The complete guide to carbon pricing

Compliance, voluntary and internal carbon pricing dynamics

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Introduction

Putting a price on carbon is widely seen as one of the most efficient measures to reduce the world's greenhouse gas emissions and avoid the worst of the climate crisis. In certain sectors, the cost of decarbonizing a company's operations and supply chain can appear somewhat prohibitive. In its report *The net-zero transition: What it would cost, what it could bring*, **McKinsey estimates** that transforming the global economy to achieve net-zero emissions by 2050 would require US$9.2 trillion in annual average spending on physical assets – US$3.5 trillion more than today. "That increase is equivalent to half of global corporate profits and one-quarter of total tax revenue in 2020," the report adds.

This extra expense is often cited by companies of all sizes as a burden: a 2022 **Deloitte survey of financial executives** in the energy and manufacturing sectors revealed that 83% percent see money spent on decarbonization as a cost rather than a profitable investment. As a result, the wide majority (75%) plan to spend less than 25% of their future cash flows on green initiatives over the next three years. Government schemes that give a price to carbon are meant to make it more expensive to emit CO2 than to invest in carbon reduction measures, tipping the balance towards decarbonization.

But pricing dynamics in compliance markets can be confusing, making it difficult for companies to prepare for the future.

Additionally, **carbon pricing goes far beyond carbon taxes**. On the voluntary carbon market too, each credit or offset has a price, reflecting the perceived value of absorbing or avoiding the emission of a ton of CO2. There, prices vary widely depending on the type and location of a particular project. Understanding the criteria that influence this price is crucial for companies to select the quality carbon removals that will truly support their decarbonization strategies.

Finally, some companies use an internal carbon price to assess how much it would cost them to emit CO2 under a compliance scheme and justify the anticipated spending on decarbonization measures.

This white paper dives into all aspects of carbon pricing, whether mandatory, voluntary or internal. Understand the factors that influence price setting, discover the carbon pricing outlook for the coming years and future-proof your organization.

Carbon pricing in compliance markets

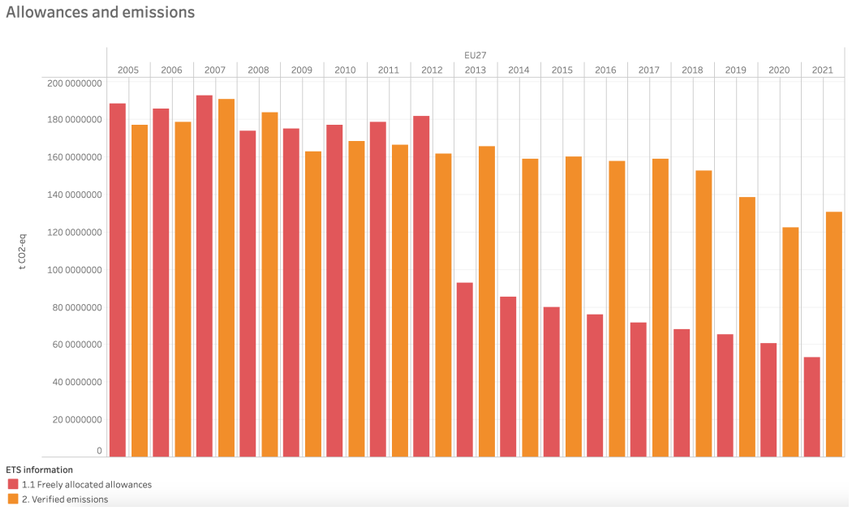
Governments around the world are using several types of carbon pricing mechanisms to attempt to lower national or regional emissions. The most common scheme is called cap and trade: regulators put a limit on the amount of emissions companies in polluting sectors (such as energy, construction or transport) are allowed to produce, then force them to purchase "allowances" for any emissions beyond this cap. According to the **World Bank's Carbon Pricing Dashboard**, 34 local and national governments, including several U.S. states, Canadian provinces and Japanese cities, have put in place such emissions trading systems – covering about 17.5% of global greenhouse gas emissions.

One of the best-known cap and trade schemes is the **European Union's Emissions Trading System or EU ETS.** Covering about 40% of the EU's total CO2 emissions, it is the EU's main decarbonization tool – and it is an efficient one: since its introduction in 2005, the EU's emissions have decreased by 41%. Allowances under this scheme are by far the most expensive in the world, having reached **€100 per ton in February 2023**. In other compliance markets, the **price of carbon oscillates** between as little as €2 in Japan, around €30 in California and Australia, and about €40 in New Zealand.

