SDPI
Sustainable Development Policy Institute

MINISTRY OF FOREIGN AFFAIRS
OF DENMARK
Denmark in Pakistan

Decoding Carbon Markets

A Simple Guide to Understanding and Engaging in Carbon Trading

Disclaimer

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ABBREVIATIONS

AI	Artificial Intelligence
CAs	Corresponding Adjustments
CAF	Corresponding Adjustment Fee
CBAM	Carbon Border Adjustment Mechanism
CCP	Core Carbon Principles
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CO_2	Carbon dioxide
CO_2e	Carbon dioxide Equivalent
COP	Conference of Parties
CORSIA	Carbon Offsetting and ReductionScheme for International Aviation
DACCS	Direct Air Carbon Capture with Storage
ERCs	Emission Reduction Credits
ESG	Environmental, Social, and Governance
ETS	Emission Trading Systems
EU	European Union
GHGs	Greenhouse Gases
GS	Gold Standard
GS4GG	Gold Standard for the Global Goals
HFCs	Hydrofluorocarbons
ICAO	International Civil Aviation Organization
ICVCM	Integrity Council for the Voluntary Carbon Market
IET	International Emissions Trading
IoT	Internet of Things
ITMOs	Internationally Transferred Mitigation Outcomes
JI	Joint Implementation
LOA	Letter of Authorization
LOI	Letter of Intent
MoCC&EC	Ministry of Climate Change & Environmental Coordination
MRV	Monitoring, Reporting, and Verification
N_2O	Nitrous Oxide
NDA	National Designated Authority
NDCs	Nationally Determined Contributions
NGO	Non-Governmental Organization
NPO	Non-Profit Organization
NOC	No Objection Certificate
PDD	Project Design Document
PIN	Project Idea Note
RE	Renewable Energy
REDD	Reducing Emissions from Deforestation and Forest Degradation
SDGs	Sustainable Development Goals
SMEs	Small and Medium Enterprises
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Markets
VCS	Verified Carbon Standard
VCUs	Verified Carbon Units
VERs	Verified Emission Reductions
VVB	Validation and Verification Body
WAPDA	Water and Power Development Authority
WWF	World Wildlife Fund

ABOUT THE GUIDEBOOK

As the fight against climate change turns into a race against time, the need to decarbonize and reach net-zero emissions quickly is crucial; carbon markets have emerged as a powerful tool to support this. Pakistan, with its relatively lower emissions and higher capacity for climate-friendly projects, holds immense potential for the development of an effective carbon market. However, the mechanisms and operating modalities behind these markets can often feel complex and exclusive; spreading awareness, building individual and institutional capacity, and facilitating project development are integral to taking full advantage of this tool.

To address these issues, this guidebook has been developed as part of a joint initiative on "Effective Implementation of Carbon Markets in Pakistan for Equitable Development and Climate Action" by the Sustainable Development Policy Institute (SDPI) and the Embassy of Denmark in Pakistan. It seeks to demystify carbon markets and make them accessible to a wider audience, providing a concise overview of the fundamentals and operating mechanisms. It explores how carbon trading works, who the key actors are, what steps are involved in project development, and how credits can be generated and traded.

Furthermore, it is tailored for a broad audience, ranging from project developers and industrialists to students, journalists, and entrepreneurs, with the aim of providing them with the essential knowledge and tools to navigate and engage with carbon markets, ensuring that Pakistan can benefit from them now, when the time is ripe.

GLOSSARY

- **Additionality:** A project is considered additional if it only happened because of the money or support from selling carbon credits. In other words, the emission reductions would not have happened without participation in the carbon market.
- **Business-as-usual:** The expected level of emissions or development that would happen if no action is taken and things keep going the way they always have been.
- **Carbon Avoidance Projects:** One of the major types of projects eligible for generating carbon credits. They stop greenhouse gases from entering the atmosphere by preventing production or release.
- **Carbon Credits:** A certificate that shows that one ton of greenhouse gases was either avoided or removed from the atmosphere. They can be bought or sold to help meet climate goals.
- **Carbon Footprint:** The total amount of greenhouse gases a person, company, or activity releases into the atmosphere.
- **Carbon Offsets:** Actions taken to compensate for or balance the greenhouse gases released into the atmosphere.
- **Carbon Removal Projects:** One of the major types of projects eligible for generating carbon credits. They take greenhouse gases out of the atmosphere by capturing and storing them after they have been released.
- **Carbon Sequestration:** Capture and storage of carbon dioxide in order to prevent it from entering the atmosphere. This can happen naturally or through technological interventions.
- **Compliance Carbon Markets:** Official markets where companies must buy carbon credits to meet obligatory climate regulations. They are part of government-run systems to reduce emissions.
- **Corresponding Adjustments (CA):** A system to ensure emission reductions are not counted twice. If one country sells its carbon credits to another, the records are adjusted such that only the buyer can count those reductions towards its climate targets.
- **Crediting Period:** The time frame during which a carbon project is allowed to earn carbon credits or offsets. It defines how long the emission reductions from the project can be counted and sold.
- **Crediting Scheme:** A system that checks and approves emission-reduction projects. If a project meets the rules, it earns carbon credits that can be sold or used to meet environmental goals.
- **Crediting Standards:** Internationally recognized organizations defining a set of rules projects must follow to be eligible for obtaining carbon credits. They make sure projects are real, measurable, and trustworthy.
- **Double Counting:** When two or more parties (companies or governments) claim credit for the same emission reduction, counting it towards both their emission reduction goals when, in reality, the reduction has been realized only once.
- **Emission Allowances:** A government-issued permit that gives a company the legal right to release one ton of carbon dioxide (or equivalent greenhouse gas) under compliance carbon markets.
- **Emissions Trading System (ETS):** A government-run program that sets a limit on how much pollution companies can produce. Companies that reduce their emissions

below the limit can sell their extra allowances to others who are likely to exceed them. It is also referred to as the cap-and-trade system.

