Market Intelligence
& Analytics

CRISIL
An S&P Global Company

Assessment of ESG Advisory Services and Carbon Markets

December 2024

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Global macroeconomic assessment

Global economy shows resilience amid uncertainty

The world economy is still growing steadily and maintaining its target inflation rate, demonstrating its remarkable resilience. Global growth has sustained amid supply-chain disruptions in the aftermath of the pandemic, a Russian-initiated war on Ukraine and the conflict between Israel and Hamas in the Middle East – further complicated by Houthi missile attacks on ships in the Red Sea, that triggered a global energy and food crisis, and a considerable surge in inflation, followed by a globally synchronized monetary policy tightening. Yet, the world avoided a recession, the banking system proved largely resilient, and major emerging market economies did not suffer sudden stops. Over the last two years, growth in employment and incomes has held steady as favourable demand and supply developments have supported major economies, despite rising central bank interest rates aimed at restoring price stability.

Global GDP is estimated to grow at 3.2% in 2024 and 2025 amid moderating inflation and steady growth in key economies

As per the International Monetary Fund's (IMF) April 2024 update, global gross domestic product (GDP) growth is estimated at 3.2% for 2023 and projected to grow at the same rate in 2024, 2025 and 2026. The latest estimate for 2024 is 0.1 percentage points higher compared with IMF's previous forecast in January 2024, mainly due to greater-than-expected resilience in the United States (US) and several large emerging markets and developing economies, as well as fiscal support in China. Emerging market and developing economies are also expected to experience stable growth through 2024 and 2025, with regional differences.

With disinflation and steady growth, the likelihood of a hard landing has receded, and risks to global growth are broadly balanced. Amid favourable global supply developments, inflation has been falling faster than expected. On the upside, faster disinflation could lead to further easing of financial conditions. On the downside, new commodity price spikes from geopolitical shocks and supply disruptions or more persistent underlying inflation could prolong tight monetary conditions. Property sector distress in China or, elsewhere, a disruptive turn to tax hikes and spending cuts could also lead to moderation in growth in the near term.

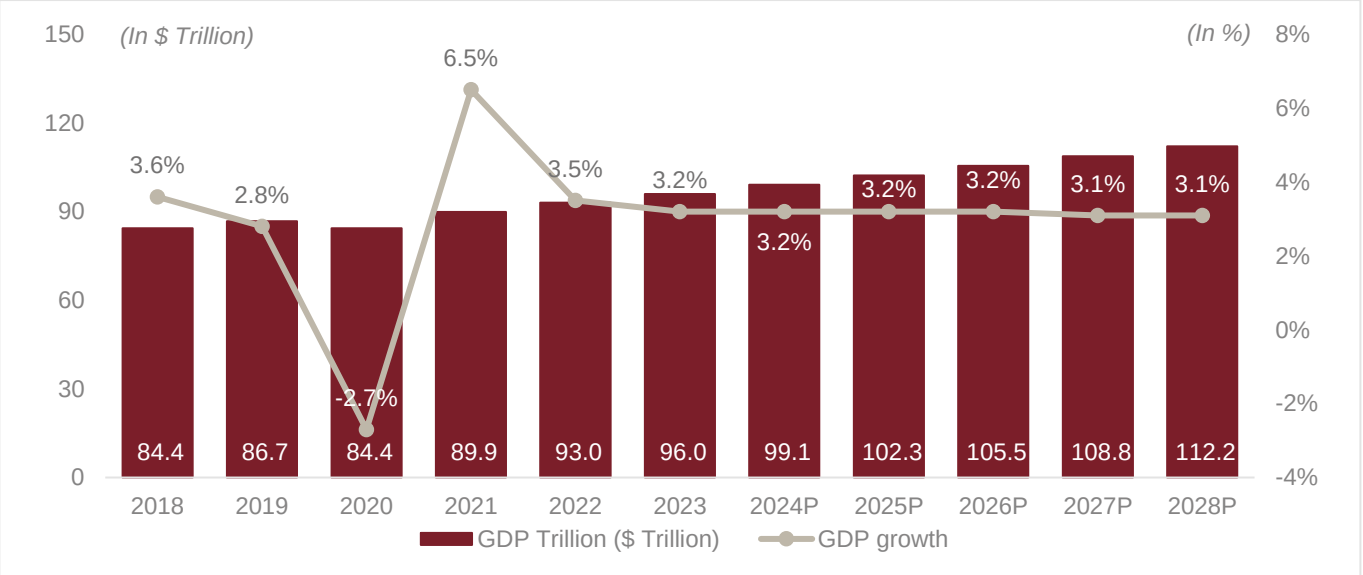


Figure 1 Global GDP trend and outlook (2018-2028P, $ trillion)

Note: P: Projection

Source: IMF economic database, CRISIL Market Intelligence and Analytics (MI&A) Research

Advanced economies to recover ground

For advanced economies, IMF projects growth to rise from 1.6% in 2023 to 1.7% in 2024 and 1.8% in 2025. In the United States, growth is projected to increase to 2.7 percent in 2024, before slowing to 1.9 percent in 2025, as gradual fiscal tightening and a softening in labour markets slow aggregate demand.

IMF projects growth in the euro area to recover from its low rate of an estimated 0.4% in 2023, which reflected relatively high exposure to the war in Ukraine, to 0.8% in 2024 and 1.5% in 2025. Stronger household consumption, as the effects of the shock to energy prices subside and a fall in inflation supports growth in real income, is expected to drive the recovery. The pace of recovery is revised downward by 0.3 percentage point for Germany for both 2024 and 2025 amid persistently weak consumer sentiment, although this adjustment is largely offset by upgrades for several smaller economies, including Belgium and Portugal.

Among other advanced economies, IMF projects growth in the United Kingdom to rise from an estimated 0.1% in 2023 to 0.5% in 2024, as the lagged negative effects of high energy prices wane, then to 1.5 percent in 2025, as disinflation allows financial conditions to ease and real incomes to recover. In Japan, output is projected to slow from an estimated 1.9% in 2023 to 0.9% in 2024 and 1% in 2025, owing to fading of one-off factors that supported growth in 2023, including a surge in inbound tourism.

Growth in emerging market and developing economies to hold stable

In emerging market and developing economies, IMF projects growth to be stable at 4.2% in 2024 and 2025, with a moderation in emerging and developing Asia offset mainly by rising growth for economies in the Middle East and Central Asia and for sub-Saharan Africa. Low-income developing countries are expected to experience gradually increasing growth, from 4.0% in 2023 to 4.7% in 2024 and 5.2% in 2025, as some constraints on near-term growth ease.

