissions to identify the highest-impact reduction opportunities and quantify emissions savings from interventions. Companies can then prioritize projects delivering multiple benefits – operational improvements, measurable GHG reductions and enhanced competitive positioning. They can also quantify how decarbonization investments enhance market access, particularly in BCA jurisdictions, and strengthen supply chain relationships.

Dynamic carbon-pricing scenario building and probability analysis

The cost-benefit framework should incorporate dynamic carbon-pricing scenarios, modelling how different policy stringency levels affect project economics over asset lifetimes. These scenarios must recognize that while currently hypothetical, costs created by BCAs will be real, substantial and ever-increasing over the next decade. Probabilistic analysis and simulations can then inform internal carbon pricing points over short- and long-term timeframes, and be factored into cost-benefit analyses. Probabilistic analysis can help organizations navigate uncertainty by quantifying the likelihood of different outcomes, making it a useful tool for assessing exposure to evolving carbon prices, BCA adjustments and other transition risks that cannot be predicted with certainty. Scenarios should also include evaluating how stakeholder engagement strategies may achieve broader value-chain emissions reductions.



“ Investors increasingly recognize that companies addressing carbon-pricing policies through systematic decarbonization investments offer superior risk-adjusted returns.

Financing strategies

Companies can develop financing strategies for GHG emissions reduction that use governmental incentives and climate-focused financial institutions.

Government support

Many carbon-pricing policies provide direct financial support such as co-financing for clean-technology deployment, free allowance allocations that subsidize investments, technical assistance or reduced taxes.

Labelled bonds

Companies can structure financing strategies with labelled bonds and loans (including revolving credit) that fund decarbonization technologies. Sustainability-linked instruments tie interest rates to emissions-reduction targets, creating rewards for achieving compliance while reducing capital costs.

Sustainability-aligned investors

Additionally, companies can engage ESG-focused investors by demonstrating alignment between decarbonization investments and compliance strategies. Companies should present financial models showing how government incentives enhance project returns and cost-benefit analyses that highlight improved financial performance. This includes quantifying how policy-driven revenue streams from tax incentives and compliance benefits improve project economics.

Syndicated climate loans

Syndicated climate loans can serve as a key financing instrument for companies adapting

to emerging BCAs. By linking borrowing terms to measurable emissions-reduction targets, these facilities enable firms to access capital at preferential rates while decarbonizing production processes and supply chains. The transparency and third-party verification embedded in such loans also strengthen emissions reporting and traceability, supporting compliance with evolving carbon disclosure and adjustment regimes. In this way, syndicated climate loans can help companies manage both the financial and operational dimensions of BCA exposure while enhancing long-term competitiveness.⁵⁹

Demand aggregation platforms

Demand aggregation platforms, such as the First Movers Coalition, pool the purchasing commitments of leading companies to create early markets for low-carbon materials and technologies. By combining corporate demand, these platforms provide clear market signals that de-risk investment and accelerate commercialization in hard-to-abate sectors. As these technologies scale, they can drive down production emissions and costs, reducing corporate exposure under emerging BCA regimes.

Investors increasingly recognize that companies addressing carbon-pricing policies through systematic decarbonization investments offer superior risk-adjusted returns. The financing strategy should therefore emphasize how compliance positions companies for long-term competitiveness, particularly regarding BCAs.

3

From insight to action

Companies can manage BCA-specific risks by integrating internal carbon pricing, supply chain engagement, low-carbon technologies and collaborative strategies.

Companies should conduct scenario planning for potential BCA expansions, evaluating different exposures, implementation timelines and likelihoods to anticipate compliance and trade impacts.

The case studies show that companies across regions face direct and indirect pricing risks, particularly through BCAs. Trade-exposed sectors, particularly in emissions-intensive industries, but also in sectors that utilize emissions-intensive components, will soon experience rising costs, administrative burdens and shifts in supply chain competitiveness. However, these challenges offer opportunities to strengthen resilience, innovation and market positioning, where companies can

decouple growth from emissions, thus reducing their BCA exposure and increasing their capacity to leverage BCAs for competitiveness.