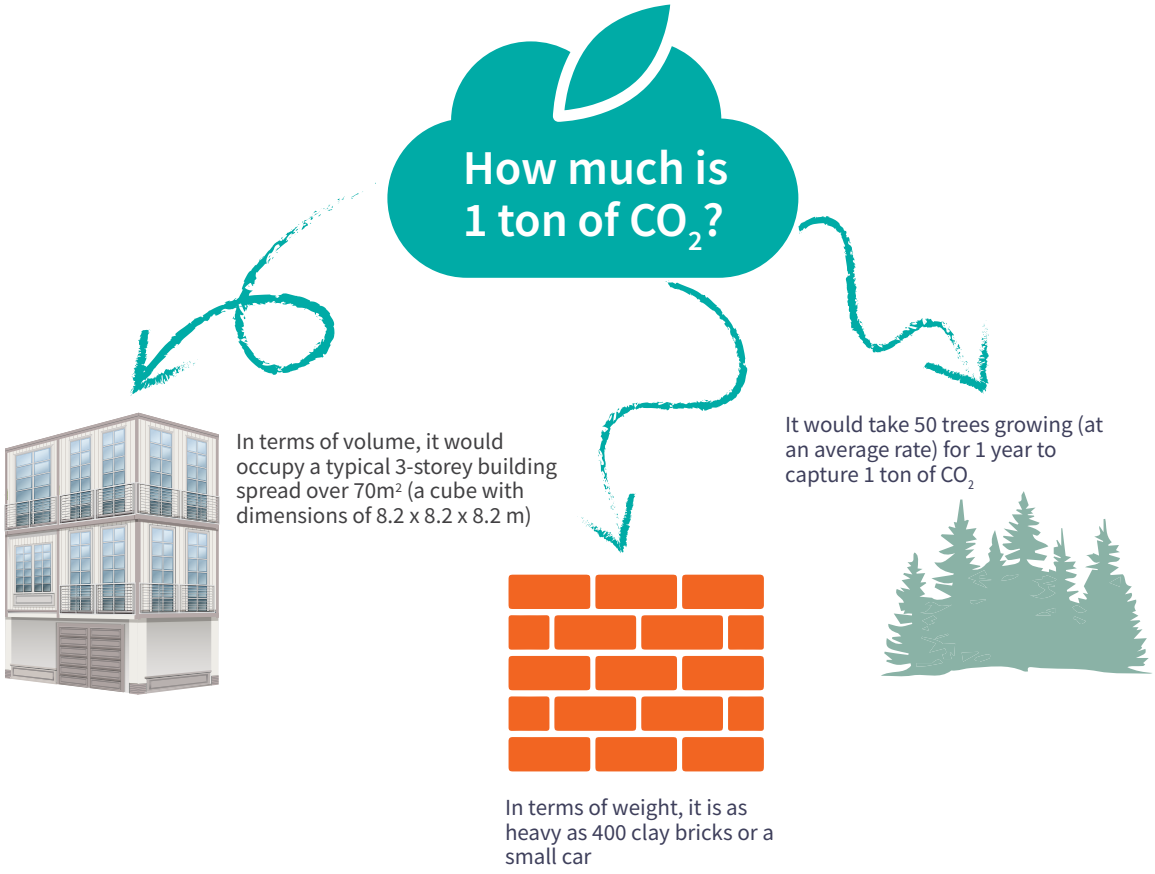
- **Greenhouse Gas Emissions:** Gases, like carbon dioxide, methane, and nitrous oxide that trap heat in the atmosphere and cause global warming leading to climate change.
- **Hard-to-Abate Sectors:** Industries that are very difficult to decarbonize because they rely on processes that release a lot of emissions and do not yet have easy or affordable clean alternatives. They mainly include cement, steel, and chemicals industries.
- **Insetting:** When a company supports carbon reduction projects within its own supply chain or business operations (value chain) instead of buying offsets externally.
- **Internationally Transferred Mitigation Outcomes (ITMOs):** A type of carbon credit created under the Paris Agreement. Countries can trade these credits bilaterally to meet their national climate targets.
- **Leakage:** A phenomenon that occurs when actions taken to stop emissions in one place cause them to go up in another.
- **Nationally Determined Contributions (NDCs):** A country's plan for how it will cut emissions and fight climate change in accordance with the goals set out in the Paris Agreement.
- **Net Zero:** Achieving a balance between the amount of greenhouse gases released and the amount removed from the atmosphere. To reach net zero, an individual, company, or country must reduce emissions as much as possible and then offset the rest.
- **Paris Agreement:** A global climate treaty to keep global warming well below 2°C – and ideally below 1.5°C – by the end of the century compared to pre-industrial times.
- **Permanence:** Ensuring that the carbon removed is permanent and would not re-enter the atmosphere in the short term.
- **Project Baseline:** An estimate of how much greenhouse gases would have been released if the carbon project did not exist.
- **Project Developer:** A group or company that designs and runs a project. They carry the responsibility of developing and implementing the project, ensuring that the achieved emission reductions are similar to those proposed during conceptualization.
- **Registry:** An online platform where carbon credits are recorded, tracked, and traded. Most registries are simple databases, but some also offer tools for buying and selling credits.
- **Retirement:** Once a carbon offset has been officially used, it is considered retired and taken out of the system so it cannot be traded again.
- **Scope 3 Emissions:** The indirect emissions from a company's value chain, e.g. from suppliers, business travel, and use and disposal of the company's products by the consumers. These are often the hardest to track and reduce.
- **Tokenization:** Turning a carbon credit into a digital token, often using blockchain technology. This can make it easier to trade, track, and prove ownership of carbon credits in a secure and transparent manner.
- **Validation and Verification Body (VVB):** An independent organization that checks carbon projects to make sure they follow the rules set by crediting standards and audit the project before it earns carbon credits.
- **Vintage:** The year in which the emission reduction or removal activity happened.
- **Voluntary Carbon Markets (VCMs):** Markets where businesses, individuals, or organizations choose to buy carbon credit offsets to reduce their carbon footprint proactively, on a voluntary basis.

SECTION 1: INTRODUCTION AND FUNDAMENTALS

What are Carbon Markets?

Carbon markets are a special form of financial markets; where financial markets provide a platform for individuals and companies to trade financial assets like stocks, bonds, commodities, and currencies, carbon markets engage in the trade of "carbon credits" or "carbon offsets" instead. In a broader sense, credits and offsets represent the right to emit a certain amount of greenhouse gases (GHGs), mainly carbon dioxide (CO_2).

Carbon markets allow putting a price on atmospheric pollution; companies pay based on the amount of CO_2 – or equivalent amounts of other GHGs – their activities emit. This price is set per ton of CO_2 (or CO_2e) and is paid through the purchase of carbon credits or offsets. The objective is to encourage efforts towards a low-carbon economy, by simultaneously penalizing pollution and providing a financial reward for reducing emissions.



What is CO_2e?

> It is a unit of measurement used to compare the impact of different GHGs on the environment. There are multiple GHGs in the atmosphere, such as methane, nitrous oxide, hydrofluorocarbons (HFCs), etc., but not all of them have the same potential to trap heat and cause global warming. To make it easier to compare and combine different GHGs – using CO_2 as the benchmark since it is the most abundant source – scientists use a common unit called CO_2 equivalent (CO_2e).
>
> CO_2e may be considered as an exchange rate of other GHGs to CO_2, expressing the quantity of CO_2 (by mass) that would warm the atmosphere equally to one unit (by mass) of another GHG over a certain period.

Why do Carbon Markets matter?

Carbon markets are a vital tool in the global response to climate change. By turning emissions into a tradable asset, they can help align environmental responsibility with economic opportunity. Among other benefits, they help drive progress on the following:

- **Mobilizing climate finance** – Carbon markets help developing and emerging economies bridge financing gaps for implementing climate friendly projects by attracting public and private investments.
- **Supporting Sustainable Development Goals (SDGs)** – Carbon market projects frequently deliver co-benefits such as improved air quality, gender inclusion, health improvement, and biodiversity conservation, explicitly aligning activities with the United Nations (UN) SDG agenda.
- **Enabling cost-effective climate action** – Carbon markets enable emission reductions to occur wherever they are cheapest and most impactful, creating a cost-effective path toward achieving global climate goals while maintaining economic competitiveness.
- **Promoting accountability and transparency** – Through robust Monitoring, Reporting, and Verification (MRV), carbon markets offer a reliable and traceable system for promoting and tracking emission reductions.
- **Supporting national climate goals** - Countries can use carbon markets to meet their climate targets, especially to fulfil their Nationally Determined Contributions (NDCs), more efficiently.
- **Encouraging innovation in low-carbon solutions** - As the demand for verified emission reductions grows, so does the incentive to develop innovative technologies and nature-based solutions; carbon markets stimulate progress in these sectors.

How do Carbon Markets work?

Every time a business or project prevents, reduces, or removes one ton of CO_2e from the atmosphere, it can generate one carbon credit or offset. These are generated through climate friendly activities like planting trees, preventing ecosystem degradation, building wind or solar farms, capturing methane from landfills and industrial activities, improving energy efficiency, etc.

1 Carbon Credit or Offset = 1 ton of CO_2e avoided, reduced, or removed

Avoidance

Avoidance occurs when actions are taken to prevent activities that potentially produce GHG emissions, e.g. replacing fossil fuel-based energy sources with renewable energy (RE) projects.