The other option for countries wishing to reduce their emissions through a mandatory carbon mechanism is a carbon tax, whereby companies simply pay a tax corresponding to the amount of CO2 they emit. About 20 countries have implemented a carbon tax on at least one sector of their economy, including Argentina, Mexico, South Africa and a number of European countries. There again, prices vary widely: in 2020, they went from **less than US$1 in Argentina** to a maximum of **US$126 in Sweden.**

Pricing carbon allowances in emissions trading schemes

In emissions trading systems, the price of allowances is determined by supply and demand, most often through an auction system. To understand how pricing works, let's look at two long-established emissions trading systems: the EU ETS and the California Cap-And-Trade Program.



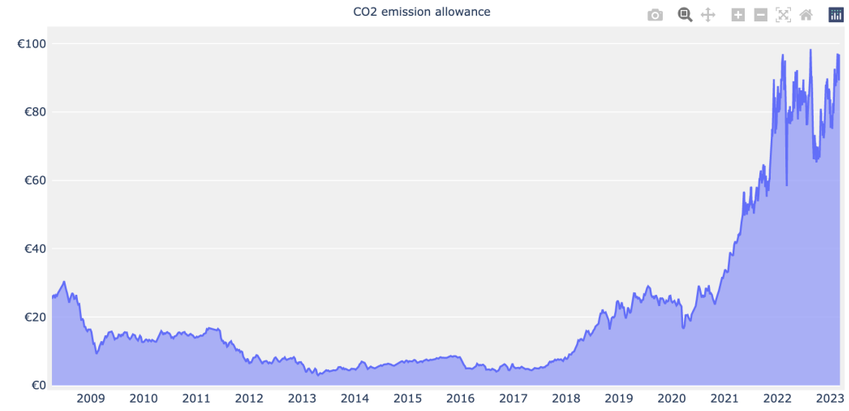
Source: European Environment Agency

EUA pricing

In the EU, member states auction their allowances (EUAs) several times a week on the **European Energy Exchange** (EEX), the common auction platform. These auctions work under a uniform pricing system, with only one bidding round and no visibility on the bids of others. At the end of the round, all bidders pay the same price for the allowances.

Since the goal of the EU ETS is to force companies to lower their emissions, the number of EUAs available to purchase has been going down steadily **every year since 2007.**

As a result of this reduced supply, the price of EUAs has **increased tremendously** in recent years. From as little as €4 in 2017, it shot up to an average of €40 in 2021 and a record of €98 in 2022. In the first quarter of 2023, the price of these carbon permits has already surpassed €100 at least twice, with many bidders going home empty-handed after auctions.



Source: Sandbag

At the end of 2022, the EU Parliament and Council agreed on a revamp of the EU ETS, broadening its ambition and accelerating the continent's decarbonization. The main changes include:

- the expansion of the scheme to cover the maritime industry, on top of the ones already covered (electricity and heat generation, oil refineries, steel works, iron, aluminum, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids, bulk organic chemicals and commercial aviation)
- a substantial increase in emissions reduction targets, to 62% by 2030 (from a 2005 baseline) for sectors covered by the scheme
- the reduction of EUA issuance by an annual rate of 4.3% per year from 2024 to 2027 and 4.4% per year from 2028 to 2030
- the rebasing of the emissions ceiling by 90 million allowances in 2024 and by 27 million allowances in 2026

In order to avoid too much price volatility, the EU has set up the **Market Stability Reserve** (MSR), whose role is to improve the system's resilience to major shocks by adjusting the supply of allowances to be auctioned. These latest amendments are expected to hike up the price of carbon credits, so the MSR will be strengthened: its increased annual intake rate of allowances (24%) will be prolonged beyond 2023, with a threshold of 400 million allowances.

Still, the price of EUAs is expected to rise steadily over the coming years, averaging €81.40 a ton in 2023, €94.14 in 2024 and €102.24 in 2025, **according to analysts**.