As per IMF, growth in emerging and developing Asia is expected to fall from an estimated 5.6% in 2023 to 5.2% in 2024 and 4.9% in 2025. Growth in China is projected to slow from 5.2% in 2023 to 4.6% in 2024 and 4.1% in 2025 as the positive effects of one-off factors—including the post pandemic boost to consumption and fiscal stimulus—ease and weakness in the property sector persists. Growth in India is projected to remain strong at 6.8% in 2024 and 6.5% in 2025, with the robustness reflecting continuing strength in domestic demand and a rising working-age population.

Table 1 Real GDP growth comparison among India vs Advanced and emerging economies

Real GDP growth (Annual % change)	2018	2019	2020	2021	2022	2023	2024P	2025P	2026P	2027P	2028P
Australia	2.8	1.8	-2.1	5.6	3.8	2.1	1.5	2.0	2.1	2.2	2.2
Canada	2.7	1.9	-5.0	5.3	3.8	1.1	1.2	2.3	1.9	1.7	1.7
China	6.8	6.0	2.2	8.4	3.0	5.2	4.6	4.1	3.8	3.6	3.4
European Union	2.3	2.0	-5.5	6.1	3.6	0.6	1.1	1.8	1.7	1.6	1.6
India*	6.5	3.9	-5.8	9.8*	7.0*	7.6*	6.8*	6.5	6.5	6.5	6.5
UK	1.4	1.6	-10.4	8.7	4.3	0.1	0.5	1.5	1.7	1.7	1.6
USA	3.0	2.5	-2.2	5.8	1.9	2.5	2.7	1.9	2.0	2.1	2.1
Middle East (Region)	1.6	0.5	-3.0	4.3	6.0	1.4	2.5	4.4	3.6	3.4	3.0
Advanced economies	2.3	1.8	-3.9	5.7	2.6	1.6	1.7	1.8	1.8	1.7	1.7
Emerging market and developing economies	4.7	3.6	-1.8	7.0	4.1	4.3	4.2	4.2	4.1	4.0	3.9
World	3.6	2.8	-2.7	6.5	3.5	3.2	3.2	3.2	3.2	3.1	3.1

*Note: P: Projected. * Numbers for India are for financial year (2020 is FY21 and so on) and as per the IMF's forecast. ^India GDP estimate for the FY24 is 7.6% according to advanced estimate from MoSPI. Note: Projection as per IMF update*
Source: IMF economic database, World Bank national accounts data, OECD national accounts data, CRISIL MI&A

Climate change to significantly shape the global economy

Climate change has potential to do significant economic harm and poses worrying tail risks. It is a global externality—one country's emissions affect all countries by adding to the stock of heat-warming gases in the earth's atmosphere from which warming arises. Recent studies suggest that the amount of planetary heating already in the pipeline because of a century of pumping greenhouse gases into the atmosphere will make global income 19% lower by 2049 than it would have been without global warming. This income loss will be driven mainly by rising temperatures, which will affect agriculture, public health, productivity and more.

The process of climate change is set to have a significant economic impact on many countries, with many lower income countries being particularly at risk. Macroeconomic policies in these countries will need to be calibrated to accommodate more frequent weather shocks, including by building policy space to respond to shocks. Infrastructure will need to be upgraded to enhance economic resilience. Elsewhere, climate change can entail significant risks to macro financial stability.

Macroeconomic overview of India

Review of India's GDP growth

India GDP grew at 5.8% CAGR between FY12 and FY24

India's GDP grew at 5.8% compounded annual growth rate (CAGR) between FY12 and FY24 to Rs 172.9 trillion in FY24. A large part of the lower growth rate was because of challenges heaped by the Covid-19 pandemic in FY20 and FY21. In FY22, the economy recovered with abating of the pandemic and subsequent easing of restrictions and resumption in economic activity.

In FY23, GDP rose 7% on continued strong growth momentum, propelled by investments and private consumption. In fact, the share of investments in GDP rose to an 11-year high of 34.0% and that of private consumption to an 18-year high of 58.5%.

For FY24, the National Statistics Office (NSO) revised its estimate for India's real GDP growth to 8.2% (which is the provisional estimate) from 7.6% in its second advance estimates (SAE). GVA growth was also revised up to 7.2% from 6.9%. Growth in FY24 was primarily driven by fixed investments on the demand side and industry on the supply side. Even as the agricultural economy slowed sharply following a weak monsoon, the surge in non-agricultural economy has more than made up for it. The government's investment push, along with easing input cost pressures for industry, has also played a major role in shoring up growth. However, services have been slowing owing to waning pent-up demand (post the pandemic), with the exception of financial, real estate and professional services, which has powered ahead on the back of robust growth in banking and real estate sectors.

Analyses of the FY24 year's growth reveal notable dichotomies. Growth has primarily been fueled by fixed investments, exhibiting a robust expansion, while private consumption growth lagged the overall GDP growth. On the supply side, the industry sector experienced the most substantial growth, while the agriculture and services sectors exhibited more modest growth rates. These trends underscore the varied performance across sectors, highlighting the nuanced dynamics shaping India's economic landscape in FY24.

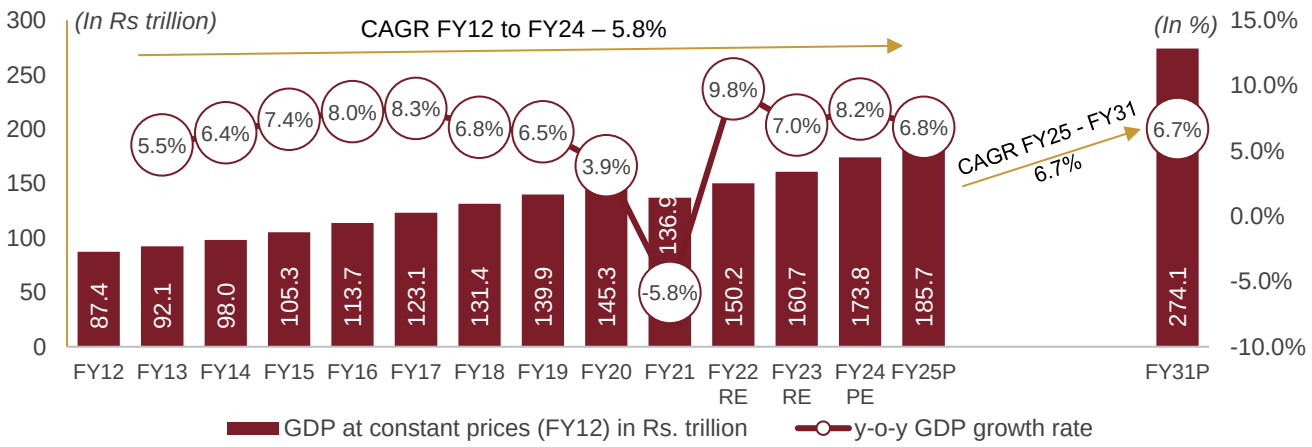


Figure 2 India real GDP growth at constant prices (new series)