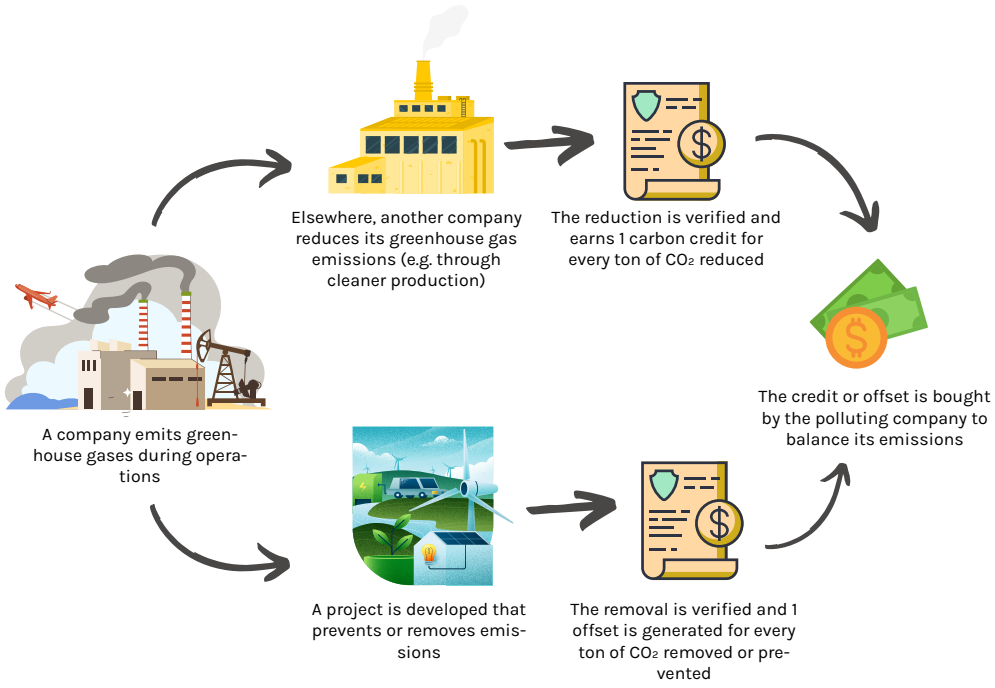
Reduction

Reduction occurs when actions are taken to decrease GHG emissions in comparison with prior practices (business-as-usual), e.g. improving fuel or process efficiency.

Removal

Removal occurs when actions are taken to extract CO_2 from the atmosphere and store it elsewhere for extended periods, e.g. in trees through reforestation.

The generated credits or offsets can then be sold in the carbon market – often to a company that is struggling to meet its own emission reduction goals. The purchasing company can use these credits or offsets to balance part of their own carbon footprint; most commonly, buying entities include companies from hard-to-abate sectors, such as cement, steel, and chemical industries.



Carbon Credits

A business or activity is said to generate carbon credits when it reduces the amount of GHGs released into the atmosphere. They are most commonly part of the cap-and-trade system, where when a business, project developer, or country emits less than its allowed share of GHG emissions, it earns one credit for each ton of CO_2e reduced.

Credits = Permission to emit

Carbon Offsets

A project is said to generate carbon offsets when it reduces or removes GHG emissions from the atmosphere. These are often used as vouchers to make up for high emissions that cannot be avoided, e.g. in hard-to-abate sectors when an activity produces more than its allowed share or targeted GHG reductions.

Offsets = Compensation for emissions

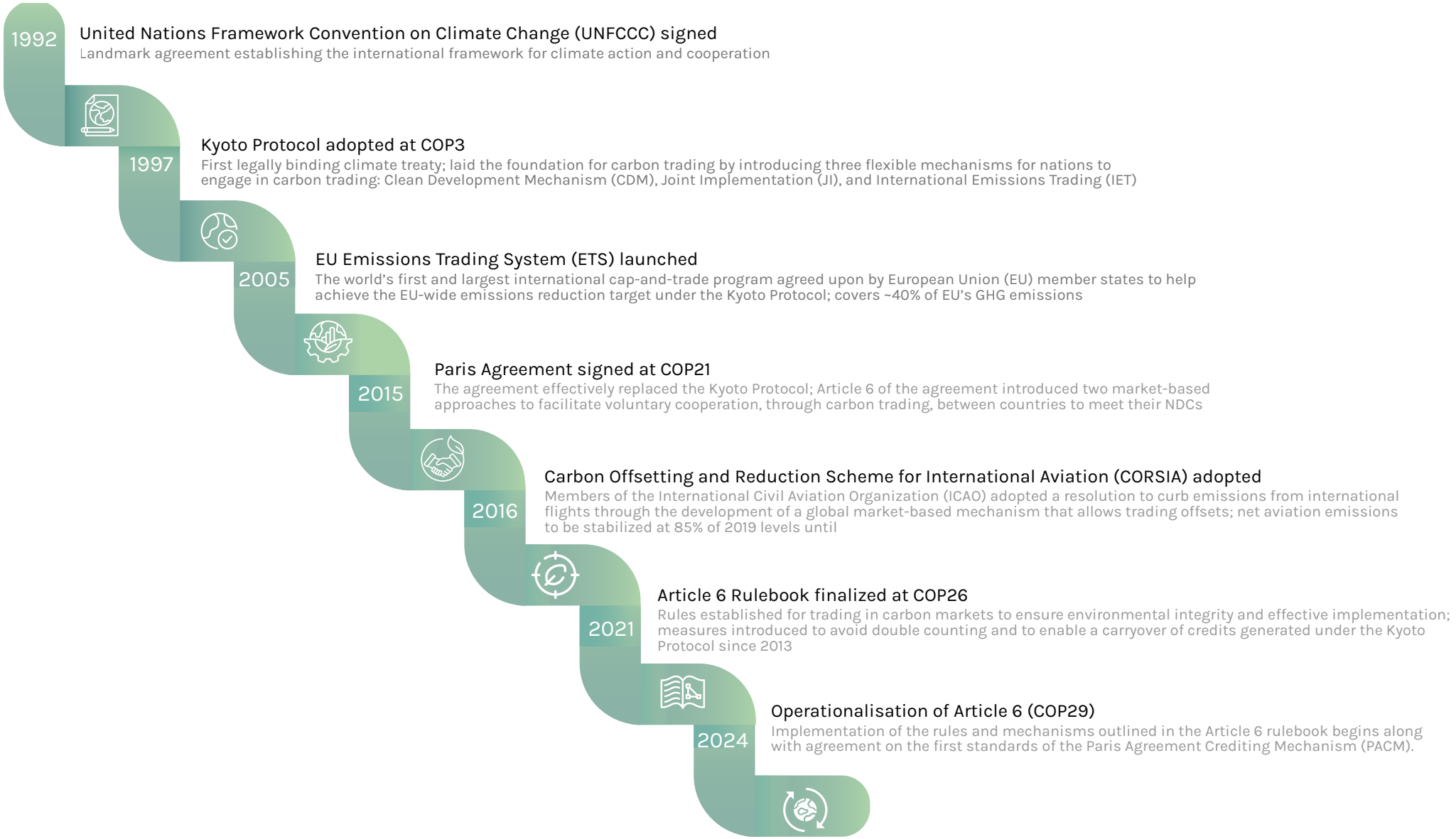
Types of Carbon Markets

There are two types of carbon markets: voluntary and compliance markets. Although, they are both designed to facilitate businesses and project developers in reducing their carbon emissions, they serve different purposes, operate under distinct regulations, and have varying impacts on businesses, communities, and the environment.

