Brazil as a strategic player in the carbon market

Why building an energy transition-led economy matters—and what it means for business value

2025

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Introduction

The current trajectory of greenhouse gas emissions remains far from achieving the goal of limiting global warming to 1.5 °C, as outlined in the Paris Agreement. To correct this trajectory, coordinated action will be required to foster international agreements, alongside national and subnational policies that enable the adoption of low-carbon practices.

The cost of not reducing emissions is high, and the impacts are already materializing worldwide, with the increasing frequency and intensity of extreme weather events causing financial losses across sectors of the economy and threatening human lives. The monetary estimate of the damages caused by each additional ton of carbon dioxide released into the atmosphere is known as the Social Cost of Carbon (SCC), which has been estimated at US$280/tCO$_2$ by the University of California, Davis.

The SCC supports the implementation of carbon pricing systems in several national and subnational jurisdictions worldwide by assigning a cost to emissions and holding major emitters financially accountable. In Canada, for example, SCC estimates have informed the establishment of minimum carbon prices applied in pricing systems.

By putting a price on emissions, there is also a financial incentive to adopt low-carbon solutions, as carbon-intensive companies subject to pricing schemes begin to weigh the cost-effectiveness of decarbonization actions against the price imposed by law or regulated markets. In other words, based on current carbon prices and future trends, companies are compelled to implement measures that reduce their emissions—or pay for those that remain unabated.

More than 90 countries and regional governments have already adopted carbon pricing mechanisms, including market-based systems and taxation. The Emissions Trading System (ETS) has been the primary regulatory instrument worldwide. It generates 67% of regulated carbon revenues (US$69.1 billion), while taxation systems account for 33% (US$33.1 billion).

The European Union Emissions Trading System (EU ETS) is the world's largest and most mature carbon-pricing mechanism. Starting in 2026, it will be complemented by the Carbon Border Adjustment Mechanism (CBAM), which imposes tariffs on carbon-intensive imports, aligning the price paid by European companies with that of importers from countries with less stringent climate rules.

Following Europe's lead, several other countries are adopting emissions pricing schemes and designing border protection mechanisms, introducing rules that will reshape perspectives and arrangements for international trade.

Brazil—with one of the cleanest energy matrices in the world and unique biodiversity—is well positioned to take on a leading role. But this will require preparation, strategy, and coordinated action between the public and private sectors. The enactment of Law No. 15,042/2024 marks Brazil's entry into this new playing field with the creation of the Brazilian Emissions Trading System (SBCE).

The new regulation establishes a robust set of guidelines, including sectoral targets, tradable assets, shared governance, and an infrastructure for measuring and tracking greenhouse gas emissions. In the first implementation phase, around 5,000 companies will be required to measure, report, and offset their emissions, laying the foundation for a structured national market.

In the following chapters, we will analyze the pillars of the Brazilian Emissions Trading System (SBCE) and their connection to Brazil's international commitments, as reflected in the updated Nationally Determined Contribution (NDC) revised in 2024. This NDC sets a target of reducing emissions by 59% to 67% by 2035, using 2005 levels as a baseline, and projects achieving climate neutrality by 2050, in line with Article 6 of the Paris Agreement.

We will also discuss the risks and opportunities arising from global carbon pricing mechanisms—and why Brazil has the potential to lead a new chapter of the low-carbon economy, bridging international competitiveness and environmental commitment.

Ultimately, this roadmap outlines pathways for companies to anticipate new requirements, integrate carbon considerations into business decision-making, and transform regulatory risks into a competitive advantage. It is an invitation to move beyond rhetoric and turn climate management into a real growth strategy.

"We are following new global trends and being influenced by their subsequent evolution. We must move toward a new economic logic—cleaner, more resilient, and aligned with climate commitments—by creating mechanisms that assign value o the reduction of greenhouse gas emissions."

Daniel Martins,
Partner and Energy and Utilities Leader

01

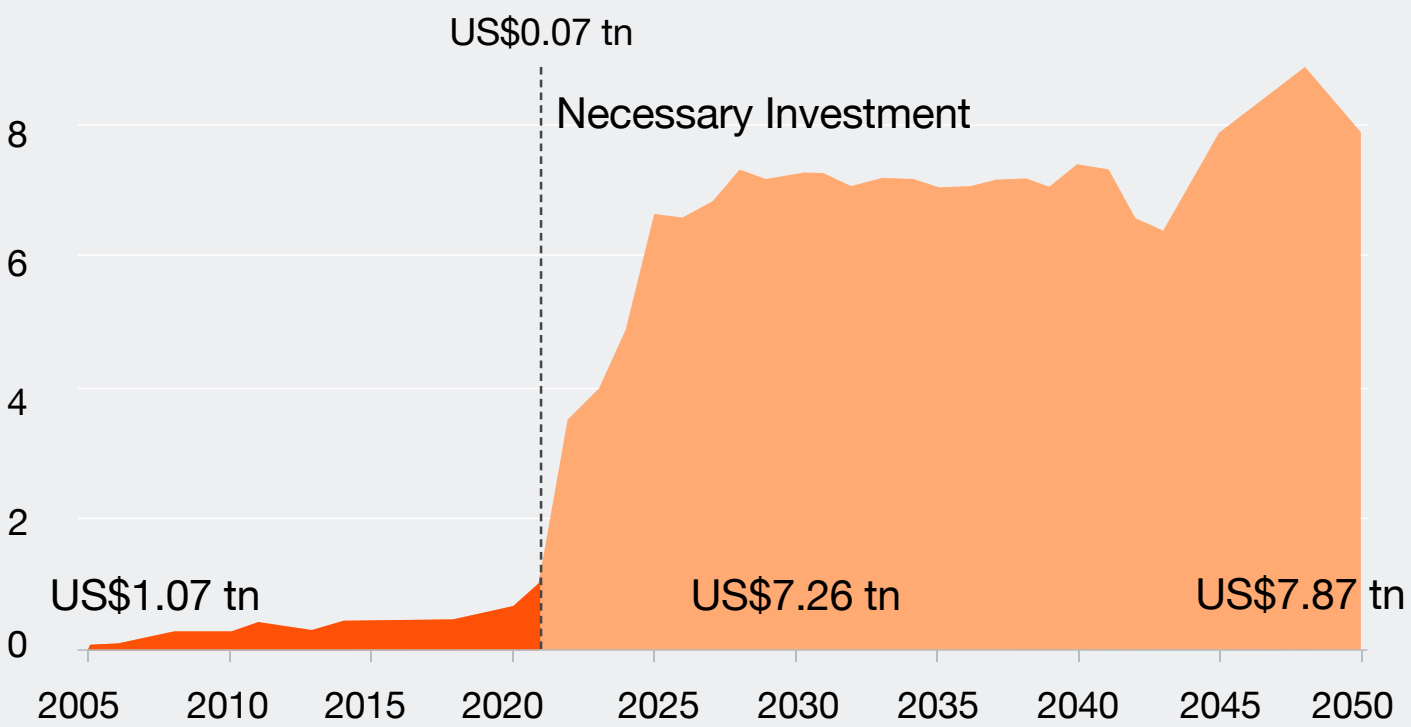
The new low-carbon economy: what is at stake?

Achieving global climate targets is no simple task. Beyond the financial costs, the price of climate inaction is already evident: more than US$2 trillion has been lost due to extreme weather events, according to a report by the International Chamber of Commerce (ICC). Hurricanes, prolonged droughts, and increasingly frequent floods directly affect food production, the availability of drinking water, and put millions of lives at risk worldwide.