RE – revised estimates, PE – provisional estimates, P – projection
Notes: The values are reported by the government under various stages of estimates
Actuals, estimates and projected data of GDP are provided in the bar graph
Source: Provisional estimates of national income 2022-2023 and quarterly estimates of GDP for the fourth quarter of FY 2023, Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation (MoSPI), CRISIL MI&A Consulting

CRISIL forecasts India's GDP to grow 6.8% in FY25

After a strong GDP print in the past three fiscals, CRISIL expects GDP growth to moderate in FY25 as fiscal consolidation will reduce the fiscal impulse to growth, rising borrowing costs and increased regulatory measures could weigh on demand, net tax impact on GDP is expected to normalize, and exports could be impacted due to uneven growth in key trade partners and any escalation of the Red Sea crisis. On the other hand, another spell of normal monsoon and easing inflation could revive rural demand.

At an overall level, India's real GDP is expected to be 6.8% in FY25. This slower growth rate vs. FY24 will be because of slowing global growth, impact of rising interest rates, waning of pent-up demand for services and increasing geopolitical uncertainty. Still, the manufacturing sector, investments and domestic demand will remain resilient. With the government focus on fiscal consolidation, investments, a key factor that boosts growth, are expected to moderate. The extent of revival in private investment cycle will determine the investment momentum this fiscal.

The other segment, urban demand, could moderate as credit conditions tighten this year. Transmission of past rate hikes to broader lending rates remains incomplete. As the wait for rate cuts from the Reserve Bank of India (RBI) prolongs, the transmission is expected to continue, raising the borrowing costs. In addition, the RBI's regulatory measures to clamp down on risky lending will weigh on credit support to consumption.

That said, the forecast of an above-normal monsoon brings hope for the rural economy, which was a laggard in the country's growth story last year. The consequent possible easing in food inflation could also boost purchasing power and support consumption. However, the distribution of monsoon will be determining factor. Freak weather events, such as heatwave and unseasonal rains, remain a risk.

CRISIL MI&A expects a normalisation of the net indirect tax impact on GDP. After strong growth in the last fiscal.

Between fiscal 2025 and fiscal 2031, India's GDP is expected to average at 6.7%

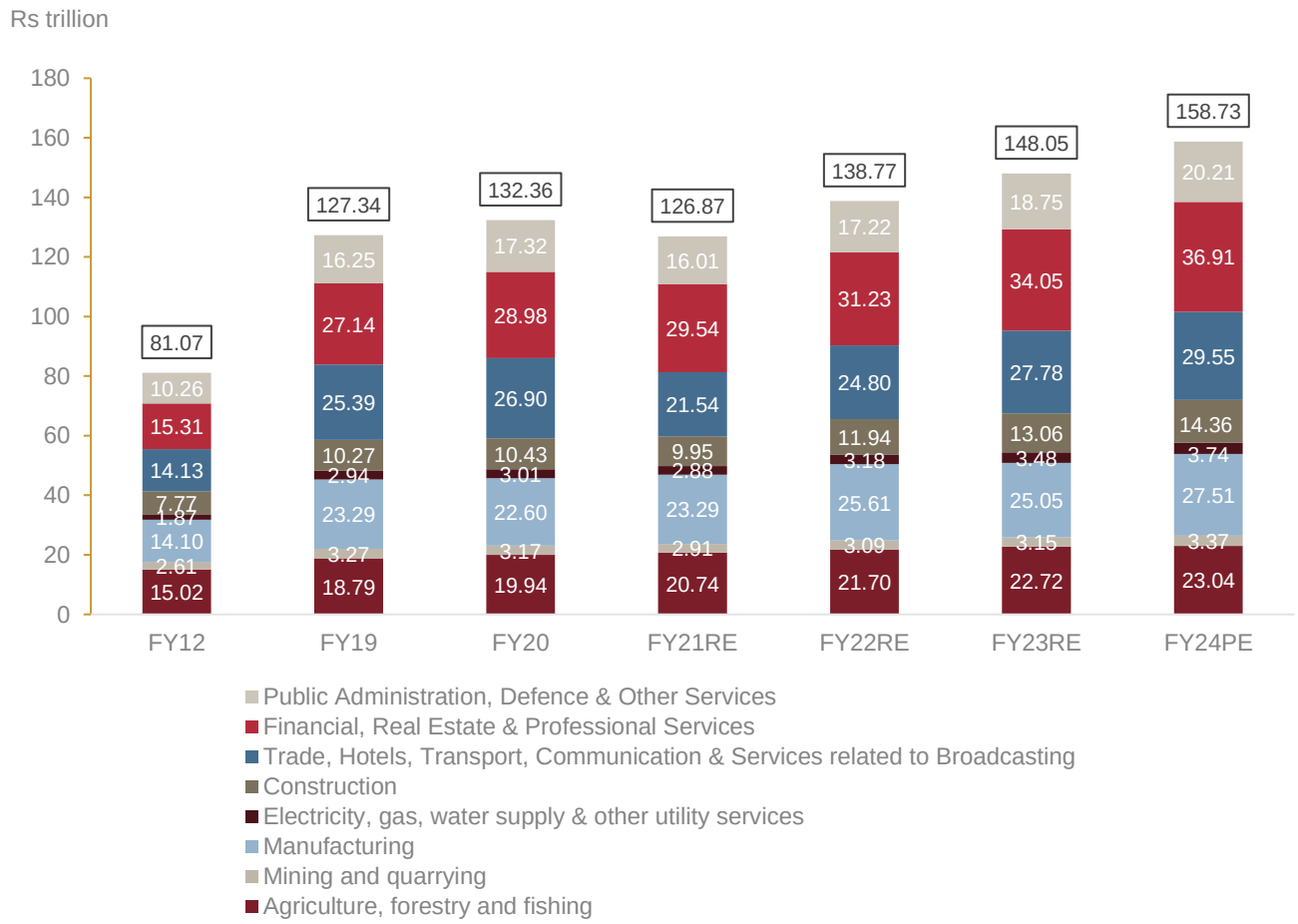
Between FY25 and FY31, CRISIL expects India to sustain average GDP growth of 6.7%, which will make India the third-largest economy in the world and lift per capita income. FY31 will mark the year when India enters the upper middle-income country club with per capita income rising to ~$4,500, as per World Bank definition.