	Compliance Carbon Markets	Voluntary Carbon Markets
Purpose	To meet legally binding emission reduction targets set by governments and regulators	To proactively demonstrate climate responsibility and achieve internal sustainability targets
Regulation	Legally enforced by national, international, or regional laws	Not legally enforced; governed by independent standards and registries
Participants	Mainly large emitters from hard-to-abate sectors	Corporations and small businesses
Issuance	Mostly credits but sometimes also offsets	Offsets only
Trading platforms	Centralized; via government platforms or exchanges	Decentralized; via global platforms and crediting schemes or direct deals
Pricing	Typically sold at high prices, driven by regulatory pressures and obligations	Prices vary based on project type, characteristics, and market demand
Main drivers	Legal compliance, financial penalties for non-compliance	Corporate sustainability goals, ESG commitments, public pressure
Incorporation of co-benefits	Secondary consideration; not a priority	Social and environmental co-benefits are an essential part of the project

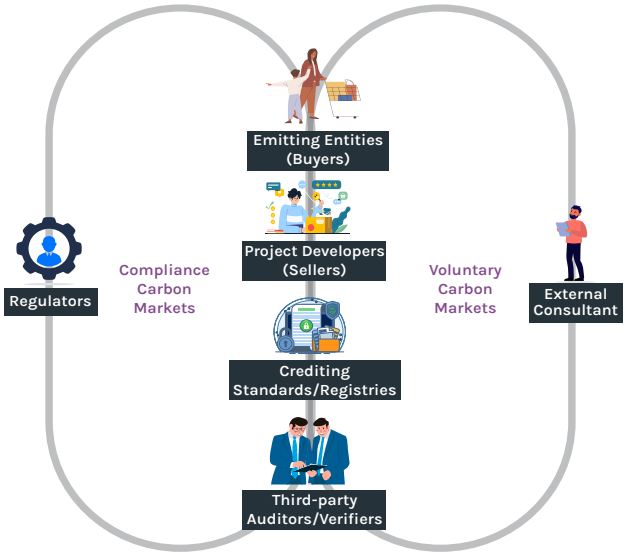
Evolution of Global Carbon Markets

Carbon markets first emerged as a promising tool to reduce carbon emissions in 1997 through the Kyoto Protocol; however, its recently gained popularity and momentum may be attributed to the signing of the Paris Agreement in 2015, where parties to the United Nations Framework Convention on Climate Change (UNFCCC) called for a strengthening of global response to climate change. The agreement focused on climate adaptation, mitigation, and finance, including provisions for facilitating the trade of carbon credits globally. Article 6 of the agreement, the groundwork for which was laid recently at COP29 in Azerbaijan, caters specifically to this, enabling voluntary cooperation to help countries achieve their NDCs.

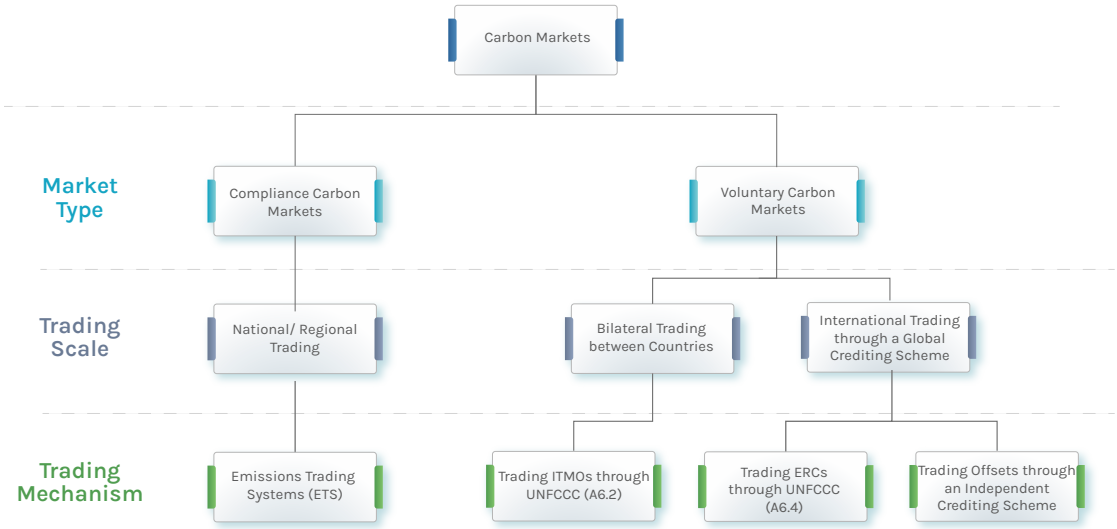


SECTION 2: THE MECHANICS OF CARBON TRADING

Who Participates in Carbon Markets?

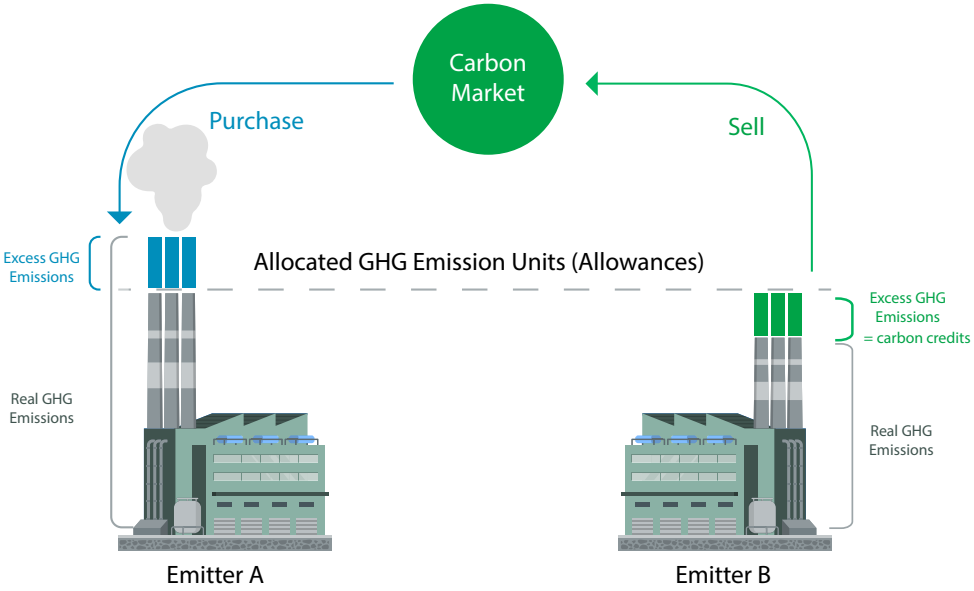


Carbon Trading Mechanisms and Standards



Emissions Trading Systems (ETS)

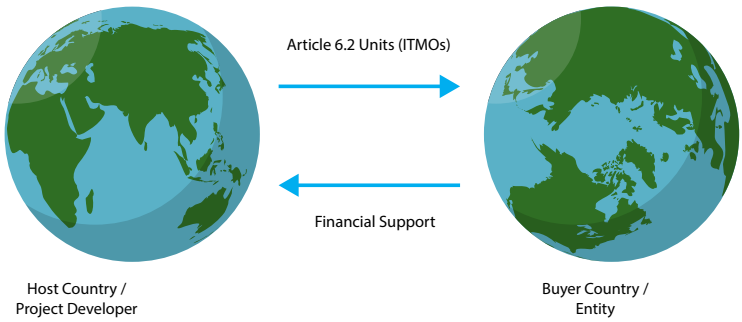
Emissions Trading Systems (ETSs) are the most common form of compliance markets; they operate on a national or regional level through a cap-and-trade regime, where a limit (cap) is imposed by the government on certain businesses – usually from high emitting sectors – on the amount of CO_2e they can emit within a given period; these are known as emission allowances. If a business's emissions go beyond its allocated allowances, it has the option to purchase excess allowances in order to avoid penalties at the end of the compliance period (usually set at one year). It may purchase these from other businesses within the same cap-and-trade system that did not exceed their allocated limits but rather had allowances to spare – and may therefore be considered as credits – due to improved environmental performance.



At present, there are 36 active ETSs worldwide, with the EU ETS being the largest and most widely recognized system; other major countries include the United Kingdom, China, Australia, Indonesia, and New Zealand. Together, they covered nearly 18% of global emission in 2024, driving reductions in a broad range of sectors including electricity and heat, industry, mining and manufacturing, aviation, buildings, transport, agriculture, and waste management. Additionally, a further 22 systems are under consideration or development including in several low-to-medium income countries, such as Pakistan, Kenya, Senegal, and Vietnam.