California allowance pricing

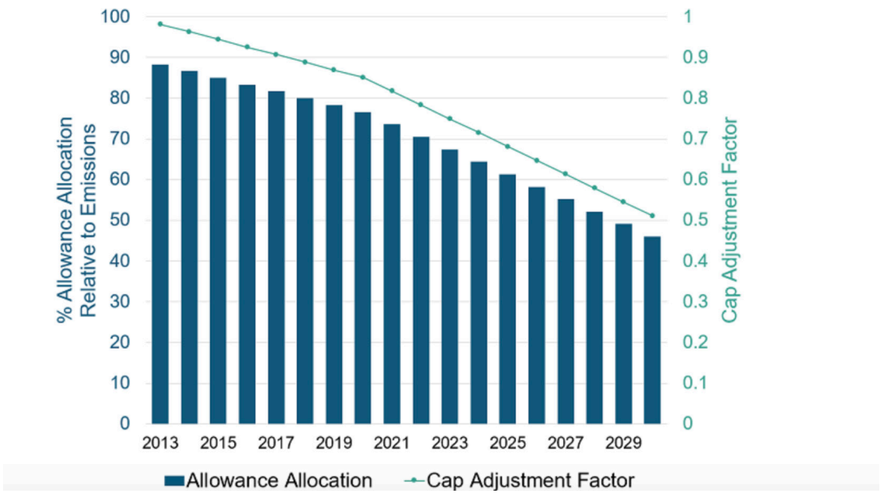
In California's Cap-and-Trade Program, another well-established emissions trading system, things work slightly differently. The California Air Resources Board (CARB) distributes allowances (CCAs) through annual direct allocation to regulated entities and sale to all market participants at quarterly auctions. As with the EU ETS, the **amount of allowances is reduced every year**, forcing companies to cut their emissions.

The California Cap-and-Trade Program is linked to Quebec's own ETS, meaning that companies in the two jurisdictions can purchase allowances from one or the other to comply with their local regulation. California and Quebec hold joint GHG allowance auctions every quarter. To this day, the price of these allowances remains much lower than that of EUAs: its highest settlement price was US$30.85 in May 2022, but it went down to US$27.85 by February 2023.

California also has mechanisms in place to **prevent too much volatility in pricing**: the auction reserve price sets a minimum price for auctions, reducing the supply of allowances if bids do not meet that minimum; meanwhile, a ceiling price is set at about two to three times the current price of CCAs which, if surpassed in bids, triggers the release of more allowances.

In 2023, **experts believe** that the average price of CCAs will remain around US$31, as a slowdown in economic activity is reducing industrial output. Still, prices are expected to rise steadily over the next decade, to the point that investors consider California's ETS an **attractive opportunity.**

Allowance Allocation as a Percentage* of Emissions for a Hypothetical Industrial Facility



source: CARB

CALIFORNIA CAP-AND-TRADE PROGRAM

SUMMARY OF CALIFORNIA-QUEBEC JOINT AUCTION SETTLEMENT PRICES AND RESULTS

Last updated February 2023

Auction Name	Total Current Auction Allowances Offered	Total Current Auction Allowances Sold	Current Auction Settlement Price	Total Advance Auction Allowances Offered	Total Advance Auction Allowances Sold	Advance Auction Settlement Price
February 2023 Joint Auction #34	56,395,720	56,395,720	$27.85	7,577,000	7,577,000	$27.01
November 2022 Joint Auction #33	58,020,854	58,020,854	$26.80	7,942,750	7,942,750	$26.00
August 2022 Joint Auction #32	56,956,085	56,956,085	$27.00	7,942,750	7,942,750	$30.00
May 2022 Joint Auction #31	58,331,300	58,331,300	$30.85	7,942,750	7,942,750	$28.13
February 2022 Joint Auction #30	58,527,697	58,527,697	$29.15	7,942,750	7,079,000	$19.70
November 2021 Joint Auction #29	68,598,217	68,598,217	$28.26	8,306,250	8,306,250	$34.01
August 2021 Joint Auction #28	71,261,536	71,261,536	$23.30	8,306,250	8,306,250	$23.69
May 2021 Joint Auction #27	71,647,138	71,647,138	$18.80	8,306,250	8,306,250	$19.04
February 2021 Joint Auction #26	54,773,607	54,773,607	$17.80	8,306,250	8,306,250	$18.01
November 2020 Joint Auction #25	56,366,432	56,366,432	$16.93	8,672,250	8,672,250	$17.35
August 2020 Joint Auction #24	59,250,484	52,627,000	$16.68	8,672,250	8,672,250	$16.73

source: CARB

Setting the price of carbon taxes

As opposed to emissions trading systems, where the price of carbon permits depends on supply and demand and is influenced by regulations and the market, carbon taxes are set directly by governments. While cap-and-trade programs set clear reduction targets but provide no certainty around costs, carbon taxes do the opposite, ensuring a high level of certainty about cost, but not about the level of emission reduction to be achieved.