To prevent these losses from multiplying in the coming decades, an unprecedented volume of investment in the energy transition will be required. According to estimates from the International Energy Agency (IEA) and the Intergovernmental Panel on Climate Change (IPCC), such investments will need to exceed US$4 trillion per year as early as 2025, and could reach between US$7.2 trillion and US$8.9 trillion annually between 2030 and 2050 (see chart below).

Annual investment demand will rise sharply compared to current levels

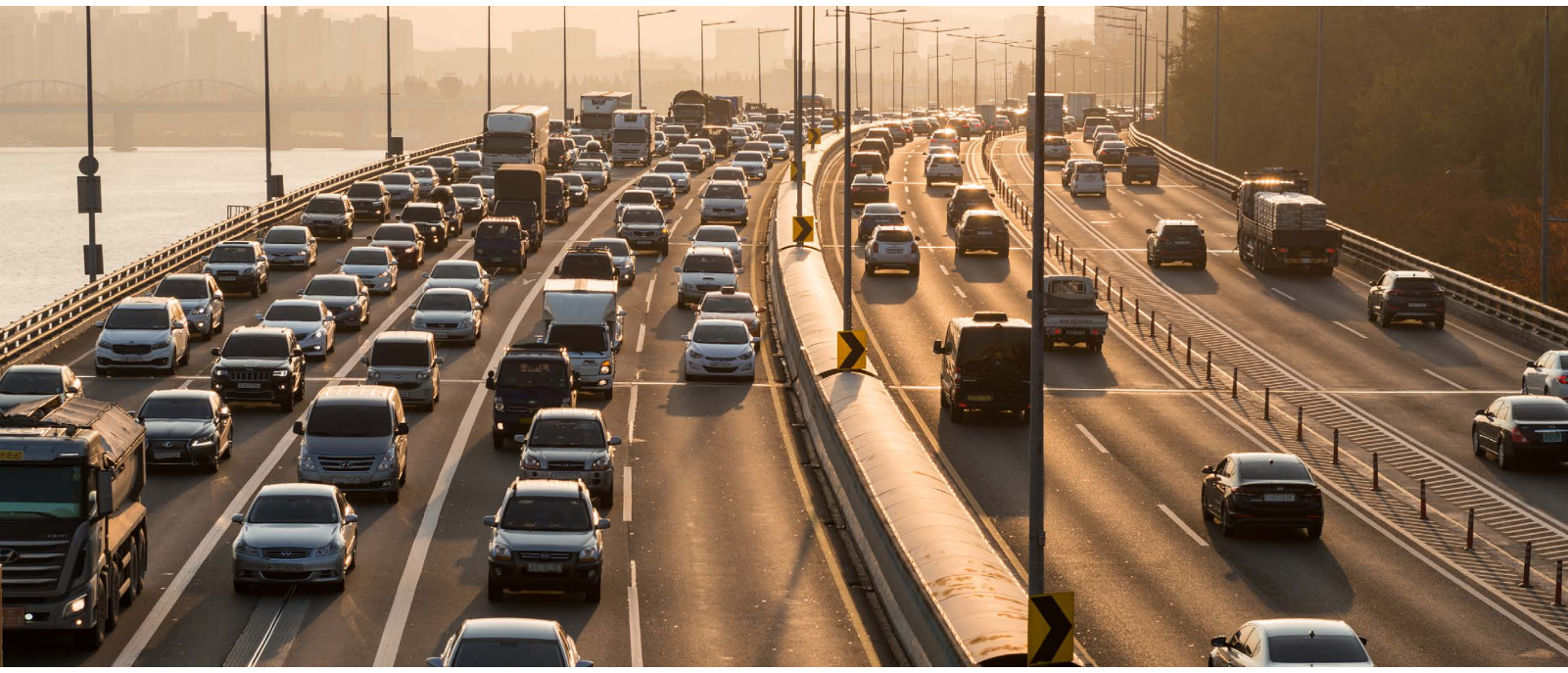
Capital required for annual investment in the energy transition (in US$ trillions)



Note: Investment requirements in real terms, 2022
Source: BNEF

In the economy's most carbon-intensive sectors—such as cement, steel, aviation, and fossil fuels—the costs of decarbonization are expected to be more substantial, necessitating the adoption of new technologies, fuel substitution, and carbon capture. These sectors are, in fact, among the first to be included in carbon regulations already established in several countries.

Economists and industry representatives believe that imposing carbon prices may have an inflationary impact on companies and consumers, potentially raising the cost of housing or vehicles in the short term, as steel and cement prices are likely to increase. The same could happen with airfares, since cleaner fuels and raw materials remain more expensive.



On the other hand, if sufficient investments are not made, the financial impacts on society will be even more catastrophic. Studies by the National Bureau of Economic Research (NBER) indicate that for every 1 °C increase in average global temperature, global GDP could decline by up to 12%, jeopardizing production chains, critical infrastructure, and even food security.

In a scenario of a 3 °C rise in global temperature, the Social Cost of Carbon (SCC) could exceed

US$ 1,300/tCO$_2$,

—far above the price estimated as necessary to achieve Net Zero targets (US$250/tCO$_2$).

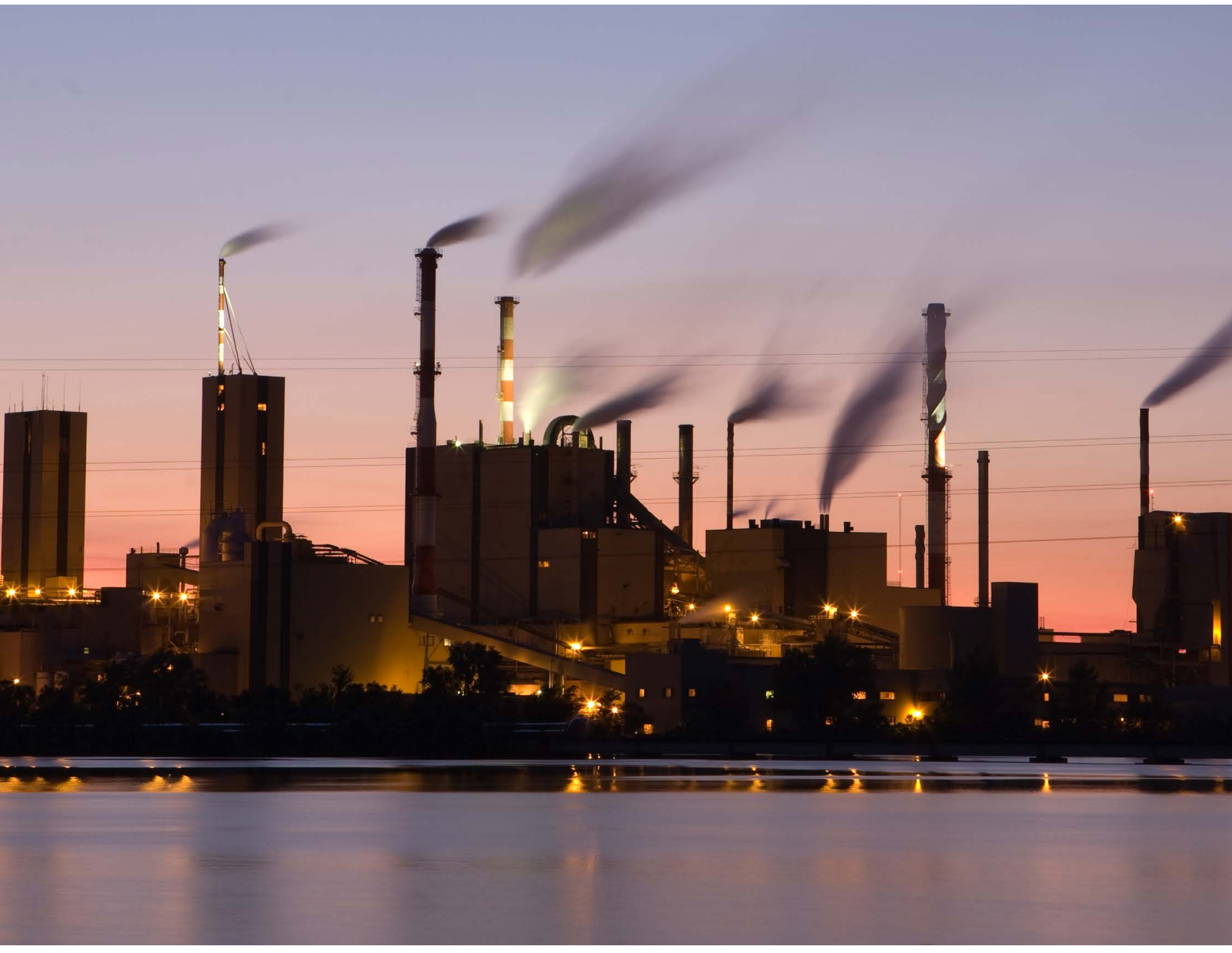
Source: International Energy Agency (IEA – Net Zero by 2050).