Going ahead, in the near-term GDP growth is majorly characterised by rise in private sector investments and improved efficiency in domestic industries. As the government focuses on fiscal consolidation, its contribution to overall capital expenditure will partly diminish compared to past few years. Nevertheless, private sector investments are expected to gradually become more significant. Manufacturing sector is expected to grow faster than in the past decade between FY11 and FY20. Manufacturing and service sector is expected to grow at 9.1% and 6.9% respectively between FY25 and FY31. But service sector will remain the dominant driver of India's growth, contributing to 55.5% share in GDP by FY31 compared to 20.0% share of manufacturing sector in FY31, even as manufacturing sector catches-up on growth momentum.

GVA sees 7.2% growth in constant terms during fiscal 2024

Gross value added (GVA) at constant prices grew 6.7% in FY23, compared with 9.4% growth in FY22. In absolute terms, constant GVA was valued at Rs 148.05 trillion in FY23, up from Rs 138.77 trillion in FY22. Additionally, in FY24, GVA is estimated to have reached Rs 158.73 trillion, up from Rs 148.05 trillion, in fiscal 2023, registering a growth of 7.2%. Overall, GVA has registered a CAGR of 5.73% between FY12 and FY24. Within GVA, i) financial, real estate

& professional services, ii) trade, hotels, transport, communication & services related to broadcasting and iii) manufacturing are the top three contributors to the overall GVA in FY24(PE) with the share of 23.25%, 18.62% and 17.33%, respectively.



Note: RE: revised estimate, PE: provisional estimate
The value represented in boxes in the above bar graph indicates the overall GVA for the corresponding period
Source: MoSPI, CRISIL MI&A

India's transition tightrope and managing trade-offs

Received wisdom is that energy security and its affordability are vital for growth and development of any economy. This is particularly true of low-income economies that need to grow faster to improve living standards. The other reality that confronts all of us is climate change, which has begun manifesting in rising incidents of heat waves, changing rainfall patterns, physical damage from natural disasters and so on. Incidentally, South Asian region has been identified as highly vulnerable to climate change and associated risks. According to an S&P Global study (2022), in the moderate emissions scenario, South Asia is likely to face water stress and extreme heat, and about 15% of annual gross domestic product (GDP) could be at risk by 2050.

To be sure, India is the fifth largest economy in the world, but in per capita terms, it ranks 143. Hence, its need to grow fast cannot be over-emphasised. CRISIL MI&A expects India to grow at 6.7% per year till the end of the decade. For India, the pursuit of higher growth is bound to raise the carbon footprint as fossil fuels remain the key component of energy supply. In addition to raising its growth rate, India is also attempting to change its composition

in favour of industry and infrastructure, which are traditionally more carbon intensive than services. Services sector has been India's leading growth engine in the past few decades.

Thus, India's ability to manage the trade-off between high growth/energy security and energy transition is being tested, the success of which strongly depends on the deftness of policy makers

India's development-decarbonisation balance

India's development-decarbonisation balance points to a gradual progress to net zero. There is no single road to decarbonisation. Given the spiralling economic and social costs of climate change, multiple energy transition pathways are emerging globally. Each country looks at energy transition from the vantage point of its economy, its strengths and weaknesses. Energy transition refers to the global energy sector's shift from fossil fuel-based systems of producing and consuming energy - including oil, coal and natural gas - to renewable energy sources such as wind, solar and nuclear. The key aim is to reduce energy-related greenhouse gas emissions through various approaches to decarbonisation.

India is the third largest emitter, but 136th in per capita emission

India has the unwelcome distinction of being the third largest emitter of GHG globally, after China and the United States (US). Its aggregate GHG emissions more than doubled between 2000 and 2022, when it emitted ~3,900 million tonne of carbon dioxide equivalent (CO2e), as per the European Commission's EDGAR (Emissions Database for Global Atmospheric Research). Emissions from China and the US were 3.9 and 1.6 times, respectively, that of India's in the same year.

However, the story changes on per capita basis, where India is one of the least polluting major country, trailing many advanced and emerging market economies. According to EDGAR data, India ranked 136th out of 208 countries in terms of per capita GHG emissions in 2022. It emitted ~2.8 tonne CO2e per capita while the corresponding number for the US and the European Union (EU) was ~18 and ~8, respectively.

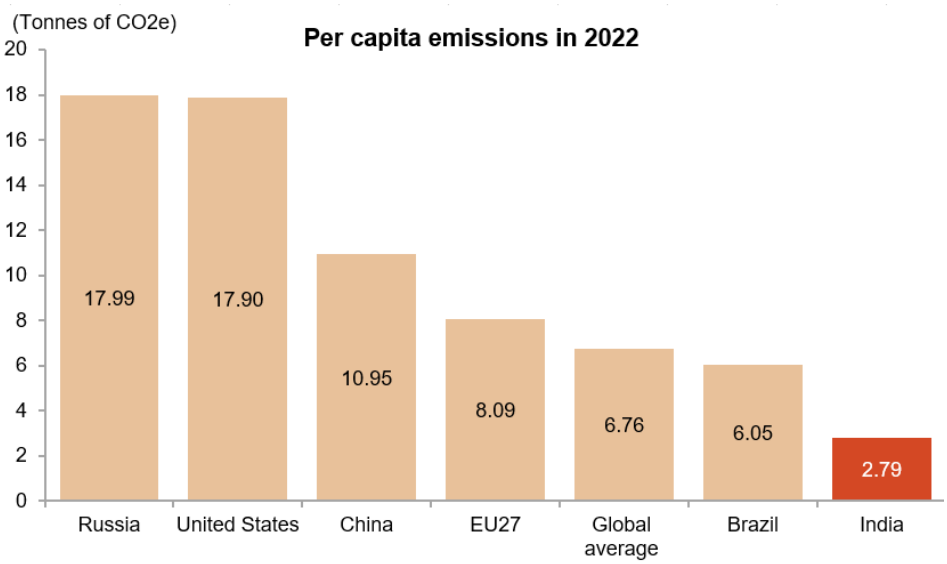


Figure 3 India's per capita emissions are among the lowest

Source: EDGAR (Emissions Database for Global Atmospheric Research) Community GHG Database - a collaboration between the European Commission, Joint Research Centre (JRC) and the International Energy Agency (IEA), and comprising IEA-EDGAR CO2, EDGAR CH4, EDGAR N2O, EDGAR F-GASES version 8.0, (2023) European Commission; CRISIL

Furthermore, since its industrialisation began later, India's contribution to global historical CO2 emissions in the 1850-2021 period is only ~4%, according to the United Nations Environment Programme, compared with 19% and 13% from the US and EU27, respectively. That said, per capita emissions in advanced countries such as the US and the EU27 are now declining, while India's are continuing to rise. To put this in perspective, United States had figures close to India's current level of per capita emissions in the late 1860s-early 1870s. In China, the corresponding figures were in the late 1980s/ 1990s, just before its economic growth accelerated upon accession to the World Trade Organisation.