Sweden is currently the country with the highest carbon tax, levied on all fossil fuels in proportion to their carbon content. **The tax** was introduced in 1991 at €25 per ton of CO2 emitted, and has gradually been increased, reaching €118 in 2022. From the introduction of the carbon tax to 2020, Sweden's greenhouse gas emissions decreased by 35%, while the country's GDP rose by 83%, proving that emissions reductions do not hamper economic output.

The price is (not quite) right

Despite the examples above, globally the average price of carbon in mandatory schemes such as emissions trading programs or carbon taxes remains too low, at an estimated US$6 per ton of CO2. **According to the International Monetary Fund** (IMF), this needs to rise to US$75 per ton by 2030 in order to limit global warming and meet the goals of the Paris Agreement.

Price differences between countries reveal a certain lack of international cooperation in harmonizing regional carbon prices and decarbonization priorities. But the implementation of the EU's **Carbon Border Adjustment Mechanism** (CBAM), essentially a carbon tariff levied on imports from outside the EU, could pave the way for a more uniform carbon price around the world. The mechanism should be in place by 2026, and will impose a carbon tax mirroring the (high) price of allowances on the EU ETS to imports including iron and steel, cement, aluminum, fertilizers and electricity, as well as hydrogen. The purpose of CBAM is to avoid carbon leakage, whereby European companies could move production elsewhere to avoid the EU's strict carbon regulations. But its knock-on effect will be to incentivize decarbonization in non-EU exporters.

Particular attention should be paid to the development of China's Emissions Trading System – the world's largest carbon market – and its interaction with the EU ETS. China's ETS began regulating electric power plants **in 2021**, and is currently being expanded to other sectors including aluminum, cement and steel. It is being implemented as a **tool to help China meet its targets** to peak emissions by 2030 and achieve carbon neutrality by 2060.

In 2021, **China's carbon price** ranged from ¥40 (US$5.80) to ¥60 (US$8.70) on the national trading platform. It is currently expected to reach an average of ¥71 (about US$10) by 2030, and up to ¥167 (about US$24) by 2050. Unlike California, China's scheme currently does not have any mechanism preventing price volatility.

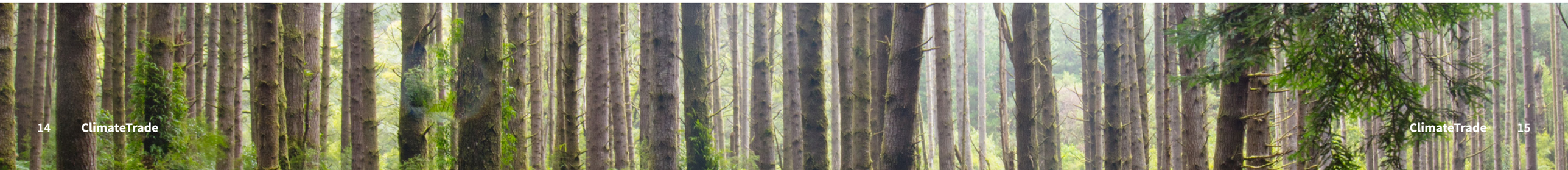
Given that China is the world's top exporter and emits about **one-third of the world's greenhouse gases**, the right pricing of allowances under this ETS, along with the implementation of CBAM, could go a long way in supporting the world's climate goals.

The ICC's Carbon Pricing Principles

To support governments and policymakers in the development of harmonized carbon pricing mechanisms across the globe, the International Chamber of Commerce (ICC) has published a list of **Carbon Pricing Principles (CCPs**). The 10 principles are based on ICC's analysis of existing schemes and include the following recommendations:

- Focus on GHG emissions reduction as prime target, including the prevention of GHG leakage
- Create a reliable, predictable overall framework
- Promote consistency between climate, energy, trade and taxation policies
- Create a clear and robust transparency framework
- Maintain accessibility to and affordability of low-carbon and clean energy sources
- Promote international linking of carbon pricing instruments
- Recognize that there is no "one-size-fits-all" single instrument
- Couple carbon pricing with investment in climate change mitigation and adaptation
- Ensure international cooperation for greater consistency globally
- Develop mechanisms through inclusive and transparent consultation with business and other key stakeholders

In 2022, ClimateTrade translated the principles into Spanish to make them more accessible to stakeholders in Spain and Latin America. Since then, we have worked actively with ICC on the promotion and implementation of the CCPs across the globe.



Carbon pricing in voluntary markets

As opposed to the mandatory or compliance market, the voluntary carbon market is not regulated by a central entity. There is no minimum threshold or maximum ceiling: the developers of carbon mitigation projects themselves set the price of their carbon credits, the same way a company would set the price of its products. Organizations looking to offset their climate impact then look for the carbon credits that match their requirements and budget.