Bilateral Trading through Article 6 of the Paris Agreement

Under Article 6.2 (A6.2), the Paris Agreement has set up a mechanism to allow countries to trade carbon credits, known as Internationally Transferred Mitigation Outcomes (ITMOs), on a decentralized basis, with countries setting their own rules. This mechanism facilitates direct trading of carbon credits, in the voluntary market, between countries to meet their NDC targets, where buyers can balance their emissions, advancing towards net-zero and sellers can use the revenue to fulfill their adaptation and mitigation needs.



To ensure environmental integrity, this mechanism also includes a system of "Corresponding Adjustments (CAs)" to prevent double counting of emission reductions – meaning once sold only the buying country can claim a transferred credit toward its NDCs.

Independent Trading through a Global Crediting Scheme

The voluntary carbon market operates through a variety of crediting schemes; these schemes provide a platform for project developers to obtain carbon credits and sell them in a regulated manner. However, their role is typically not confined to the issuance of credits only; depending on the services they provide, they may simultaneously serve as registries, project methodologies, standards, and validation and verification bodies (VVBs) as well.

Project methodologies

They outline the rules and procedures – such as GHG accounting methodologies and programme requirements for monitoring, reporting, verification, and certification – to determine project eligibility, additionality, baseline, and emissions.

Registries

They are responsible for reporting and tracking project information, such as project status, required documents, credits generated, ownership, sale, and retirement.

Standards

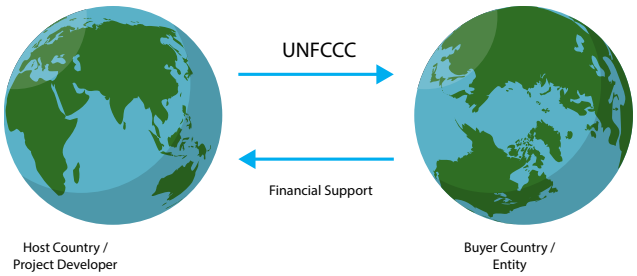
They provide guidance and specifications on GHG quantification, monitoring and reporting; they do not have systems for registration or enforcement.

VVBs

Validation and verification bodies (VVBs) evaluate carbon projects to ensure they follow the outlined project methodology and rules set by the crediting scheme; they audit the project before carbon credits are approved and issued against it.

Multiple crediting schemes (both crediting mechanisms and standards) exist at present, each with their own set of rules, requirements, and methodologies; the most common ones are highlighted here.

Paris Agreement Crediting Mechanism (Article 6.4) establishes a UN-supervised international carbon market governed by a supervisory body (the UNFCCC). It issues Emission Reduction Credits (A6.4ERCs), which can be purchased by countries, companies, or individuals to achieve their emission reduction goals. This mechanism also includes provisions for the transition of credits earned through the Clean Development Mechanism (CDM) projects under the Kyoto Protocol – from 2013 onwards) – given they meet certain conditions.



Verra – formerly known as Verified Carbon Standard (VCS) – is a non-profit organization (NPO) founded in 2005 that lays out the rules and requirements that project must follow in order to get certified for carbon credit issuance. At present, it is the largest voluntary standard in the world and incorporates independent auditing, accounting methodologies, and a registry system. It caters to a wide range of project areas – including renewable energy, energy efficiency, forestry, agriculture, and waste management – issuing Verified Carbon Units (VCUs) to projects that meet robust environmental and social criteria – ensured through third-party verification – and demonstrate additionality.

The Gold Standard for the Global Goals (GS4GG) was developed in 2017 by the Gold Standard Foundation – an NPO established by the World Wildlife Fund (WWF) and other international non-governmental organizations (NGOs) – and is one of the most credible and robust standards in the voluntary carbon market today. It covers a range of project areas – such as renewable energy, energy efficiency, waste management, land-use and forests (excluding REDD+), and water – and requires that projects contribute to at least two SDGs as well in addition to SDG 13 (Climate Action). It issues GS Certified Statements or products, including Verified Emissions Reductions (VERs).

Carbon Market Integrity & the ICVCM

The Integrity Council for the Voluntary Carbon Market (ICVCM) is an independent governance body established to ensure that carbon credits traded in voluntary markets are of high quality, transparent, and environmentally credible. Its core goal is to build trust in the voluntary carbon market by defining and enforcing clear criteria for what constitutes a high-integrity carbon credit. ICVCM has developed the Core Carbon Principles (CCPs) – a set of 10 rigorous benchmarks that all crediting programs must meet to ensure environmental integrity, additionality, permanence, and robust monitoring and verification. Crediting standards – like Verra, Gold Standard – and specific credit types/ methdologies are independently assessed against these principles. Approved credits are then labeled as "CCP-eligible", providing buyers, investors, and regulators with confidence that the credits genuinely contribute to climate action. By harmonizing standards and increasing transparency, ICVCM is helping to scale carbon markets responsibly and equitably.

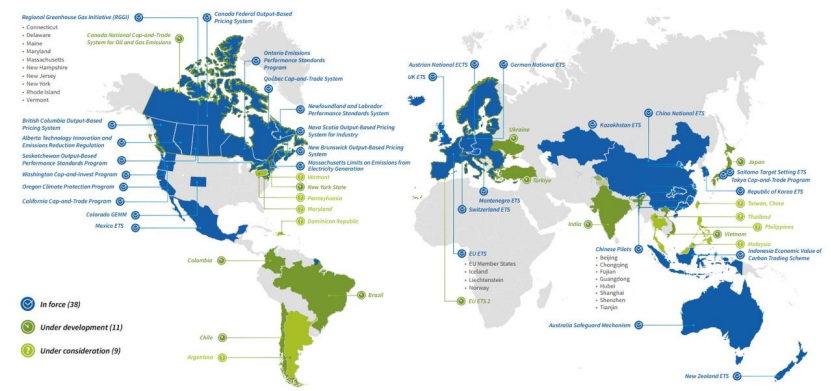
Carbon Markets in Numbers

Compliance Carbon Markets

38 CO_2 Emissions Trading Systems in force

covering **10** $GtCO_2e$

accounting for **19%** of global GHG emissions



USD **74** Billion raised in 2023

almost USD **303** Billion since 2007

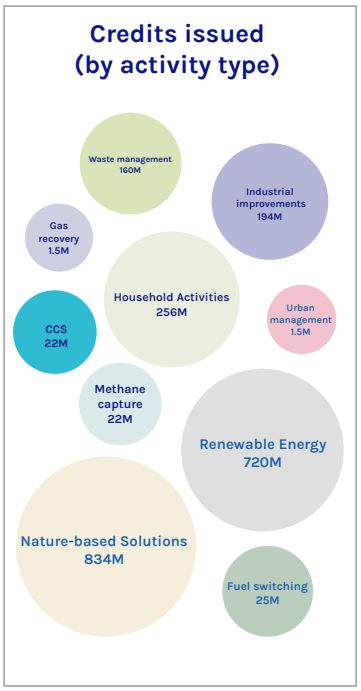
Price Range
US$/$tCO_2e$
$0.46 – $167

Voluntary Carbon Markets

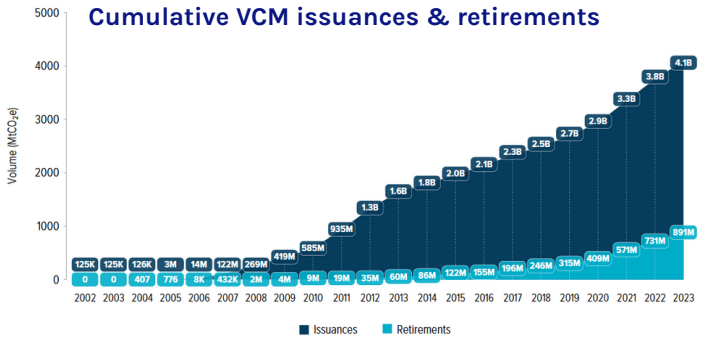
>6000 Registered Projects b/w 2002 and 2025