These figures highlight the need to reorganize the economy by creating mechanisms that assign value to emission reductions rather than bearing the costs of inaction. More than an economic measure, it is a strategy to preserve lives, ensure climate security, prevent trillion-dollar losses, and sustain global competitiveness.

The expectation is that, as international regulation advances and the regulated and voluntary markets consolidate, carbon markets will become one of the main platforms for financing the transition toward a more sustainable, fair, and competitive energy future.

By implementing these systems in a planned and gradual manner, we enable carbon-intensive sectors to prepare for the transition and contribute to achieving climate goals.

1.1



Why put a price on carbon?

As the impacts of climate change become more frequent and severe, the urgency to adopt mechanisms that reconcile economic development with environmental responsibility is increasing. Carbon pricing is therefore essential to align growth with climate action.

For the private sector:

- Promotes decarbonization by inducing market behavior that discourages greenhouse gas (GHG) emissions and encourages cleaner practices.
- Increases the competitive advantage of lower-emission practices and of companies that reduce their carbon footprints, contributing to the achievement of corporate climate targets.
- Stimulates innovation and the adaptation of value chains to more sustainable standards, by making low-carbon technologies and sustainable solutions—such as carbon capture and storage (CCS) and renewable hydrogen—more attractive.
- Enables decision-making and resource allocation in sustainability, as environmental costs are incorporated into investment, production, and consumption analyses, making decarbonization scalable.
- Encourages the creation of new markets and business models focused on the climate transition, such as carbon credit trading, reforestation, and nature-based solutions.

For the public sector:

- The revenue generated enables investments in energy transition initiatives, resilient infrastructure, and social equity, becoming a relevant source of funding to support the transformation itself.
- Contributes significantly to helping countries meet their climate targets by setting sectoral emission limits or imposing costs on emissions in line with each sector's capacity for action.

By assigning a cost to CO_2 emissions, carbon pricing sends a clear signal to the market: emissions become an expense, while investing in clean solutions becomes more advantageous—something indispensable for companies seeking to align their business with climate goals.

Its adoption, however, may bring challenges. In the early stages, for instance, operational costs may rise, especially for companies with high emission intensity and limited capacity to implement technological innovation. In addition, global market dynamics require the creation of protective mechanisms for sectors under pressure from international trade and competition with countries with less stringent environmental regulations.

This scenario is shifting with the expansion and consolidation of these mechanisms worldwide, as well as with growing pressure for climate action and transparency in both domestic and international trade. Companies that anticipate the transition by modernizing their processes will be better prepared to compete in a market driven by traceability and climate commitments.

1.2

The global context of carbon pricing

Carbon pricing worldwide is implemented through three types of instruments. The first consists of regulated systems, which currently account for 99% of global financial flows. However, these systems are expected to share space with the second type in the future: international markets developed under the Paris Agreement framework. The third type comprises voluntary carbon markets, which have been gaining traction as regulated systems mature.

Overview of carbon pricing systems

Commitments undertaken by the private sector

US$0.7 bn
In value of carbon credits traded

Project examples
- Land use
- Agriculture
- Energy efficiency

The international market, in its early stage, aims to support countries in meeting their NDCs

195 countries
with active NDCs

Brazil
- 59%–67% emissions reduction target by 2035
- Potential to generate and sell credits globally

Voluntary

International

Regulated

Legal requirement that obliges certain sectors to reduce GHG emissions

US$104 bn
in government revenues → **ETS**
US$75 bn

Carbon tax
US$29 bn

Carbon Border Adjustment Mechanism (CBAM)

European Union

Steel	Hydrogen	Cement
Fertilizers	Electricity	Aluminum

The debate on carbon pricing has advanced mainly through regulated markets, which currently account for most global financial flows. This will be the central focus of this reading path, given the current stage of Brazil's market regulation.

Although still under development, voluntary carbon markets have been gaining momentum and represent an important complementary pathway, especially for sectors and countries seeking to accelerate the climate transition before mandatory regulations are implemented.

1) Regulated carbon pricing instruments

There are currently 110 carbon pricing instruments in place across more than 90 national and subnational jurisdictions, covering about one-quarter of global emissions. Each jurisdiction defines its own rules, such as sectoral coverage, gases included, revenue allocation, and exemption criteria, among others. These instruments are organized into two main models:

Emissions Trading Systems (cap-and-trade): Governments set a cap on emissions and issue allowances that can be distributed for free or sold through an auction. As these systems mature, free allocations tend to be replaced by auctions or trading among regulated companies, which fosters market formation and signals higher prices.

Direct Carbon Tax: Governments set a price per ton of CO_2e emitted, imposing a direct cost on emitters and encouraging reductions.

Emissions Trading Systems (ETS), based on the cap-and-trade model, account for the largest share of priced emissions and generate the highest global revenues among regulated instruments, particularly in European countries.

In 2024, these systems raised approximately US$69.1 billion, with the EU ETS accounting for the majority, followed by systems in Germany, California, the United Kingdom, and the Regional Greenhouse Gas Initiative (RGGI), which brings together states in the northeastern United States.

Meanwhile, direct carbon taxation systems raised about US$33.1 billion. A notable example is Canada, which applies a combined model: the BC Carbon Tax, implemented in British Columbia, and the Federal Fuel Charge, a nationwide levy on fuels that sets a fixed price per ton of CO_2 emitted. Other notable cases include France, with its national carbon tax, and Norway, which implemented one of the world's first carbon taxes back in 1991.