The voluntary carbon market is extremely varied, both in terms of types of projects and in terms of pricing, which is why it is important to understand the factors that influence carbon credit prices, including supply and demand, geography and quality.

Supply and demand factors

The World Bank's latest **State and Trends of Carbon Pricing** report reveals that carbon prices rose sharply in 2021, mostly due to increased demand as decarbonization efforts accelerate.

"For the first time, the total value of the voluntary carbon market exceeded more than US$1 billion in November 2021," the report says. "This rapid increase in value reflects both rising prices and rising demand from corporate buyers leading to higher transacted volumes."

According to the authors, global average carbon credit prices on the voluntary market moved from US$2.49/tCO2e in 2020 to US$3.82/tCO2e in 2021, and the volume of credits transacted in the voluntary market exceeded 362 million credits in 2021, 92% more than in 2020. This growth in demand and upward price trend is attracting investors, who are starting to see carbon credits as an investment product that is set to bring high returns in the coming years.

Project costs and additionality

The location and type of a carbon mitigation project influence the funding available to it, as well as its development costs. For instance, the **Fairtrade minimum pricing model**, developed **in collaboration with Gold Standard**, calculates a minimum price that ensures the average costs of the projects are covered, and these costs include:

- investment in equipment and machinery
- project costs like transport, monitoring, training, etc.
- carbon verification and certification costs
- a margin for the project to make a small benefit

The model also deducts any revenues (for instance from the sale of clean electricity) from the price. According to this, the Fairtrade minimum pricing for carbon mitigation projects is €8.20 for energy efficiency projects, €8.10 for renewable energy projects and €13 for forest management projects.This is much higher than the current average, and should encourage companies to **seek fairly-priced carbon credits to offset their footprint.**

As with many other products, there is a certain degree of correlation between the price and quality of carbon credits. One of the main principles for determining the **quality of a carbon offset** is its additionality: whether the project would happen without the financing provided by carbon offsetting.

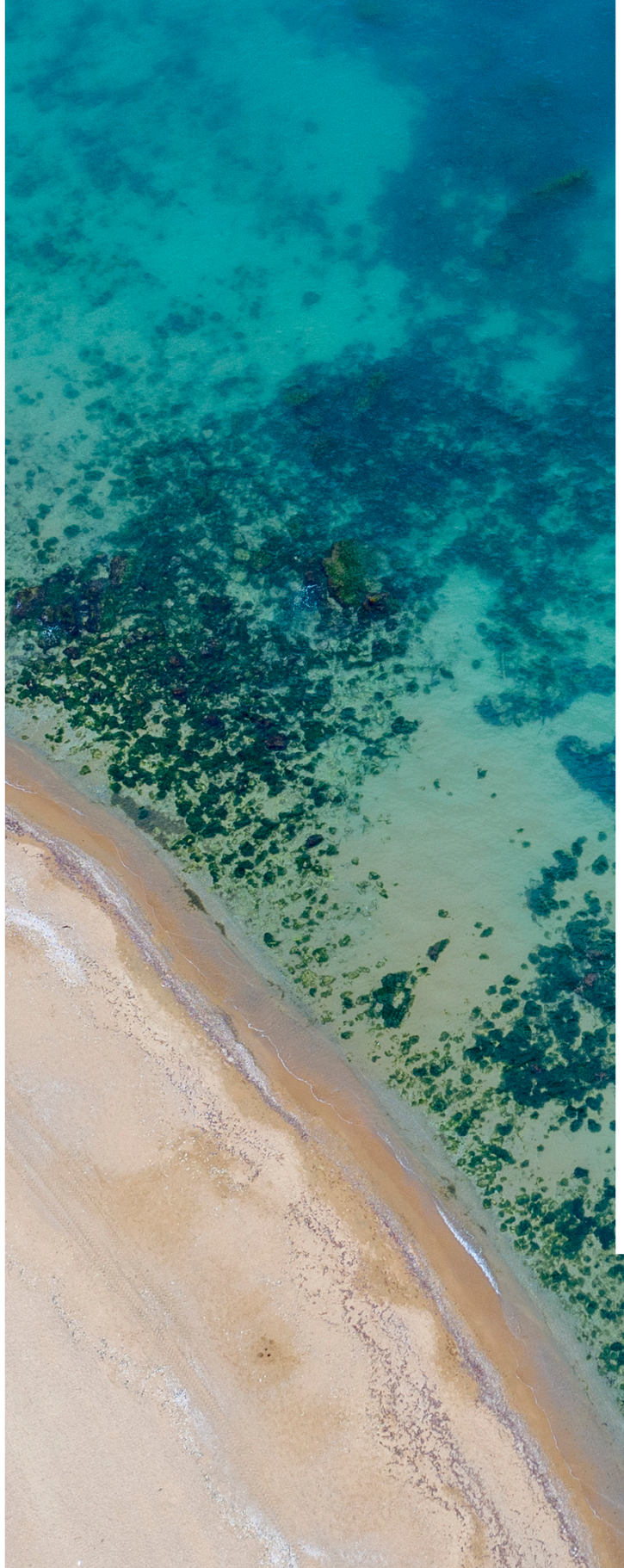
This principle is now leading many companies to move away from carbon credits generated by renewable energy projects, even though these are often the cheapest type of offset available. That's because private investment in solar or wind energy is now abundant, and the industry doesn't need carbon finance to survive.
"A highlight this year is the increased interest in forest and land use-based credits. Carbon credit issuances from forestry and land-use projects increased 159% over the past year, accounting for more than a third of total credit issuances in 2021," notes the World Bank report.