Energy sector fuels more than 75% of India's emissions

India's aggregate emissions, much like per capita emissions, are continuing to rise, led by emissions from its power sector. Interestingly, the agriculture sector is next, followed by the industrial sector.

A detailed disaggregation of India's GHG emissions (excluding land use, land change and forestry), data for which is available till 2019, revealed the following:

- Energy-related emissions represented more than 75% of aggregate GHG emissions in 2019, driven by the high reliance on coal for power. Within this, emissions from energy industries (electricity, refineries and solid fuel manufacturing) accounted for more than half (~56%)
- Emissions from agriculture represented ~13% of aggregate GHG emissions in the year, within which enteric fermentation (release of methane by ruminant animals) represented more than half (~53%) of the emissions
- Emissions from industrial processes and product use represented ~8% of aggregate GHG emissions. Within this, the mineral industry accounted for more than half (~60%)

The path towards net-zero and the financing gap

Given the above imperative, India's energy-mix strategies include a greater shift towards cleaner energy alternatives (solar, wind, biomass, etc.), increased manufacturing capacities (for instance, photovoltaic modules or solar panels, low carbon bio-based products, etc.), energy use efficiency (in various sectors viz. industry, buildings, transportation, etc.) and a policy push for hydrogen (given its immense potential in acting as a long duration storage of renewable energy) including production-linked incentives.

Panchamrit: India's energy transition plan

Following are government's short- and long-term energy transition milestones under the *Panchamrit action plan* (five-pronged target). These are part of India's Nationally Determined Contributions (NDCs) at the United Nations Framework Convention on Climate Change (UNFCCC) in 2022:

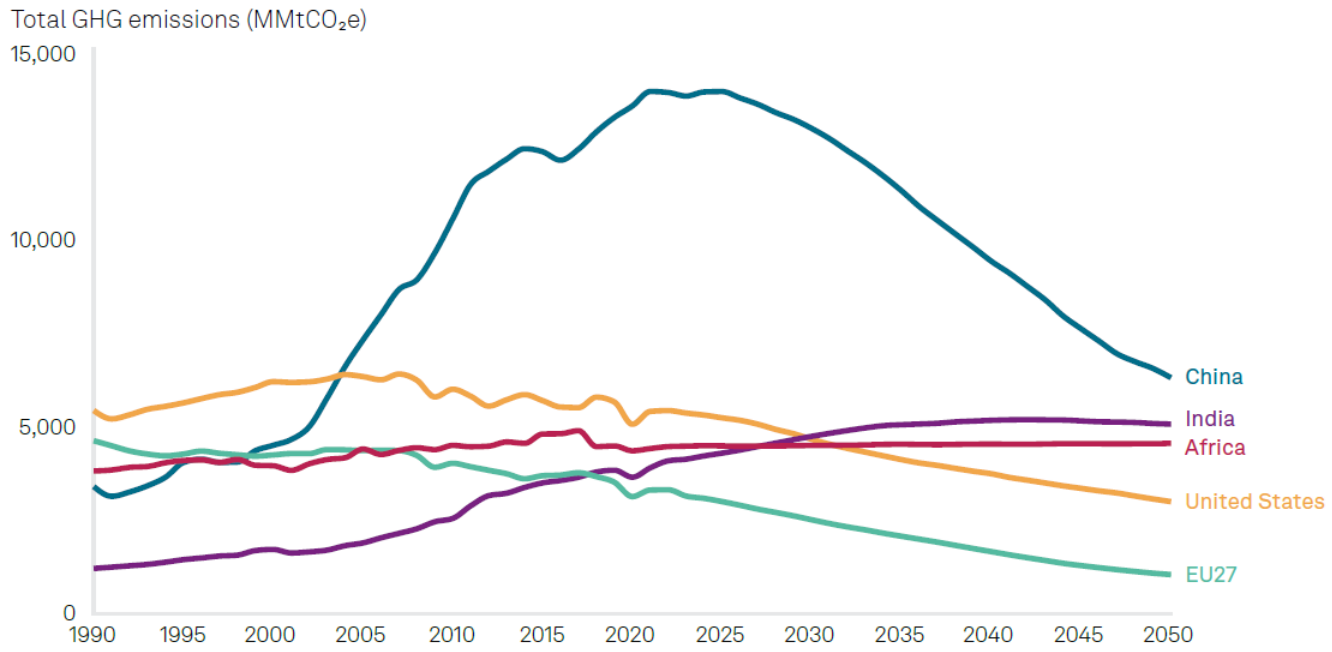
1. Reaching a non-fossil fuel energy capacity of 500 GW by 2030, i.e., ~50% if the installed capacity, up from 43.9% at November-end
2. Fulfilling at least half of its energy requirements via renewable energy by 2030
3. Reducing CO2 emissions by 1 billion tonne by 2030, through additional forest and tree cover
4. Reducing carbon emission intensity of the GDP below 45% (from 2005 levels) by 2030 (it was down by 33% from 2005 levels already by 2019)
5. Finally pave the way for achieving a net-zero emission target by 2070

The transition towards clean energy will require large sums of money, be it setting up physical infrastructure for renewable sources of energy such as solar or wind, or efforts required towards greening of the industrial and transportation sector. According to the International Energy Agency, 2022, $160 billion per year would be required between now and 2030 for India to reach net-zero by 2070. The magnitude of this requirement can be understood when viewed against the fact that India's latest full budget (for fiscal 2024) had allocated only Rs 35,000 crore (~$4.4 billion) towards energy transition.