Revenue from carbon pricing, by instrument, in 2024

Reflects the contribution to global government revenue from carbon pricing, by instrument

Carbon Tax
US$33.1 billion

ETS
(Emissions Trading Systems)
US$69.1 billion

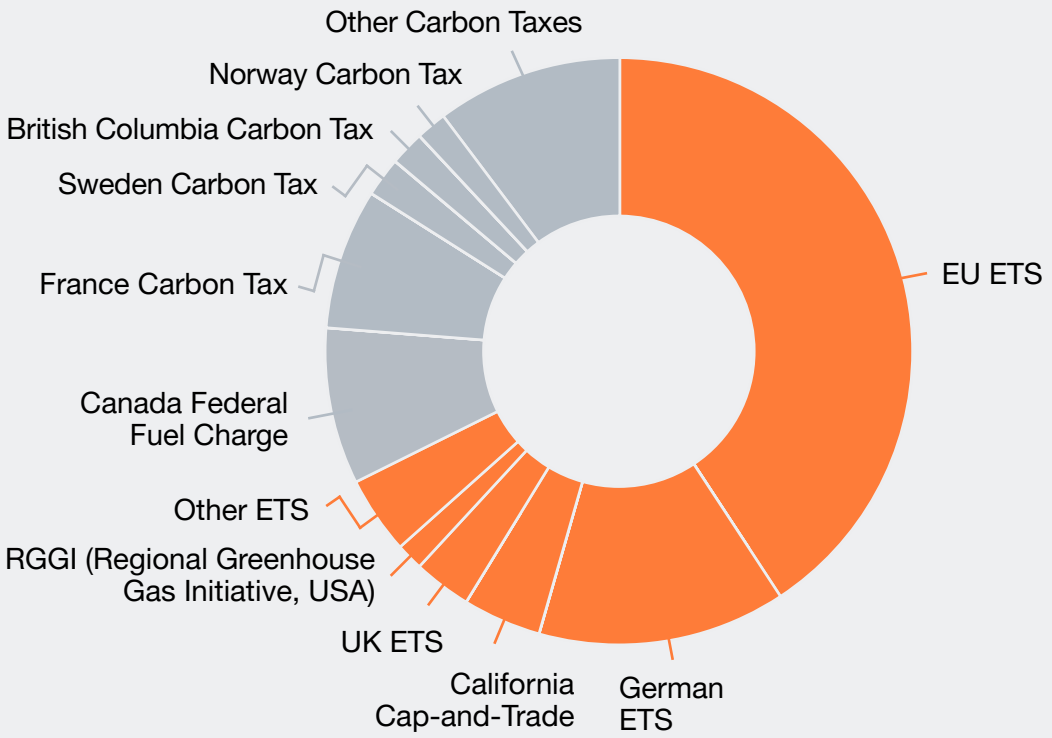


Image source: Carbon Pricing Dashboard, World Bank

In countries with more restrictive policies and broad sectoral coverage, rising carbon costs may exacerbate inequalities and affect local competitiveness—not only for companies but also for national economies.

The asymmetry between the adoption of policies and nations' climate action capacity underscores the need to create protective mechanisms for regulated markets, as well as policies for a **just transition** and enhanced cooperation.

To prevent carbon costs from becoming a competitive disadvantage compared to companies in countries with less restrictive rules, economies with regulated carbon pricing generally adopt two main instruments: allocating free allowances to sectors more exposed to international markets and implementing a border protection system.

The first border protection system, the European CBAM, is in the implementation phase and is expected to begin applying import tariffs in Europe from 2026. Importers of carbon-intensive products—such as steel, cement, and fertilizers—will be required to pay a tariff proportional to the embedded emissions. Beyond Europe, other countries are already designing similar systems.

This trend is increasing regulatory pressure on carbon pricing worldwide, introducing rules that will create new perspectives and arrangements for international trade. In practice, countries and companies that do not price their emissions will begin to face the cost of emissions in their exports, potentially threatening their competitiveness if they fail to align their trajectories with global requirements.

2) International markets

Since 2025, with 195 countries participating in the Paris Agreement, discussions have focused on creating a global carbon market. The goal is to facilitate international cooperation in meeting climate targets by providing a price signal that encourages less carbon-intensive practices and reduces the costs of implementing climate plans.

Article 6 of the Agreement establishes guidelines for creating such a market, allowing for the transfer of mitigation outcomes between countries, provided that transparency, traceability, and environmental integrity criteria are observed. According to the official COP29 portal, this international cooperation could reduce the costs of implementing national climate plans by up to US$250 billion per year by 2035.

- **Article 6.2:** Internationally Transferred Mitigation Outcomes (ITMOs), enabling countries to transfer certified emission reductions among themselves, if traceability and environmental accounting criteria are respected.
- **Article 6.4:** Establishment of a structured mechanism for the generation and trading of carbon credits, based on specific projects approved by an international supervisory body. These credits, known as A6.4ERs, may be used by other countries in fulfilling their NDCs, or by companies with voluntary climate responsibility and carbon neutrality commitments.

The topic has been a recurring item on the agenda of the United Nations (UN) Conferences of the Parties (COPs). Over the years, discussions on carbon pricing and the regulation of international markets have alternated between moments of progress and stagnation.

However, it was at COP29 in 2024 that a significant milestone was reached: the definition of rules for the operation of the **global carbon market**, including the establishment of guiding criteria for selecting methodologies for carbon credit generation and removal activities under Article 6.4.

Despite this progress, the international carbon market must still undergo an implementation phase before it enters into force. In addition, the varying levels of climate ambition reflected in each country's NDCs may create distortions in this market. With the update of countries' NDCs expected at COP30, a greater balance among national responsibilities is anticipated, contributing to the development of a fairer market.

3) Voluntary Carbon Markets

Voluntary carbon markets are platforms where companies, organizations, and individuals can purchase carbon credits to offset their greenhouse gas emissions voluntarily. Unlike regulated markets, these systems are not legally required—but they have been gaining relevance as pressure for environmental commitments and climate neutrality grows in the private sector.

In 2024, the total value of voluntarily traded carbon credits reached US$16.3 billion. Despite their non-mandatory nature, voluntary markets have become an important catalyst for climate action in the private sector, driven by the growing engagement of companies that set their own decarbonization targets.

02

Brazil in action: building a regulated carbon market

For Brazil to assume a leading role in the international carbon market, it is essential to ensure consistency between its national climate commitments and its global engagement.

This ambition is directly linked to the mechanisms set out in Article 4.2 of the Paris Agreement, which requires each country to present a Nationally Determined Contribution (NDC)—that is, its individual target for emission reductions and climate adaptation.

Brazil's NDC, updated in 2024, sets a goal of reducing emissions by 59% to 67% by 2035 relative to 2005 levels and reaffirms the commitment to achieving climate neutrality by 2050.

As one of the strategies to support the country on its path to emission reductions, Law No. 15,042/2024 was enacted, establishing the Brazilian Emissions Trading System (SBCE). This system will serve as the backbone of the national regulated market, ensuring that transactions are conducted with credibility, traceability, and alignment with international standards.

2.1

Brazilian Emissions Trading System

The Brazilian Emissions Trading System for Greenhouse Gases (SBCE) is the regulatory framework that structures the country's carbon market and establishes the foundations for companies in carbon-intensive sectors to trade emission allowances and removal certificates.

The law aims to enable Brazil to meet its climate targets in a cost-effective, gradual, and equitable manner, promoting the reduction and removal of greenhouse gas (GHG) emissions through coordinated participation by the public, private sectors, and civil society.

The implementation of the SBCE will be gradual, with five phases, and completion is expected after 2030. This phased approach is designed to provide predictability and legal certainty for regulated companies.

Phase 5

Start of the fully operational market, with the first auction of CBEs and the opening of the secondary market for trading between companies.

Phase 4

Publication of the PNA, start of the allocation cycle of emission allowances (CBEs), and first auctions.

Phase 3 (24 months)

Start of mandatory reporting and monitoring plans, which will serve as the basis for the first National Allocation Plan (PNA).

Phase 2 (12 months)

The implementation of the MRV system (Monitoring, Reporting, and Verification) requires standardized emission reporting by companies, which serves as the basis for market oversight.

Phase 1 (12–24 months)

Initial regulation, creation of the governing body, and definition of regulated sectors.

It is estimated that around 5,000 companies will fall within the scope, with a focus on the industrial sector, which accounts for a large share of regulated emissions. Primary agricultural production activities are temporarily excluded from the market, as are waste and effluent treatment units that adopt proven neutralization technologies.

The requirement for Monitoring, Reporting, and Verification (MRV) will apply to companies emitting 10,000 tons of CO_2e per year, with stricter obligations above the 25,000-ton/year threshold—including the reconciliation and offsetting of emissions through the purchase of assets in the regulated market.