Despite the increasing interest in nature-based carbon credits, their **price has taken a hit** following early 2023 **reports that questioned** their actual carbon reduction potential of forest projects.

Transparency

This leads us to the most important consideration when choosing carbon offsets on the voluntary market: transparency. The variety of different prices can be overwhelming, and reports like the one cited above tend to lower the credibility of carbon mitigation projects and the market in general. Additionally, brokering companies serving as intermediaries between sustainable projects and corporate buyers have been accused of pushing prices down at the source, then hiking them up when on-selling the credits. **In a 2022 investigation**, the *Financial Times* discovered that the price offered by brokers could be double the actual price of carbon offsets when sold directly by the project.

But when done correctly, the voluntary carbon market (VCM) can be **a powerful force for global decarbonization**. ClimateTrade offers a **marketplace** where project developers can set the price of their carbon credits and sell them directly to companies around the world. We base all our transactions on blockchain infrastructure, which means that data cannot be duplicated or manipulated. This guarantees the integrity of data and the traceability of carbon offsetting transactions.



VCM pricing outlook

Despite recent controversies, analysts are bullish about the future of the voluntary carbon market: **BloombergNEF predicts** that it could reach US$1 trillion as early as 2037, “with the right rules”. This optimism derives from the sector’s ongoing efforts to standardize the quality of carbon offsets (through initiatives such as the Integrity Council for the Voluntary Carbon Market’s **Core Carbon Principles**) and to prioritize carbon removals.

Importantly, the report’s authors noted that fairly-priced, high-quality carbon credits are the only way forward for the voluntary carbon market. “Today’s offset market, built mostly on bilateral transactions for cheap credits, is potentially digging its own grave,” said Kyle Harrison, Head of Sustainability Research at BNEF. “Buyers need transparency, clear definitions around quality and easy access to premium supply(...). These changes will send demand signals to the projects making the greatest decarbonization impact and in need of the most investment.”

BloombergNEF ran several different scenarios to estimate the growth of the voluntary carbon market by 2050. Under current conditions, where companies can purchase any type of carbon offset (regardless of quality) to achieve their net-zero goals, 5.4 billion offsets will be sold annually in 2050, at an average price of US$35/ton.

In another scenario, only offsets from projects that actually removed carbon from the atmosphere would count towards net zero targets, with credits from avoided deforestation or clean energy projects eliminated from the market. In this case, carbon credits would be sold at US$250/ton by 2037, with the annual market reaching nearly US$1 trillion. According to the authors, a removal-only offset market would direct investment into technologies like direct air capture and force some companies to invest in other impactful decarbonization strategies rather than just offsets, but it could also deter more cash-strapped companies from participating in the market.

Internal carbon pricing

From the analysis of the mandatory and voluntary carbon markets above, two clear conclusions emerge: **carbon has a price, and it is trending upwards.** Soon enough, companies of all sizes and all sectors will have to pay some sort of compensation for their greenhouse gas emissions. In preparation, many are using an internal carbon price (ICP), a sort of carbon tax simulation that allows them to free up investment for decarbonization.
The Carbon Disclosure Project (CDP), a non-profit organization helping investors and companies manage their environmental impact, has been collecting internal carbon pricing data since 2014. Its India Director, Prarthana Borah, **describes the ICP** as "a tool that allows for a reduction in emissions as well as directs investments for more efficient and clean technologies". She adds: "Companies can assess climate-related risks, identify opportunities, prepare for future climate regulations, and advance corporate sustainability with ICP. For investors, ICP can be used to analyze the potential impact of policy on investments thus enabling the reallocation of investment towards low carbon and climate-resilient activities."
According to CDP, 1,077 companies worldwide reported using an ICP in 2021, and an additional 1,601 said they planned to use one in the next two years. The data also shows that putting an internal price on carbon is often correlated with other strategic climate actions, such as setting a Science-Based Target or sourcing more energy from renewables.