Global south is focused on a "just energy transition" which takes a more holistic approach taking account the their stage of development and associated challenges. The Just Transition Declaration agreed at the UN Climate Change Conference in Scotland (COP26), recognises the need to ensure no one is left behind in the transition particularly those working in sectors, cities and regions reliant on carbon-intensive industries and production.

India's transition path will be slower than other large economies. According to S&P Global, while emissions in the US have peaked around 2020 and have been declining since, emissions in China are likely to peak around 2025 and then decline rapidly.

India's absolute greenhouse emissions to increase at least till 2050



As of February 2024.
$MMtCO_2e$ = million metric tons of CO_2 equivalent.
Source: S&P Global Commodity Insights.

Figure 4 India's absolute greenhouse emissions trajectory

Overview of the Global Carbon Market:

Understanding Green House Gases (GHGs), Climate Change and the 1.5-degree concern

The earth receives heat from the Sun in form of Solar radiation. While a portion of this solar radiation reflects into the space, some is absorbed by the planet, maintaining a comfortable temperature range for lives on the planet to thrive. This heat is absorbed by the gases present in the atmosphere. These gases that absorb heat are termed Green House Gases (GHGs) and the phenomenon of trapping heat is called the greenhouse gas effect. These gases include carbon dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O) and fluorinated gases like Hydrofluorocarbons (HFCs), perfluorinated chemicals (PFCs), and Sulphur hexafluoride (SF_6). These gases act like blankets, trapping heat. Different greenhouse gases have varying capacities to absorb and emit radiation which contributes to global warming. Global Warming Potential (GWP) is a metric used to compare the ability of different greenhouse gases to trap heat in the atmosphere.

Human activities, particularly the burning of fossil fuels for energy, have significantly increased the concentration of these greenhouse gases in the atmosphere. This disruption in the balance of greenhouse gas effect causes more heat to be trapped in the atmosphere leading to rising global temperatures and climate change. This has focused the attention of the stakeholders on atmospheric concentrations of greenhouse gases.

The international body, Intergovernmental Panel on Climate Change (IPCC), established by United Nations Environment Program (UNEP) and World Meteorological Organization (WMO), plays a key role in assessing the science related to climate change. The IPCC, in its assessment, began exploring the mitigation and stabilization scenarios. These scenarios look at the atmospheric CO_2 concentration needed to stabilize the temperature at various levels above pre-industrial times. Emissions scenarios have always been a crucial part of IPCC reports.

The scientific community, through the Intergovernmental Panel on Climate Change (IPCC), has identified in the IPCC sixth assessment report, that limiting global warming to 1.5 degree Celsius above pre-industrial levels as critical to avoiding the most devastating consequences of climate change. These consequences may include intensified weather extremes like severe heatwaves, droughts, floods, etc., sea level rise, mass extinction and bio-diversity loss, food, and water security risk, etc.

Researchers have established a correlation between atmospheric CO_2 concentration and the temperature changes. Carbon budget is a concept used by climate policymakers to help set emissions reduction targets in a fair and effective way. Carbon budgets link the rate of emissions to the additional rise in temperature and can offer a stepped approach to reaching climate targets. It examines the maximum amount of cumulative net global anthropogenic carbon dioxide (CO_2) emissions that would result in limiting global warming to a given level.

As the research from scientific community revealed a limited window for global CO_2 emission to stay within safer level of temperature increase, policymakers sought ways to incentivize the significant reductions in greenhouse gas emissions. One of the pathways identified to stay within carbon budget is pricing carbon emissions.

The concept of Carbon pricing, and consequently carbon markets, emerged in response to the growing scientific consensus on the dangers of climate change. One of the tools for combating climate change is putting a price on carbon emissions. By putting a price on carbon emissions to account for the negative externalities, it creates an incentive for market forces to move economies away from burning fossil fuels.

Kyoto Protocol and Emissions Trading

The Kyoto Protocol, adopted in 1997, operationalizes the United Nations Framework Convention on Climate Change (UNFCCC) by committing industrialized countries and economies in transition to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets.

The protocol had one important element, the establishment of flexible market mechanisms, which were based on the trade of emissions permits. Under the Protocol, countries were required to meet their targets primarily through national measures. However, the Protocol also offered them additional means to meet their targets through market-based mechanisms including Clean Development Mechanism (CDM). It was the first global, environmental investment and credit scheme of its kind, providing a standardized emissions offset instrument, Certified Emission Reduction (CERs) units.

Paris Agreement Crediting Mechanism

Article 6 of the Paris agreement can be seen as a successor to the Kyoto protocol's Clean Development Mechanism (CDM) with a broader scope of international cooperation, improved governance, and transparency. It sets out how countries can pursue voluntary cooperation to reach their climate targets. It enables international cooperation to tackle climate change and unlock financial support for developing countries. The carbon crediting mechanism under the Paris Agreement allows countries to raise climate ambition and implement national action plans more affordably. It identifies and encourages opportunities for verifiable emission reductions, attracts funding to implement them, and allows cooperation among countries and other groups to conduct and benefit from these activities.

Through this mechanism a company in one country can reduce emissions in that country and have those reductions credited, so that it can sell them to another company in another country. That second company may use them to comply with its own emission reduction obligations or to help it meet net-zero targets.

The Paris Agreement Crediting Mechanism is also seen as a source of climate finance for developing nations, with a share of proceeds going towards adaptation funding to build resilience to the inevitable impacts of climate change.

Each country that is party to the Paris Agreement, a landmark international agreement adopted in 2015, outlines its climate action plan within its Nationally Determined Contributions (NDCs). These plans typically include emission reduction targets, adaptation strategies, and sustainable development plans.

Carbon pricing Instruments

Carbon pricing seeks to align the costs of consuming carbon-intensive fuels or using carbon-intensive processes with the social costs of those activities. It is implemented to reduce GHG emissions by providing a price signal closely linked to actual emissions. It provides economic incentive for the changes needed in investment, production, and consumption patterns, and to induce technological advancements. Policymakers use carbon pricing as a policy tool to decarbonize economies. The carbon pricing instruments are categorized as "compliance/regulatory" instruments or "voluntary carbon crediting" mechanisms. Entities regulated by Cap-and-Trade (CaT) or Carbon Taxes are mandated to financially account for the emissions produced from business activities. Participation in voluntary carbon crediting on the other hand is optional, with participants earning "credits" in recognition of quantified and verified emissions reductions or removals.

Carbon tax is a tax levied on the carbon emissions from producing goods and services. Carbon taxes are intended to make visible the hidden social costs of carbon emissions. They are designed to reduce greenhouse gas emissions by essentially increasing the price of producing goods hence incentivizing to reduce GHG emissions.