Price Range
US$/$tCO_2e$
$3 – $10

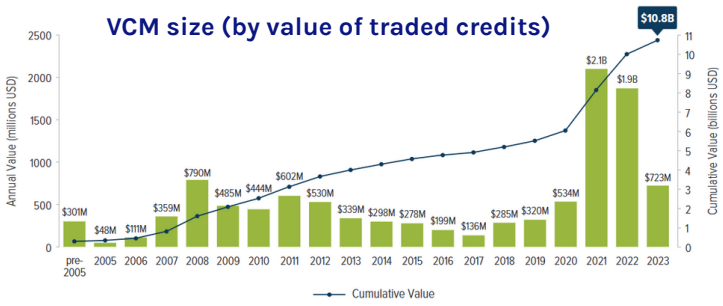
Credits issued (by activity type)



Cumulative VCM issuances & retirements



VCM size (by value of traded credits)



Lifecycle of a Carbon Market Project

Although the exact procedure to engage in the global carbon market varies between countries, the general cycle from start to finish tends to be the same; countries often impose additional regulations and requirements to align with their national goals.

Project Design

As a first step, the project developer, seeking to take advantage of the carbon market, must identify a climate-friendly activity. For participation in both compliance and voluntary markets, these projects should fall under one of two categories: GHG avoidance and carbon removal.

Next, a Project Design Document (PDD) must be developed. A PDD is a detailed document – 60-100 pages long – detailing the technical aspects of the project, its key activities, socio-economic benefits, expected emission reductions calculated using a reliable accounting methodology, and a robust MRV strategy. This is one of the most crucial, and therefore time consuming – typically 1-2 years long – steps of the process and is often outsourced to an external consultant/team of experts hired by the project developer.

Project Validation

Once developed, the PDD must be submitted to an accredited independent third-party auditor, such as Bureau Veritas or ERM, referred to as a Validation and Verification Body. The auditor validates the PDD against an established crediting standard and registers the project with a recognized carbon crediting scheme.

Project Implementation

Following registration with a crediting scheme, the project enters the implementation phase, and data is regularly collected and analyzed to determine emission reductions or removals achieved.

Monitoring and Verification

Project developers must monitor emission reductions over a fixed period – called a crediting period – in accordance with the structure proposed in the PDD. These reductions are then verified by the VVB, which submits a detailed report to the crediting scheme.

Validation and Issuance of Carbon Credits

Once verified by the accredited VVB, the emission reductions must be validated by the crediting scheme, which then issues carbon credits against them. These credits are recorded in an official carbon registry and an invoice is generated as proof for the project developer. Projects often go through periodic verifications to issue new batches of credits; long-term projects (like forestry) must also show that carbon reductions or removals are permanent and not reversed in the short-term.

Trading or Retirement of Carbon Credits

Following the issuance of carbon credits, they may be sold in the voluntary or compliance carbon markets, as applicable, to buyers – other companies or countries – once a satisfactory price is obtained. Once the buyer uses these carbon credits to achieve the intended compensation or offsetting benefits, the credits are retired, i.e. removed from the registry of available credits, thus no longer available for sale.

GHG Avoidance Projects

Avoidance projects prevent the release of GHG emissions into the atmosphere, in the present and future. Therefore, they include activities that reduce production (e.g. a shift to cleaner fuels) and release (e.g. the use of scrubbers or adsorbers) of emissions, or the preservation of natural resources (e.g. preventing deforestation). Areas of interest under this category include:

Renewable energy projects

Replacing fossil fuel energy with clean sources like wind, solar, or hydro to avoid emissions

Energy efficiency projects

Reducing energy use in buildings, industries, or transport (e.g. by switching to LED lighting and efficient boilers, behavioural change, etc.)

Avoided deforestation and ecosystem degradation

Protecting natural systems such as forests, grasslands, mangrove belts, etc. from destruction, preserving the carbon they store

Improved cookstove

Switching to efficient cookstoves to reduce wood or charcoal use, avoiding deforestation and smoke emissions

Fuel switching

Transitioning from high-carbon fuels (like coal) to low-carbon ones (like biomass) in industrial production and transport

Methane capture

Preventing methane – from industries, landfills, or agricultural activities – from being released into the atmosphere, by capturing and eliminating it, e.g. by converting it into CO2 which has a lower warming potential or reusing it in industrial activities

Industrial gas destruction

Capturing and destroying potent industrial gases like HFCs or N_2O emitted from industrial activities

Carbon Removal Projects

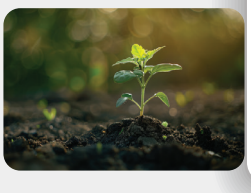
Removal projects are designed to remove CO_2 that has already been released into the atmosphere through nature-based or technology-based methods. Potential project areas under this category include:

Afforestation and reforestation

Planting new forests or restoring degraded ones to absorb CO_2 from the air

Carbon capture and storage (CCS)

Capturing CO2 directly from the atmosphere and storing it underground through processes like Direct Air Carbon Capture with Storage (DACCS) and enhanced rock weathering



Biochar

Producing biochar through the gasification and pyrolysis of biomass to stabilize carbon and lock it in the ground, e.g. by applying in farmlands or incorporating in construction or waste management systems

Blue carbon projects

Restoring coastal ecosystems like mangroves that capture and store carbon

Soil carbon sequestration

Improving farming practices, such as focusing on regenerative agriculture, to store more carbon in soils

What makes a High-Quality Project?

All economic activities tend to have a carbon footprint or impact on GHG emissions; the extent to which this impact is positive or negative plays an important role in defining whether a project is suitable for generating carbon credits/offsets and trading under global carbon markets. For a project to be considered eligible, it must be either an avoidance or removal project, with two key characteristics: additionality and permanence; additional features such as a strong baseline and sustainable development co-benefits are crucial to improving the quality, and therefore the price, of generated credits/offsets.

Essential Characteristics

Characteristic	Description	Project Example
Additionality	If emission reductions/removals from a project would not have happened without the support of the carbon market, it is considered additional; in essence, the project must go beyond business-as-usual.	Reforesting degraded land that would have remained barren without carbon finance; here, the carbon credits directly enable real, measurable climate benefits.
Permanence	The durability of the emission reductions/removals achieved by a carbon credit/offset project. It ensures that the carbon benefits – like stored or avoided CO_2 – are long-lasting and not easily reversed.	A reforestation project in a protected area, where trees are safeguarded, and carbon remains stored for decades or even centuries, rather than being cut down or lost to natural events in the short-term.

Additional Characteristics

Characteristic	Description	Project Example
Externally verified and registered	The project must be recorded in a formal, traceable registry that incorporates robust verification criteria and tracks credit issuance, transfer, and retirement to prevent fraud or double counting.	A project registered with UNFCCC, Verra, or Gold Standard is likely to generate higher value credits than with a less common, relatively unknown registry.
Limited or no leakage	Leakage refers to the unintended increase in GHG emissions outside the boundaries of a carbon credit project, caused by the project's activities. It occurs when reducing emissions in one area leads to higher emissions elsewhere, which can weaken the overall climate benefit.	A nature-based project like mangrove restoration may risk leakage if nearby forests are cleared to compensate for lost space; managing this risk through careful land-use planning and safeguards to avoid shifting emissions improves the quality of associated offsets.
Project location	The geography and sociopolitical condition of the area the project is set up in.	A project in a developed country with political and economic stability is likely to generate higher quality credits compared to a project in a developing country with poor governance frameworks and economic instability.
Strong baseline	A baseline reflects what emissions would have occurred if the project had not been developed. A conservative and realistic baseline is important along with a well-established methodology to measure it.	For a reforestation project, baseline data is gathered using satellite imagery before the implementation of the project and later compared to visuals after project implementation to measure the impact.
Sustainable development co-benefits	The positive social, economic, or environmental impacts that arise in addition to the emission reductions of a carbon credit project. These are especially valuable when they align with numerous SDGs.	A reforestation project in a rural area that restores degraded land could generate multiple co-benefits, such as: sequestering carbon from the atmosphere (SDG13), biodiversity protection (SDG15), improved livelihoods through local employment and income from forest products (SDG8), and cultural and educational value by involving communities in stewardship (SDG10).
Vintage	The year in which the emission reduction or removal actually took place. It helps buyers understand when the climate benefit occurred and is a key factor in evaluating the relevance, credibility, and market value of the credit.	A carbon credit from 2008, issued under an older methodology with limited verification standards, is considered less credible or relevant today than a credit issued in 2023, verified under a robust and recent standard.