So what exactly is an internal carbon price, and how can companies use it to further their climate goals?

Different types of ICP

There are three different options for applying an internal carbon price in company planning, but all of them have the same purpose: assigning a cost to every ton of carbon emitted, then factoring that cost into business or investment decisions, incentivizing carbon reduction.

Each of the three options below have their own benefits, and organizations should look to apply the one that best fits their objectives and requirements.

Internal carbon tax

With an internal carbon tax, a fee is collected internally for every ton of CO2 emitted. This generates direct revenue for investment in carbon reduction measures such as energy efficiency or low-carbon technology. This method can also be called “carbon fee”.

In order to implement this type of ICP, organizations voluntarily add a cost to GHG emissions in relation to operational costs, increasing their operating expenses. This should open the door for short-term actions to reduce emissions. Parts of the funds collected can be used to offset emissions through the purchase of carbon credits on the voluntary market, while another part should be invested in long-term carbon reduction projects and technologies.

The price of this carbon fee can be set based on current carbon taxes in the area where the company has operations – usually between US$5 and US$25 per ton. Since this technique involves the actual collection of funds, companies tend to apply rather conservative estimates of the cost of carbon.

Shadow carbon price

Considered the most widely used ICP mechanism, the shadow carbon price sets a theoretical cost on carbon emissions – meaning no money is actually set aside. It helps companies understand the various impacts of climate-related risks and model how different carbon prices may affect their operations and investments.

To apply a shadow carbon price, organizations simply create an additional investment analysis factor (the carbon value) in the calculation of their internal rate of return (IRR), including it in all investment decisions.

Since this technique is theoretical, companies tend to make more bullish assumptions about the future price of carbon, with shadow carbon prices easily reaching hundreds of dollars per ton.

Implicit carbon price

An implicit carbon price tends to be applied by all companies with public carbon reduction targets: it is based on the cost of cutting carbon emissions through projects like renewable energy, as well as the costs of complying with government regulations.

To calculate it, companies divide the cost of abatement or renewable energy procurement by the tons of CO2-equivalent abated.