Members of the Alliance of CEO Climate Leaders⁶⁰ have collectively demonstrated emissions can be decoupled from production growth through coordinated technology investment and transparent reporting. By aligning corporate strategies with measurable sectoral targets, the Alliance showcases how executive-level commitment and collaboration can deliver both competitiveness and verifiable emissions reductions – a model relevant to industries exposed to BCAs.



1. **Internal carbon pricing adoption:** An internal carbon price – as seen in S Group, UltraTech Cement and Petrobras – anticipates regulatory costs and creates incentives for low-carbon investment when set at a level sufficiently high to reflect likely BCA and carbon-pricing exposures, aligning corporate strategies with global carbon frameworks. Companies can consider embedding this price in major capital expenditures, long-term planning and risk management processes. In parallel, companies could conduct scenario mapping to assess how evolving BCA designs and related shifts in domestic carbon prices may alter cost structures, competitiveness and investment priorities over time, ensuring that internal pricing and strategic planning remain adaptive to a dynamic policy environment.
2. **Engagement with suppliers:** Companies can consider systematically measuring, monitoring and improving supplier emissions using robust digital MRV systems. Supplier audits, capacity-building initiatives and sustainable supply chain frameworks – as implemented by CATL and UltraTech Cement – enhance accountability, mitigate indirect BCA exposure and provide a competitive edge in carbon-regulated markets, even though BCAs typically do not cover Scope 3 emissions.
3. **Investment in digital carbon accounting systems:** Accurate and transparent emissions data can enable streamlined reporting, reduce compliance risks, inform operational decisions, facilitate supply chain collaboration and increase investor confidence.
4. **Adopting low-carbon technology and process innovations:** Companies can consider pursuing energy-efficiency measures, integrate renewable energy, adopt circular economy practices and, where needed, adopt hydrogen-based production or CCUS. Technology roadmaps and R&D collaborations – as demonstrated by S Group, CATL and Petrobras – support long-term carbon risk management and open new market opportunities.
5. **Financial strategies underpinning decarbonization:** Sustainability-linked bonds, green loans and bonds, decarbonization funds and scenario-based planning can mobilize resources for low-carbon investments.

Combining financial instruments with operational optimization, diversified sourcing and product innovation enhances resilience against carbon costs.

6. **Cross-sector and internal collaboration:** Participation in industry coalitions, joint MRV initiatives and procurement networks helps companies address compliance challenges, harmonize standards and collectively reduce emissions. Equally important is internal cross-functional collaboration and knowledge-sharing within the organization, enabling companies to strategically navigate the BCA landscape while enhancing regulatory compliance and competitiveness.
7. **Adoption of the PACE framework:** Where appropriate, the PACE framework can guide decision-making, integrate carbon considerations into strategic planning and enhance alignment across operations, supply chains and stakeholder engagement.
8. **Other procurement actions to navigate BCAs:** Mapping suppliers of in-scope goods by origin, volume and embedded emissions; shifting towards lower-carbon suppliers or materials; forming cross-functional BCA teams supported by governance structures, external consultants or specialized software; and updating contracts to include emissions-reporting and BCA-compliance clauses.
9. **Alignment with internationally harmonized carbon accounting standards:** As they emerge, companies can align with these standards to secure access to affordable green finance, which could enable the leveraging of BCAs as opportunities rather than obstacles.

Border carbon adjustments mark a new phase in global trade, one that will unfold at different speeds, with varying ambitions and divergent impacts. Many companies face real constraints, from cost pressures and policy uncertainty to uneven infrastructure and market readiness, making the path forward complex. Yet even within these limits, there is space to act: by identifying practical opportunities, collaborating across value chains and maintaining a long-term view, business leaders can increase their business competitiveness while helping to ensure that the transition supports both resilience and sustainable growth.

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