SECTION 3: TAPPING THE CARBON MARKET IN PAKISTAN

The Emerging Carbon Market in Pakistan

Pakistan is gradually transitioning from being a climate finance recipient to a potential climate market participant and innovator. The country is beginning to understand that with the right institutional frameworks, registry systems, and project pipelines, carbon markets can complement traditional finance sources and help unlock climate-smart investments at scale.

As a result, Pakistan is building upon its historical participation in carbon markets under CDM – with over 75 projects approved between 2006 and 2020 – and transitioning into both Article 6 and voluntary carbon markets.

Recent key developments include:

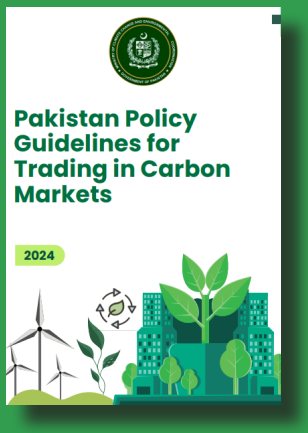
Voluntary Carbon Market Participation: Pakistan has initiated voluntary carbon projects under frameworks like Verra's REDD+, and clean energy and energy efficiency methodologies.

Article 6 Readiness: Pakistan is preparing to operationalize carbon trading under Article 6 of the Paris Agreement by taking measures such as:

- Establishing a Designated National Authority (DNA) within the Ministry of Climate Change and Enviromental Coordination.
- Drafting a national carbon market framework and policy guidelines, with an MRV system reportedly under development.
- Launching pilot projects like methane capture at the Lakhodair landfill site in Lahore.

National Policy Guidelines on Carbon Markets

Early in 2025, the Ministry of Climate Change and Environmental Coordination (MoCC&EC) launched policy guidelines for the development of carbon markets in Pakistan, laying the foundation for a transparent and robust carbon trading framework aligned with Article 6 of the Paris Agreement. The policy aims to facilitate voluntary carbon markets in particular, through a regulated structure, enabling the generation and international transfer of high-quality, high-integrity carbon credits, developing a market early, with a good reputation and creating opportunities for local businesses.



The guidelines outline eligibility criteria for projects, with a focus on priority sectors with strong mitigation potential, including renewable energy, agriculture, forestry, waste management, and transport. They stress the importance of additionality, sharing of co-benefits, robust MRV systems, and alignment with national climate targets in achieving successful implementation and reaping maximum benefits of this tool in a timely manner.

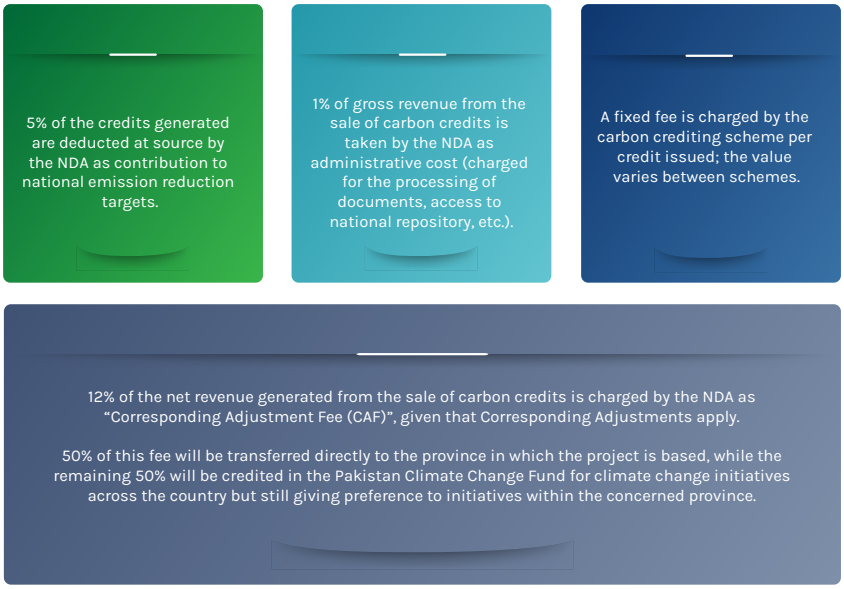
Developing a Carbon Project in Pakistan

Since Pakistan is yet to establish a compliance carbon market, businesses and project developers can only tap into the voluntary carbon market, either through the Article 6 market regulated by MoCC&EC or through direct trading with companies looking to offset their carbon emissions in the international market. Although Pakistan is currently exempted from offsetting emissions under CORSIA, businesses can also sell carbon credits to emitters with emission reduction obligations under this scheme.

For a project developer in Pakistan, the process to engage in the international market is the same as that outlined in Section 2. However, if they are looking to trade under the Article 6 mechanism, some additional steps are also involved; these are detailed, from start to finish, below:

Participation Costs

Project development and revenue generation also come with minor costs; there are four types of fees – three monetary and one in the form of credits – that have to be paid at various stages during the development process.



Challenges and Opportunities

Pakistan, as a climate-vulnerable and low-emitting developing country, holds significant potential to benefit from carbon markets; however, several structural and institutional barriers must be addressed to unlock this potential. Going forward, a holistic and inclusive effort is needed, tailored to all relevant stakeholders. Keeping this in view, some challenges and opportunities for key stakeholders in the development and exploitation of carbon markets in Pakistan are highlighted below:

Private sector and industry

Key Actors:

- Industries from hard-to-abate sectors
- Large emitters (e.g. textiles, energy producers)
- Multinationals and corporations
- Small and medium-sized enterprises (SMEs).

Challenges:

- Lack of incentives or mandates for internal carbon accounting and emission reductions.
- Insufficient pipeline of verifiable emission reduction projects, especially in cement and textile sectors.
- Portfolio focused mainly on bankable projects, which, by their very nature, are not additional and therefore not suitable for carbon credit generation; an innovative switch from business-as-usual would be required to be eligible for participation.

Opportunities:

- Potential avenue for advancing Corporate Social Responsibility (CSR) initiatives.
- Integration of internal carbon pricing mechanisms to future-proof supply chains.
- Accelerated achievement of decarbonization and net-zero targets by developing insetting programmes to encourage companies to reduce emissions within their value chains rather than buying external credits or offsets.
- Support in aligning with international regulations – such as the Carbon Border Adjustment Mechanism (CBAM) and Environmental, Social, and Governance (ESG) initiatives – to maintain trade competitiveness.

Government and Regulatory Bodies

Key Actors:

Line ministries (mainly Ministry of Climate Change & Environmental Coordination, Ministry of Energy, Ministry of Finance, Ministry of Industries and Production, Ministry of Planning, Development, and Special Initiatives)

Regulators (e.g. State Bank of Pakistan, Securities and Exchange Commission of Pakistan, Pakistan Environmental Protection Agency, etc.).