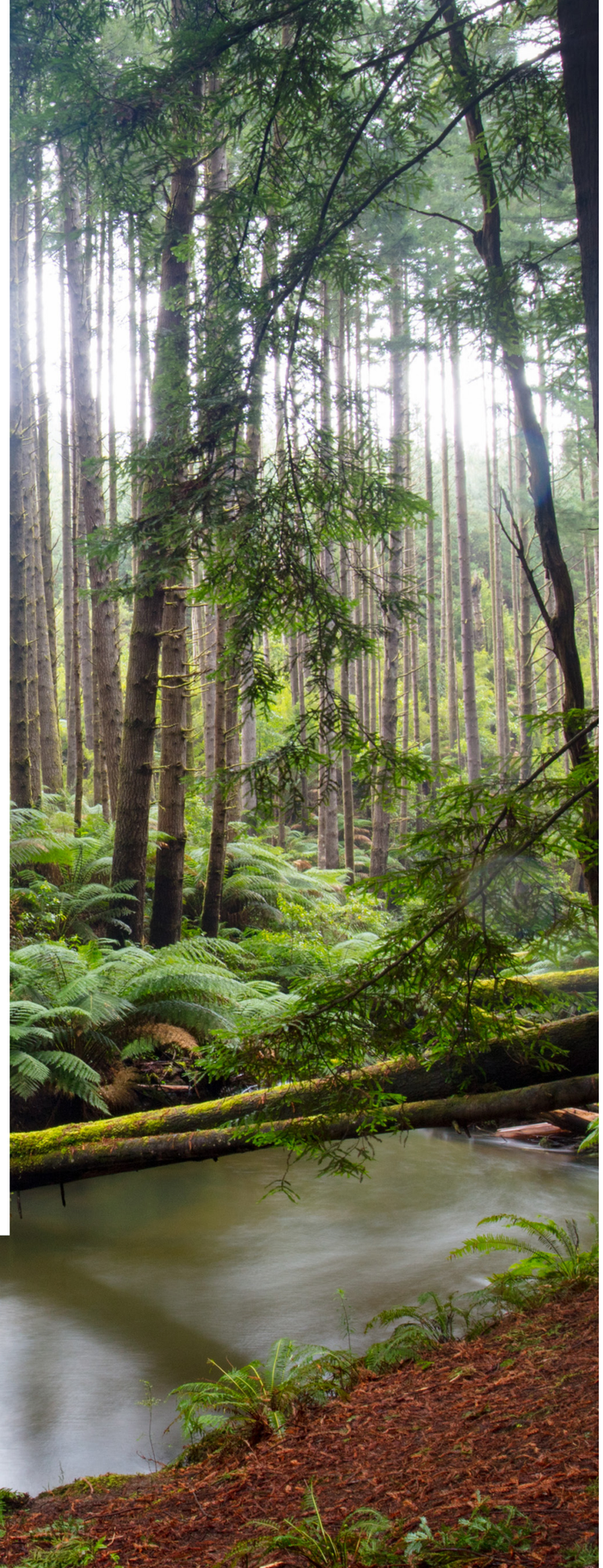
How to set an internal carbon price

There is no unique way to set an internal carbon price. First, companies need to look at the different options described above and figure out what would work best for them at this stage in their decarbonization journey.

Then, the recommendation is to research the data available to understand how other companies are pricing carbon internally. CDP itself offers a lot of guidance and benchmarks to support this exercise, such as the **Carbon Pricing Corridors**. If the company is based in the EU or any other market with an ETS, aligning the ICP with the current cost of allowances is the easiest way to set a realistic cost of carbon. Keeping an eye on the evolution of carbon credit prices in the voluntary market is also a good idea. Whatever external guidance the company uses should be reviewed according to internal priorities and existing plans – for instance, the transition to renewable energy.

A 2021 **McKinsey survey** showed that the internal carbon price set by companies varies widely depending on their sector and region. The median price went from US$5 a ton for business services to US$65 a ton in the pharmaceutical industry. But whichever the sector, **setting a very low price on carbon is not an efficient strategy**. McKinsey reminds readers that, to meet the goal of the Paris Agreement, the cost of carbon must range between US$40 and US$80 per ton now, and increase to US$50 to US$100 by 2030.

The internal carbon price is an incredible tool to support corporate decarbonization before the widespread implementation of a costly carbon tax. When set correctly, the ICP can promote investment in disruptive low-carbon technologies and high-quality carbon removals that bring long-lasting environmental and social benefits to the planet.



Conclusion

While the price of carbon is likely to remain volatile for the time being, companies can already take measures to transition to the low-carbon economy and prepare for more stringent carbon mechanisms in the future. The first step is to calculate carbon footprint by scope and set internal goals and budgets for its reduction, using the internal carbon price. Next, implement reduction measures and offset the emissions that cannot be eliminated in a transparent and impactful manner, leveraging high-quality carbon removals. Finally, it is crucial for companies to engage with their customers to share progress and inspire individual climate action. The ultimate goal for organizations should be to lead their industry's climate-driven transformation, generating a positive impact for the planet and aligning their activities to a new global paradigm.

Join the conversation:

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About the authors

ClimateTrade is a blockchain-based climate pioneer, aiming to empower large-scale decarbonization through constant innovation. The **ClimateTrade marketplace** allows companies to offset their climate impact transparently and efficiently by purchasing carbon, plastic and biodiversity offsets, as well as renewable energy certificates or iRECs directly from more than 140 certified projects in over 20 countries. Available projects include nature-based solutions, green energy, community development, reforestation and more, all aligned with the UN Sustainable Development Goals. Blockchain technology brings unique added value by guaranteeing full transparency, traceability, speed and lower costs for all transactions, while delivering a ground-breaking user experience.

The **ClimateTrade API** and **Whitelabel** allow clients to integrate marketplace functionalities into their own platform, automatically calculating the carbon footprint of a product or service and giving customers the option to offset it at or after check-out. Essentially, ClimateTrade's software solutions can help clients tackle their scope 3 emissions and support their net zero strategy.

Offsetting carbon footprint through ClimateTrade solutions always results in the issuance of a personalized certificate with information about the project that generated the associated carbon credits, as well as a blockchain key for traceability. This functionality makes it easier to report on carbon offsetting activities and fulfill ESG requirements.

To date, ClimateTrade has allowed the offsetting of more than **10 million tons of CO2.** The company is also spearheading disruptive innovation around the digital certification of carbon mitigation projects and supporting the digitization of national carbon registries.


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