In some regulatory carbon markets, governments or regions set a cap on total emissions and distribute tradable permits (allowances) within that limit. These permits represent the right to emit one ton of CO_2 or equivalent GHGs. This mechanism of pricing carbon is referred to as **Cap-and-Trade mechanism**. Several Emission trading schemes (ETSs) and other national and sub-national government trading mechanisms employ this method to incentivize the entities to reduce their emissions. Globally, there are currently 75 carbon pricing instruments in operation, comprising 36 emission trading systems and 39 carbon taxes. Furthermore, an additional 22 emission trading system (ETS) are in various stages of consideration and development. This proliferation is particularly noticeable in parts of the world which are home to key emerging economies, like Mexico and Brazil in Latin America and China, India and Indonesia in the Asia-Pacific region. Entities covered by the scheme must hold enough allowances to cover their emissions or acquire them through trading.

An instrument is considered "under development" when a government has officially confirmed that it is actively working on implementing a crediting mechanism, even if no credits have been issued yet. This can include situations where a mandate has been established, but the process is still ongoing. On the other hand, if a government has publicly stated its intention to explore the implementation of a crediting mechanism, and this intention is formally confirmed by official government sources, the instrument is considered "under consideration".

Carbon Offsets are a specific type of carbon allowances/ credits used for voluntary emissions compensation. These credits are generated through projects that reduce, avoid, or remove emissions. The projects can range from renewable energy installations to afforestation programs. Individuals or organizations can purchase these credits to neutralize/ offset their carbon footprint by supporting emission reduction projects elsewhere. Carbon offsets can help companies achieve carbon neutrality, demonstrate environmental responsibility, and meet sustainability goals. They can also provide financial support for climate projects in developing countries.

Carbon Markets – Tool for combating climate Change

Carbon markets enable governments and non-state actors to trade greenhouse gas emission credits. The aim is to achieve climate targets and implement climate actions cost effectively. A carbon market is a system that allows entities to trade carbon emissions. It provides a platform for buying and selling carbon credits, which represent the right to emit a specific amount of carbon dioxide or other greenhouse gases. These markets function as platforms for trading units representing verified greenhouse gas (GHG) emissions reductions or removals, typically measured in tons of CO_2 equivalent (CO_2e). Carbon credits are traded on specialized exchanges and over-the-counter markets, allowing companies to acquire the credits they need to meet their emissions targets. Emerging Carbon pricing regulations in the carbon market incentivize companies to reduce their environmental footprint and invest in carbon-neutral or low-carbon technologies.

Regulatory and Voluntary Carbon Market

As carbon pricing gained momentum, a clear distinction emerged between two main types of carbon markets:

Regulatory Carbon Markets: Governments establish regulatory carbon markets to control emissions within their jurisdiction. They typically employ cap-and-trade systems, where a limit (cap) is set on total emissions, and companies can buy and sell permits (credits) to stay under the cap. This system allows for flexibility in achieving emissions reduction goals while providing a market-based solution.

Voluntary Carbon Markets: Voluntary carbon markets operate outside government regulations. They allow companies and individuals to offset their carbon footprint by purchasing carbon credits from verified projects. These markets provide a platform for corporations and individuals to take climate action beyond regulatory requirements. These operate outside of government regulations. Companies participating in these markets choose to voluntarily compensate for their emission footprint by purchasing equivalent offset credits.

Understanding Carbon Credit markets

Companies worldwide are facing growing pressure to reduce their emissions and set their Net-Zero targets. This pressure is pushing them to invest in offsetting the emissions and therefore relying on high-quality, independently verified carbon credits.

Carbon credits are units that are generated through implemented mitigation activities that result in reducing the GHG emissions over and above the baseline. Carbon credits can also represent emission removals from the atmosphere, such as sequestering carbon through afforestation or directly capturing carbon from the air and storing it. Each carbon credit represents one ton of carbon dioxide equivalents (CO_2e) reduced or removed.

As the demand for carbon credits soars, so does the demand for rigorous verification and certification.

Supply of carbon credits is delivered by three main categories of crediting mechanisms:

International crediting mechanisms – International crediting mechanisms are those administered or managed by an international organization like the United Nations Framework Convention on Climate Change (UNFCCC). This category includes, for example, mechanisms established under the Kyoto Protocol (including CDM) and Article 6 of the Paris Agreement.

Governmental crediting mechanisms – Governmental crediting mechanisms, under the Regulatory Carbon Market (RCM),are those programs established and administered by an individual national and sub-national governments. They operate within a specific county or region and may cater to domestic emission reduction goals or compliance with local regulations such as the European Union Emission Trading Scheme (EU ETS), China's national ETS, Californian Compliance Offset Program and the Australian Carbon Credit Unit (ACCU) Scheme.

Independent crediting mechanisms – Independent crediting mechanisms, under the Voluntary Carbon Market (VCM), include those that are not directly affiliated with any specific government or international treaty. They are

administered by independent, nongovernmental organizations that develop their own methodologies and standards for verifying emission reductions, such as Verra and Gold Standard.

Carbon credits are retired once the benefit has been claimed for voluntary or compliance purposes. Demand for credits can stem from a range of drivers:

1. **International compliance:** This primarily consists of (i) countries purchasing/utilizing credits or "mitigation outcomes" recognized under international treaties to help meet their GHG mitigation commitments; and (ii) airlines purchasing credits eligible for meeting their obligations under CORSIA.
2. **Domestic compliance:** This includes companies purchasing credits that are eligible for meeting their obligations under domestic law, usually an Emission trading scheme (ETS) or a carbon tax. These may include credits issued under international, governmental, or independent crediting mechanisms, depending on the rules established by respective governments.
3. **Voluntary:** This consists of (mostly private) entities purchasing carbon credits for the purpose of complying with voluntary mitigation commitments. This buyer group primarily sources credits issued under independent crediting standards, though some entities also purchase those issued under international or governmental crediting mechanisms.