Challenges:

- No centralized system to track carbon trading exists at present, leading to difficulties in keeping records of credit generation and retirement, creating risks of double counting.
- Lack of clarity on carbon credit ownership and benefit-sharing making it difficult to track emission reductions and benefits, especially in forestry or land-based projects, where land ownership is often disputed and project outcomes difficult to measure.
- Limited coordination across ministries creating barriers in effective utilization of carbon market revenues.
- Weak enforcement and integration of MRV systems, creating concerns over transparency and quality of generated credits.

Opportunities:

- Development of a National Carbon Registry and baseline emission factors to ensure accurate tracking of emission reductions and revenues, followed by development of sector-specific carbon project methodologies tailored to local systems.
- Generation of revenue through participation in bilateral carbon markets under Article 6.2 to accelerate achievement of national adaptation and mitigation goals.
- Launch of pilot offset programs, e.g. in renewable energy, waste management, and forestry, to increase contribution to national climate goals.
- Initiation of capacity building activities to enhance local expertise in carbon markets, e.g. training local personnel to become certified auditors/verifiers.
- Facilitation of public-private partnerships to scale demand and supply of high-quality carbon credits.

Project Developers

Key Actors:

Entrepreneurs

NGOs

Community leaders

Conservation groups

Landowners (e.g. farmers)

Other individuals developing carbon avoidance or removal projects

Challenges:

- Lack of awareness on carbon pricing mechanisms and credit generation potential.
- Capacity gaps in applying international standards and accessing the global market.
- Limited capacity to bear pre-financing costs, such as upfront costs for developing PDDs, verification, and registration with carbon standards.
- Scarcity of certified local experts for project validation or MRV, increasing reliance on expensive foreign consultants.
- Difficulty in aggregating small-scale projects, especially in agriculture or household energy where the resulting impacts tend to be dispersed, i.e. materialized on an individual or household level within project communities.

Opportunities:

- Access to a wider market for acquiring funds for project development and business expansion through the generation and sale of carbon credits.
- Scaling projects with social and environmental benefits – such as clean cookstoves, water purification, and off-grid solar plants – through SDG-aligned credits for accelerated development.
- Possibility to form carbon cooperatives or developer alliances to bundle together small-scale projects, with pooled finances and shared MRV capacity to increase the quality of issued credits.

Carbon Market Success Stories

Sapphire Wind Farm Project

Developed by Sapphire Wind Power Company Limited (a subsidiary of Sapphire Textile Mills Limited)

Located in Jhimpir, Thatta District, Sindh

Key Features

- Total Capacity = 49.5 MW (actual installed capacity = 52.8 MW)
- 137 GWh of electricity delivered to the fossil-fuel dominated WAPDA grid
- In Operation since 2015

Carbon Market Attributes

- Registered as a CDM project with the Gold Standard Crediting Period = 10 years (first credits issued in February 2022)
- Annual Emission Reductions = 78,196 tCO_2e
- > 230,000 credits generated (10,500 already retired).

Social & Environmental Co-benefits

- Renewable energy supports the country's energy security
- Strengthened economic development and the creation of green jobs for local populations
- Built using new, technologically advanced wind turbines, contributing to industrial innovation and know-how

Pakarab Fertilizer Cogeneration Power Plant

Owned by Pakarab Fertilizers Limited (a private entity partly owned by Fatima Group) to shift away from fossil fuel based energy mix

Located in Multan, Punjab

Key Features

- ≈ 30 MWh supplied annually to the fertilizer manufacturing process of Pakarab Fertilizers Limited
- Emission reductions achieved through fuel savings and improved process efficiency

Carbon Market Attributes

- Registered as a CDM project with Verra
- Crediting Period = 7 years (ended in 2016)
- Annual Emission Reductions ≈ 120,000 tCO2e
- All corresponding credits already transferred to the project developers

Social & Environmental Co-benefits

- Installation of a filtration system serving 10,000 local residents
- Development of a children's park to give local communities a healthier family-friendly environment
- Construction of a primary and secondary school - with a capacity of 1,000 students - for the surrounding community
- Multiple professional training courses for women in the area

Delta Blue Carbon

Developed by the Government of Sindh and Indus Delta Capital Limited to address the looming risk of deforestation and forest degradation due to persistent demand for fuelwood, fodder, and open-range grazing.

Located in the Indus Delta Region of Sindh

Key Features

- Project area spans over 350,000 hectares, with 108,024 hectares already planted with mangrove trees
- Integration of adaptation and mitigation activities, rejuvenating degraded coastal habitats through afforestation and reforestation, preserving biodiversity by protecting 11 globally threatened species including the Indus River Dolphin

Carbon Market Attributes

- Registered as a CDM project with Verra (preparing to transition to the Paris Agreement Crediting Mechanism under Article 6.4)
- Crediting Period = 60 years (first credits issued in 2015)
- Annual Emission Reductions = 2.4 million tCO2e (projected removals of 142 million tCO2e over the project's lifespan)

Social & Environmental Co-benefits

- Creation of 21,000 jobs planned, to enhance livelihoods and well-being of local communities
- Installation of 5 reverse osmosis water filtration plants to provide clean and safe drinking water to 49,000 people across 60 villages
- Provision of support to multiple local dispensaries to improve access to healthcare facilities
- Upgrade of educational programmes in community schools
- Training of 18,000 male and 6,000 female community members in different skills related to natural resource management

SECTION 4: THE FUTURE OF CARBON MARKETS

Carbon markets are evolving rapidly as new technologies, policies and business models emerge. It is crucial, especially for a developing country like Pakistan, to stay on top of these rapid changes and take advantage when opportune – sooner rather than later – to maximize benefits and establish itself as a key player in the market.

Key Trends to Watch

Some key trends and innovations that are shaping the present and future carbon trading landscape are highlighted below:

Digital Monitoring, Reporting, and Verification

Digitalization is emerging as an integral element of improving efficiency and preserving integrity in carbon trading, as an increasing number of crediting standards opt for it. Blockchain, satellite imagery, IoT devices, and AI-enabled digital MRV are central to reducing verification costs and building buyer trust, especially as integrity and traceability become dealbreakers in the voluntary carbon market.

Insetting and Corporate Net-zero Targets

Thousands of corporations have committed to net-zero targets. As they decarbonize their operations, demand for high-quality, verifiable carbon credits (especially removals) is expected to skyrocket – making voluntary carbon markets more central. At the same time, many of them are considering opportunities in insetting – targeted emission reductions or removals within their value chains – to reduce their Scope 3 emissions, potentially opening a plethora of options for trading in voluntary carbon markets.

Price Discovery and Shifting Buyer Interests

Credit prices within markets now vary significantly based on credit quality – with credits that include sustainable development co-benefits or carbon removals trading at premiums. Buyers are increasingly screening based on project vintage, location, and integrity. At the same time, there is a marked preference for carbon sequestration, ecosystem regeneration, and engineered carbon removal projects, while interest in renewable energy projects is shrinking as they find it increasingly hard to justify their additionality.

Blockchain and Tokenization of Carbon Credits

Blockchain is transforming how carbon credits are issued, tracked, and traded. By tokenizing credits on public or permissioned blockchains, platforms are enhancing transparency, traceability, and accessibility, making it easier to trade carbon credits in a decentralized manner without the cumbersome processes associated with traditional markets. It also enables real-time auditability and combats double-counting, a persistent challenge in traditional registries. Pioneers in tokenized carbon ecosystems include Toucan and Regen Network.

Market Infrastructure and New Trading Platforms

New exchanges and spot markets are emerging to improve liquidity, transparency, and fair pricing in both voluntary and compliance carbon markets. The objective is to make them more accessible to a wider range of buyers and better adapted to local and regional contexts.

Urban and Community-based Carbon Projects

Cities and local communities are increasingly becoming hubs for carbon projects, allowing municipalities to access the necessary financial resources through voluntary carbon markets. Initiatives like urban forestry, energy-efficient housing, and sustainable transport are opening new avenues for localized climate action and community empowerment.

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