The system will operate with two main types of assets:

- **Brazilian Emission Allowances (CBEs):** Tradable permits that authorize emissions within the sector-specific cap (cap-and-trade). They are allocated to companies under the SBCE, which can sell or purchase them as needed. The definition of industry limits will be set in the National Allocation Plan.
- **Verified Emission Reduction or Removal Certificates (CRVEs):** Credits generated from projects that remove or additionally reduce emissions (such as reforestation, carbon capture, or renewable energy). The use of CRVEs (also known as offsets) will be limited within the SBCE, with specific criteria yet to be defined.

Key issues still pending

Although the legal framework has been established, key points for the proper functioning of the SBCE remain undefined. How these issues will be regulated will determine not only the system's environmental effectiveness, but also its economic viability and international credibility. During the SBCE's implementation phase, several key questions are expected to be addressed:

Ambition and scope

- What will the emission limits be for each sector?
- Will targets be defined by intensity or in absolute terms?
- What will the industry coverage and share of emissions be?

Market protection and competitiveness of the Brazilian industry

- Will there be free allocations? For which sectors and at what level of representation?
- Will a border protection mechanism be adopted for products imported from countries without carbon pricing?

Integration with the voluntary carbon market

- What role will CRVEs play in the system? Can they be used to meet the obligations of regulated companies?
- What criteria will define the acceptance of these assets: credits with *vintage*[1], methodologies, certifiers, and integrity?

[1] Vintage credits: refers to the year in which the emission reduction or removal was generated and certified. Markets often limit acceptance to more recent credits to ensure the relevance and additionality of the assets—for example, only credits generated within the last five or ten years.

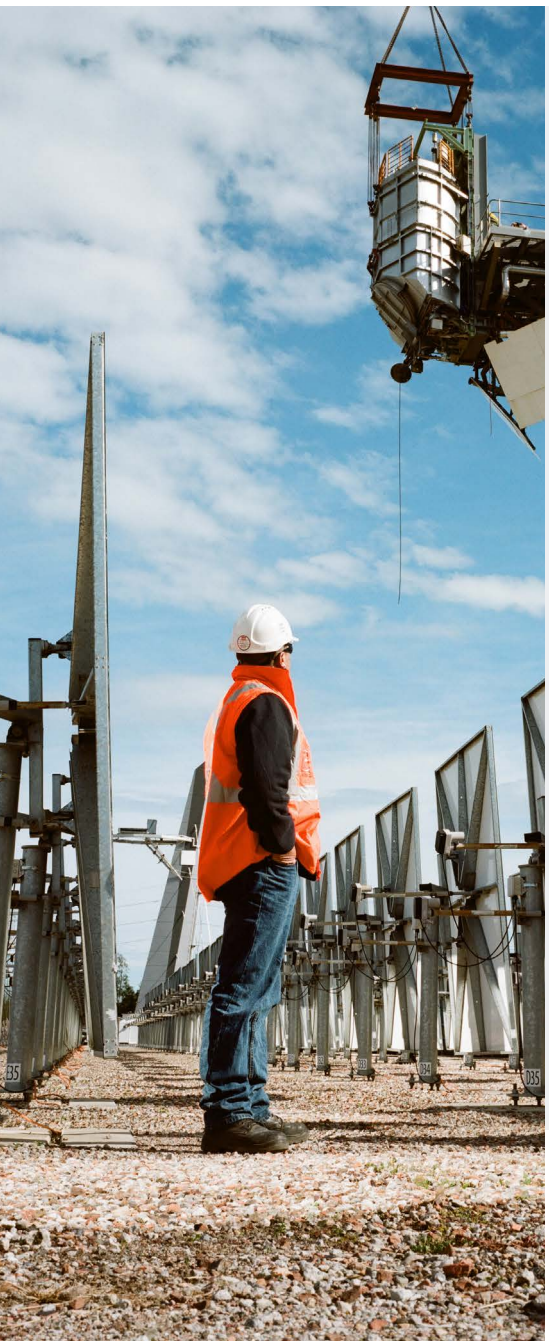
Secondary markets

- Will there be a secondary market for trading?
- Who will be the operators? Could they be from the private sector?

Integration with international markets

- Will there be integration with other regulated markets?
- Could Brazil become an exporter of decarbonization assets?
- How will this impact the fulfillment of Brazil's NDC?
- What rules will ensure corresponding adjustments[2] and prevent double counting?

[2] Corresponding adjustments: an accounting mechanism under Article 6 of the Paris Agreement to avoid double counting of emission reductions transferred between countries.



With the creation of this framework, Brazil moves closer to the instruments established under Article 6 of the Paris Agreement, with the possibility of aligning CRVEs with A6.4ER credits, provided they follow robust methodologies, are audited, and comply with UN criteria.

In addition, the carbon market opens the door for Brazil to integrate with other international regulated markets under Article 6.2, similar to the market link established between Switzerland and the European Union or between California in the United States and Quebec in Canada.

2.2

Brazil on the global carbon stage

With the enactment of Law No. 15,042/2024, Brazil has become more concretely integrated into the international ecosystem of regulated carbon markets. However, for the country to export credits and mitigation outcomes to other nations, it must first demonstrate consistent progress in meeting its own climate targets.

Brazil's potential is significant, given its unique natural resources, including vast areas for forest conservation, ecosystem restoration, and sustainable land-use projects, which enhance its capacity to generate high-integrity environmental credits.

Studies by Strategy& indicate that by 2030, the potential supply of carbon credits in Brazil—considering the country's full range of available resources—could reach around 370 $MtCO_2e$, approximately nine times higher than the estimated domestic demand (between 17 and 72 $MtCO_2e$). Since Brazil's demand represents only 2.5% to 5% of global demand, much of this volume will need to be connected to external markets, for example, through the voluntary market or Article 6 of the Paris Agreement.

Brazilian credits currently account for approximately 7% of global demand and are expected to represent 12% to 13% in the coming years. Of this volume, more than 50% would be directed toward international demand, reinforcing the country's role as a carbon credit exporter.

Turning this potential into a competitive advantage will depend on effective regulation, combined with robust mechanisms for traceability and the sustainable use of natural resources.

2.3

Opportunities and risks for Brazilian companies

The expansion of carbon pricing mechanisms worldwide is reshaping the logic of international competitiveness. Even in countries where there is still no direct carbon charge, in a globalized world, companies already face financial impacts embedded in product prices, stemming from taxes, regulatory requirements, and instruments such as the CBAM.

This cost, known as the hidden cost of carbon, can represent more than 1.5% of production value in carbon-intensive sectors such as steel, cement, and chemicals, and up to 10% of electricity costs in G20 countries, according to a **2023 PwC study**.

For operations in Brazil, carbon pricing could become a source of competitive advantage, given the country's lower potential carbon intensity, driven by its abundant natural resources and renewable energy sources. Critical sectors illustrate this scenario below:

Energy sector

Brazil's energy matrix, largely based on renewable sources, may give the country a structural competitive edge compared to nations with higher emission intensities. In 2023, the carbon intensity of electricity generation in Brazil was 0.10 tCO_2e/MWh, while countries such as China, India, and South Africa exceeded 0.5 tCO_2e/MWh. This represents a gap of up to 492% compared to the countries with the highest emissions.

In primary energy, the picture is also favorable for Brazil: the national carbon intensity was 1.36 tCO_2e/toe, compared to 3.02 in India, 2.75 in China, and 2.61 in Vietnam, making Brazil the lowest among the countries analyzed—a differential that may translate into lower carbon adjustment costs in regulated markets being implemented worldwide.

By applying a theoretical carbon price of US$35/$tCO_2$, Brazil could hold a competitive advantage over China of nearly US$17/MWh in electricity and US$49/toe in primary energy, underscoring Brazil's structural comparative advantage, sustained primarily by its low-emission power matrix.

Brazil stands out for its clean energy matrix and can leverage its energy advantage to export low-carbon industrial products

Competitive advantages of Brazil's clean energy matrix

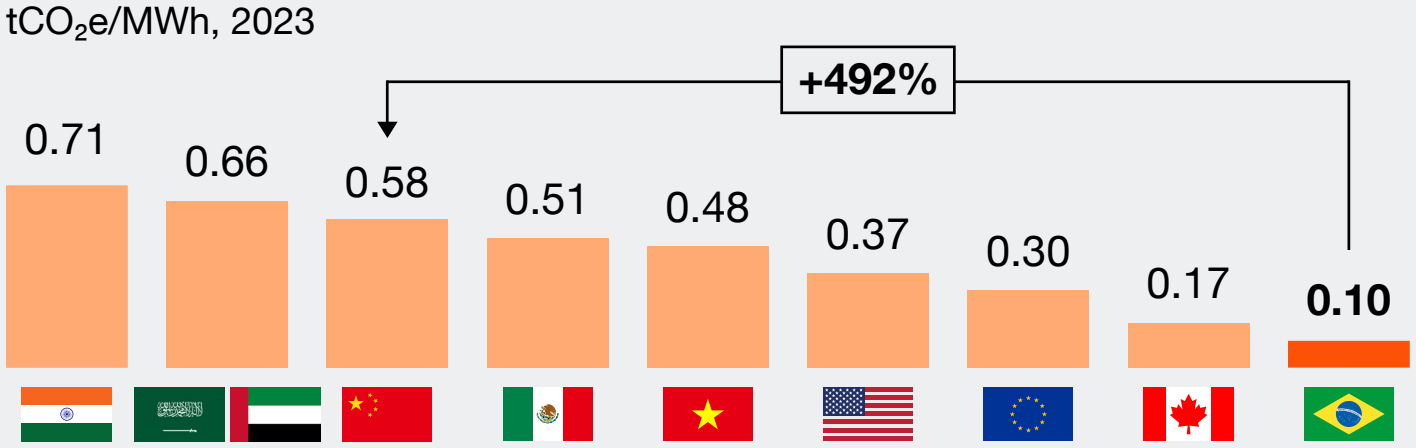
Competitive advantage in power generation

Potential competitive advantage in Brazil [US$/MWh]

India	Saudi Arabia & UAE	China	Mexico	Vietnam	USA	EU	Canada	**Brazil**
21.47	19.52	16.89	14.27	13.16	9.46	7.05	2.50	

Carbon intensity – Power generation

tCO_2e/MWh, 2023



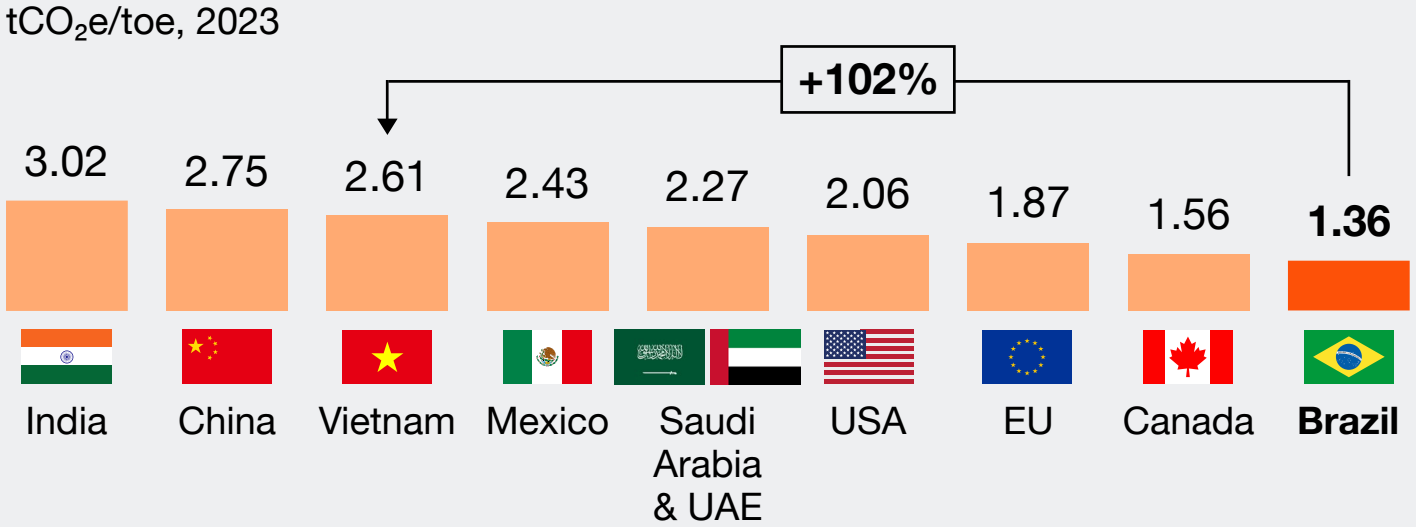
Competitive advantage in primary energy

Potential competitive advantage in Brazil [US$/toe]

India	China	Vietnam	Mexico	Saudi Arabia & UAE	USA	EU	Canada	**Brazil**
57.89	48.50	43.73	37.17	31.75	24.40	17.74	6.91	

Carbon intensity – Primary energy

tCO_2e/toe, 2023



Sources: PwC analysis, Global Trade Analysis Project e IEA.

Ferrous metals and aluminum sector

Brazil can position itself strategically in sectors highly exposed to climate regulation—such as iron, steel, and aluminum—when considering CO_2 emission intensity per ton of product.

In addition, in sectors with high export volumes, the country has a more competitive CO_2 intensity.

Exporters of iron, steel, and aluminum to the EU in 2022

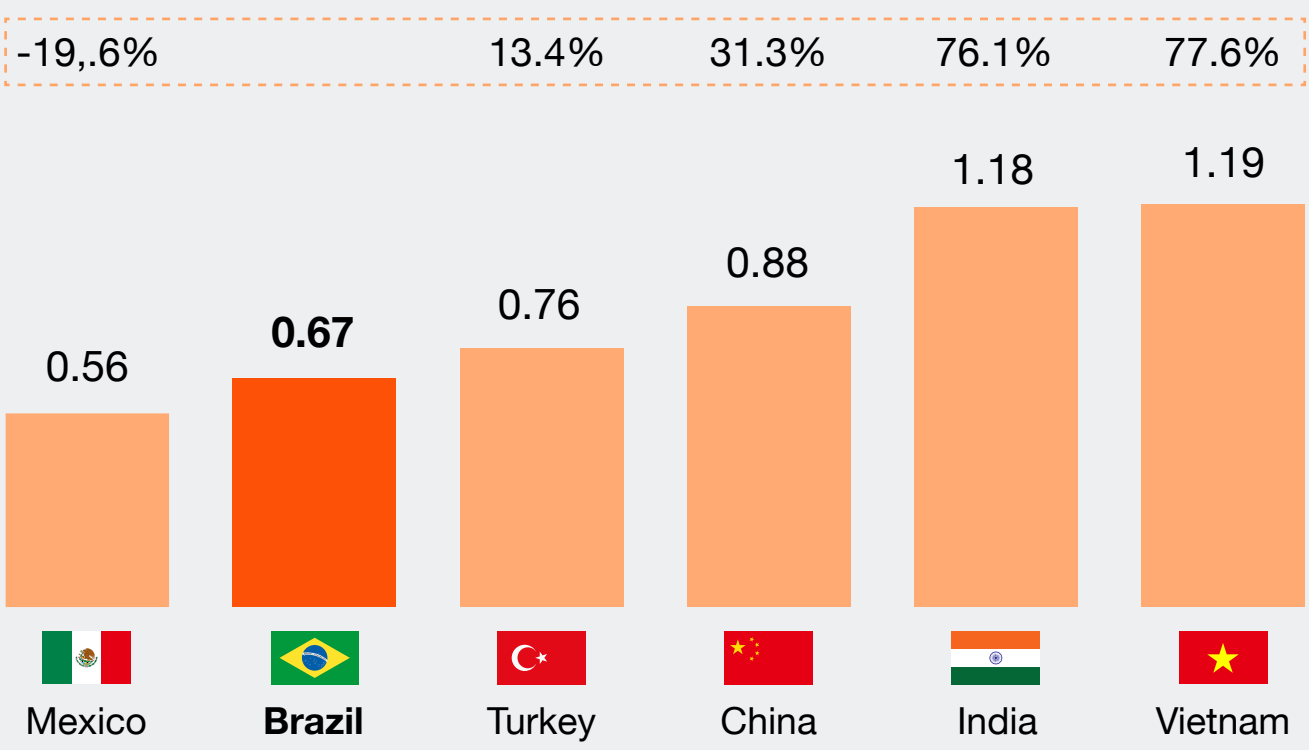
In US$ billions / selected exporters

	Rank	Country	Value	Share
Iron and steel	1st	China	21.8	20.8%
	2nd	Turkey	10.8	10.4%
	3rd	India	7.5	7.2%
	10th	Vietnam	3.1	3.0%
	12th	**Brazil**	**2.9**	**2.7%**
	36th	Mexico	0.2	0.2%
		Total	**46.3**	**44.2%**

	Rank	Country	Value	Share
Aluminum	1st	China	6.1	13.0%
	3rd	Turkey	4.5	9.6%
	5th	India	3.0	6.3%
	22nd	Vietnam	0.3	0.7%
	39th	Mexico	0.1	0.2%
	40th	**Brazil**	**0.1**	**0.2%**
		Total	**14.0**	**30.0%**

CO_2 intensity by GDP of selected countries

In kg of CO_2 / GDP, in 2022



In 2022, China led iron and steel exports to the European Union, with US$21.8 billion (20.8% share), while Brazil exported only US$2.9 billion (2.7%). However, the CO_2 intensity of China's steel industry is significantly higher, highlighting Brazil's competitive potential in carbon-intensive sectors in scenarios where carbon price signals are implemented.

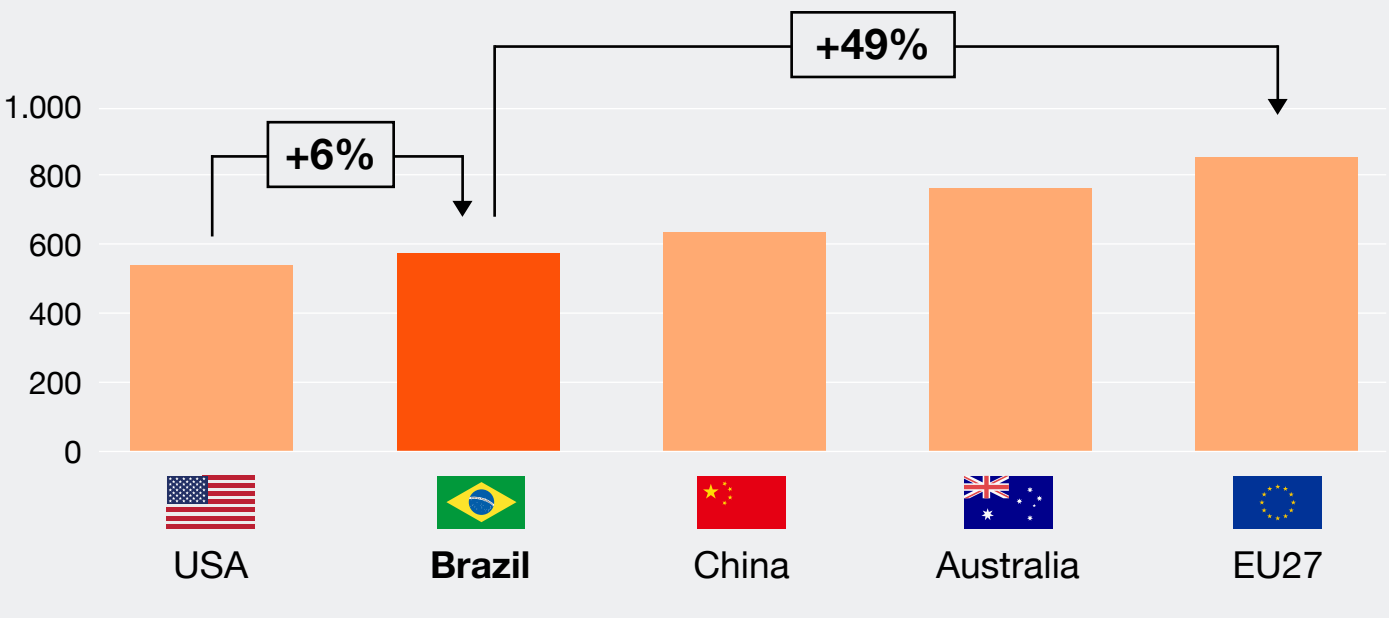
In China, 90% of steel production follows the higher-emission route (Blast Oxygen Furnace – BOF), while in Brazil, 78% of production uses the same method. In addition, Brazil can enhance its competitiveness by adopting new, lower-emission technologies, such as Direct Reduced Iron/Hot Briquetted Iron (DRI/HBI) and Electric Arc Furnace (EAF), given the country's potential for producing lower-cost renewable hydrogen.

Brazil maintains its competitiveness in low-emission steel production compared to other potential competitors

Competition in low-emission steel production

Cost of steel production via the DRI-EAF-H_2 route – LCoS

US$/ton of crude steel, excluding carbon price



LCoH considered (US$/Kg – renewable sources)

US$1	**US$3**	US$3	US$5	US$5

Notes

- Brazil will be competitive compared to other players—except for the US, which will have its LCoH impacted by the IRA.
- Availability of iron ore and relatively lower labor costs than in other markets favor Brazil's competitiveness.
- Low-emission production will place Brazil in a favorable position regarding border adjustment mechanisms (e.g., the European CBAM).

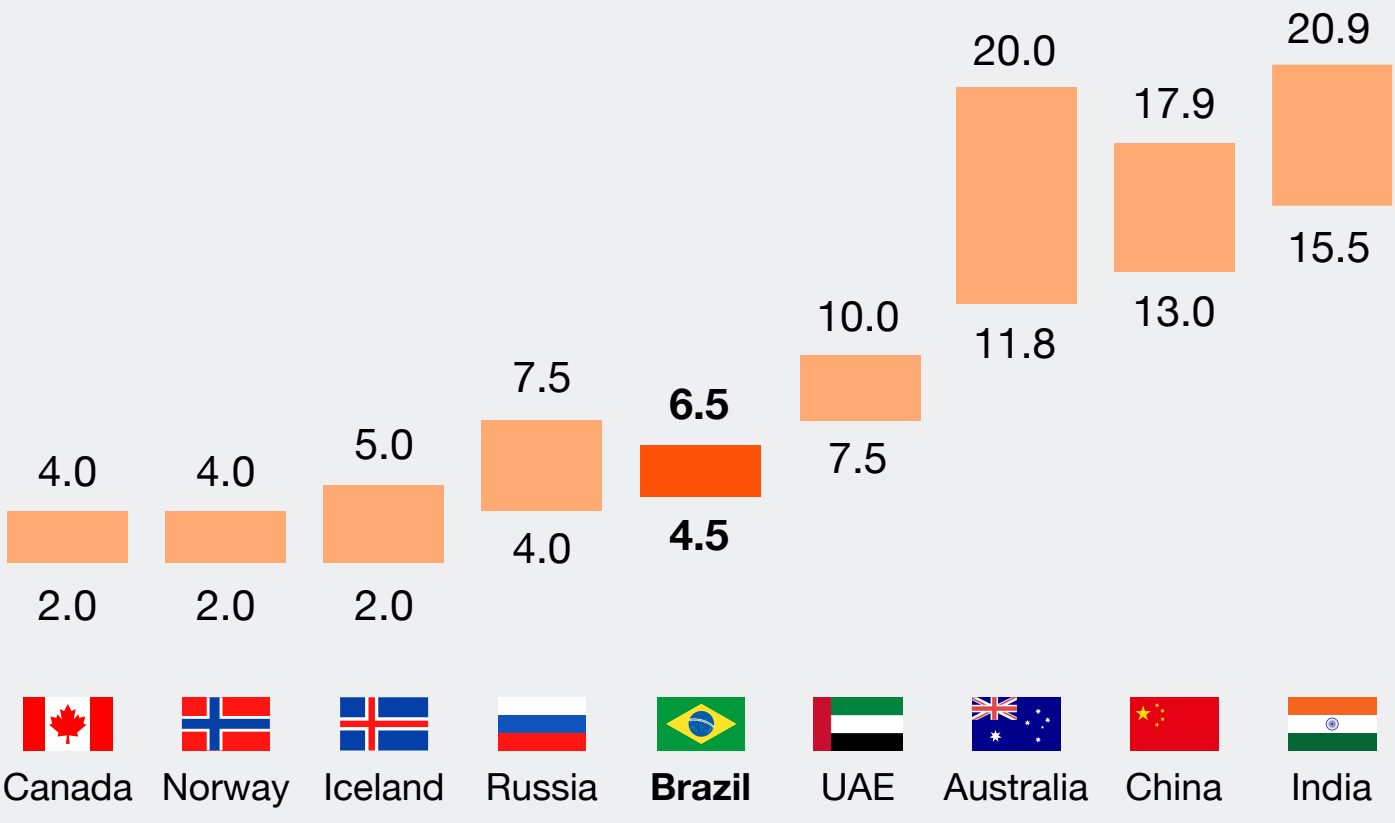
The impact is likely to be even more significant in the aluminum sector. In 2022, Brazil exported only US$0.1 billion to the EU (0.2% share), compared to US$6.1 billion from China (13%) and US$3.0 billion from India (6.3%), for example. However, Brazil's emission intensity in aluminum production is 50% to 75% lower than that of these countries, due to lower electricity-related emissions, which are highly relevant in this production process.

Although the European CBAM does not yet include electricity emissions within its regulatory scope, incorporating power-matrix emissions is decisive for strengthening Brazil's competitiveness in aluminum.

Brazil can leverage aluminum's low carbon intensity and its geopolitical position to become an exporting country

Carbon intensity of aluminum – tCO_2 / t Aluminum, historical series

Selected countries



Main competitors for Brazil

- **Russia**
  - Hydropower in Siberia has decreased in intensity, but it impacts logistics costs for exports to the European market.
  - Risk of worsening geopolitical context may close the European market to Russia.
- **Australia**
  - Variation in carbon intensity depending on plant location and energy source.
  - Investments in more efficient plants, more renewable energy, and incentives for the consumption of low-carbon aluminum.
- **UAE and India**
  - High dependence on fossil fuels in production.
  - The main path to reduction is the expansion of renewable sources, still at an incipient stage in China and India.

With the global evolution of carbon pricing systems, Brazil may benefit from increased competitiveness in specific industrial products, such as iron, steel, and aluminum, which are likely to face lower border adjustment costs in regulated markets. The consolidation of the SBCE, combined with investments in energy efficiency and robust traceability mechanisms, could be decisive in turning this potential into a real advantage in low-carbon international trade.

A new cycle of opportunities

When seen beyond regulatory requirements, the energy transition can serve as a lever for reindustrialization and sustainable growth. Analyses by Strategy& reveal that more than 30 industrial pathways linked to the low-carbon economy—such as green steel, biofuels, hydrogen, electrification, the circular economy, and energy efficiency—could add BRL 1 trillion to GDP and generate 3 million jobs by 2030.

For Brazilian companies, anticipating this movement is strategic. This involves mapping emissions along the value chain, with special attention to the segments most exposed to carbon pricing, and analyzing financial impacts under different regulatory scenarios. Tools such as internal carbon pricing, combined with the implementation of the SBCE, can guide more efficient decisions and prepare companies for an increasingly demanding market environment.

In addition, in a context of consolidation of mechanisms such as the EU's CBAM, Brazil can strategically position itself. With a clean energy matrix and solid experience in supply chain traceability, the country has the potential to create labels, certifications, and MRV systems that meet international standards.

Investing in emissions management, climate risk assessment, and integrating ESG criteria into business decisions is a prerequisite for maintaining relevance and competitiveness in a transforming global landscape.

03

Next steps: from climate management to a growth strategy

1.

Anticipate carbon pricing to protect your competitiveness

Even if your company is not yet within the scope of the SBCE, anticipating internal carbon pricing helps identify financial and operational risks. Run simulations to project scenarios and inform investment, purchasing, and innovation decisions.

2.

Map the carbon cost in your operations

Start identifying the main emission points across your activities and value chains. In many industries, up to 80% of emissions are concentrated in just 20% of operations. Collecting relevant and useful data on these emissions is crucial for calculating the impact of carbon pricing and informing strategic decisions on production, exports, and competitiveness.

3.

Integrate climate strategy into the core of the business

Avoid treating sustainability as a side agenda. Integrate emission reduction targets into growth, productivity, and innovation plans. Efficient carbon management can generate competitive advantage, reduce risks, and attract capital.

4.

Prepare to operate in a global market with growing demands

With the entry into force of the EU's CBAM and similar mechanisms, traceability and product carbon intensity will become decisive criteria for market access. Brazilian companies can stand out thanks to their clean energy mix, but they need to prove it with reliable data, certifications, and MRV systems.

5. Seize the moment to innovate and capture value

Identify opportunities in sectors such as renewable energy, bioeconomy, carbon capture, and nature-based solutions. According to estimates by Strategy&, Brazil could add BRL 1 trillion to GDP by 2030 through sustainable industrial pathways.

6. Turn climate risks into opportunities for innovation

Carbon pricing may seem like an additional cost, but it is also a driver of efficiency, modernization, and differentiation. Companies that invest early in low-carbon solutions will be better prepared for a world in transition.

A successful transition to the new economy requires anticipation. Climate and environmental policies tend to evolve rapidly, and the carbon market follows suit. Even amid uncertainties, the cost of inaction continues to rise.

By integrating climate strategies into value chains, your company can anticipate risks, adjust purchasing, investment, and innovation decisions—and transform regulatory pressures into long-term value. This is not a definitive manual, but rather an invitation to action: a starting point for turning challenges into a growth strategy.

Contacts

Adriano Correia
Partner and Clients
& Industries Deputy Leader
adriano.correia@pwc.com

Daniel Martins
Partner and Energy
and Utilities Leader
daniel.martins@pwc.com

Luciana Medeiros
Partner and Retail
and Consumer Leader
luciana.medeiros@pwc.com

Lindomar Schmoller
Partner and Financial
Services Leader
lindomar.schmoller@pwc.com

Mayra Theis
Partner and Agribusiness Leader
mayra.theis@pwc.com

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