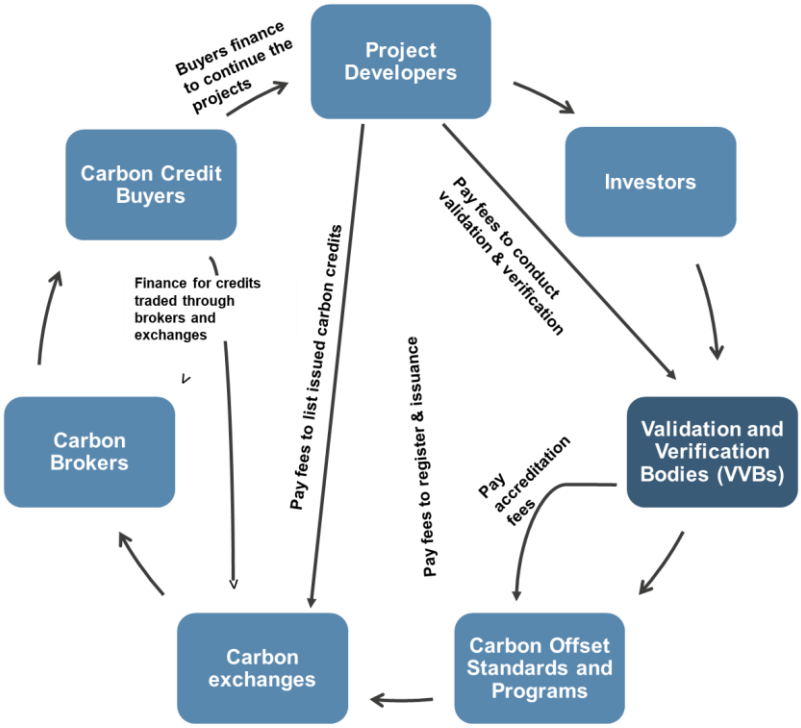
Table 2 Comparing Different Carbon Market

Market Elements	Governmental Crediting Mechanism (RCM)	Independent Crediting Mechanism (VCM)	International Crediting Mechanism
Established by	National and Sub-national governments	Independent organizations	International Treaties (e.g., Kyoto Protocol, Paris Agreement)
Oversight	National and Sub-national governments	Independent non-governmental organization	International Organizations (UNFCCC)
Geographic Scope	National and regional	International	International
Examples	EU ETS, California cap and trade program	Verified Carbon Standards (VCS), Gold Standard (GS)	CDM and Article 6 from Paris agreement
Regulation	Highly regulated, with robust monitoring, reporting, and verification (MRV)	Low to no regulation, different accounting methodologies with varying degrees of rigor	UN-recognized accounting methodologies

Key players of Carbon Credit Ecosystem

The carbon market is a complex ecosystem with a diverse range of actors contributing to the financing, development, verification and trading of carbon credits by the end users. Each player in this value chain plays a crucial role in ensuring the integrity, growth, and effectiveness of the market. Voluntary Carbon Market (VCM) starts the moment a project developer (e.g., company, farm, individual or organization) plans, implements, registers carbon credits, and obtains certification of carbon dioxide avoidance, reduction, or removal. To obtain a verification, a project developer is required to apply and comply with standards, methodologies, processes, and rules, approved by standards, and verify and validate their project through third-party auditors or Validation and Verification Bodies (VVBs). Projects can be developed in different areas such as Community based (improved cookstoves, water purifiers and solar lights), Nature based (Forestry, Agriculture, and Wetlands), Energy, Construction, Waste, Livestock and manure management, Industrial Processing, Transport and Mining etc.

Figure 5 Carbon Credit Ecosystem



Source: CRISIL MI&A

Project Developers:

Project developers identify, design, and implement emissions reduction projects that generate carbon credits. They are responsible for developing the concept, securing necessary permits and approvals, and managing the project's implementation. Project developers ensure that their projects meet the requirements of recognized carbon standards, comply with relevant regulations, and deliver verifiable emissions reductions. They also secure funding for project development and implementation, often through partnerships with investors.

Renewable energy developers, sustainable forestry initiatives, carbon capture and storage (CCS) projects, energy efficiency projects, and waste management facilities are some key examples of Project Developers.

Investors:

Investors provide funding for project development and the issuance of carbon credits. They play a critical role in enabling the implementation of emissions reduction projects. Investors are seeking projects that offer a strong return on investment, along with positive environmental impact. They assess the project's technical feasibility, financial viability, and the quality of the carbon credits generated. Emerging trends in sustainable investing are driving increased interest in carbon credit projects. Investors include Venture capitalists, private equity firms, impact investors, pension funds, and institutional investors.

Validation and Verification Bodies (VVBs):

Independent third-party validation and verification bodies (VVBs) are crucial for ensuring the credibility and integrity of carbon markets. They verify the emissions reductions achieved by projects, in accordance with the carbon offset standards, ensuring that the carbon credits issued represent real and measurable emissions reductions.

VVBs adhere to strict standards and protocols to maintain the credibility of the verification process. They are responsible for conducting rigorous assessments, collecting data, and evaluating project performance against established criteria. Accreditation of VVBs by organizations like ANSI – ANAB, GAB, VCS, CCBA, etc. further enhances the credibility of the verification process.

Carbon Exchanges & Brokers:

Carbon exchanges and brokers facilitate trading and market liquidity. They provide a platform for buying and selling carbon credits, connecting buyers and sellers, and creating a liquid market for emissions reduction efforts. Exchanges and brokers ensure transparency, fair pricing, and efficient trading processes. They play a crucial role in ensuring the smooth functioning of the market and facilitating the allocation of emissions reduction efforts. Specialized exchanges like the Carbon Trade Exchange (CTX) and the AirCarbon Exchange (ACX), as well as independent brokers, are some key players.

Credit Buyers:

Companies, individuals, and organizations purchase carbon credits to offset their emissions. These buyers can range from large multinational corporations to small businesses in various industries, including energy, transportation, manufacturing, and finance, and also individuals who seek to reduce their carbon footprint.

Regulatory Carbon Market (RCM)

Policymakers around the world consider regulatory an essential tool combating climate change. The regulatory market, also known as compliance carbon markets, aims to establish a carbon price by laws or regulations which control the supply of allowances that are then distributed by national, regional, and global regimes. This can be accomplished through either a carbon tax or a cap-and-trade scheme, shifting economic incentives by making it more expensive to pollute. Carbon pricing shifts investment towards greener alternatives and encourages technological innovation; and revenues from auctioning can be used to fund research, development, and deployment of emerging technologies, to help decarbonize sectors across the economy. There are several instruments functional in the form of either Carbon Tax or Emission Trading Systems (ETSs) or other governmental crediting mechanisms that price carbon.

Regulatory carbon markets rely heavily on government leadership and action to function effectively. Governments determine which sectors or activities fall under the market's purview. The cornerstone of a regulatory market is the overall cap on total emissions. This cap establishes a clear target for collective emission reduction within the covered sectors. The stringency of the cap directly influences the market price of carbon and the level of emission reduction achieved.

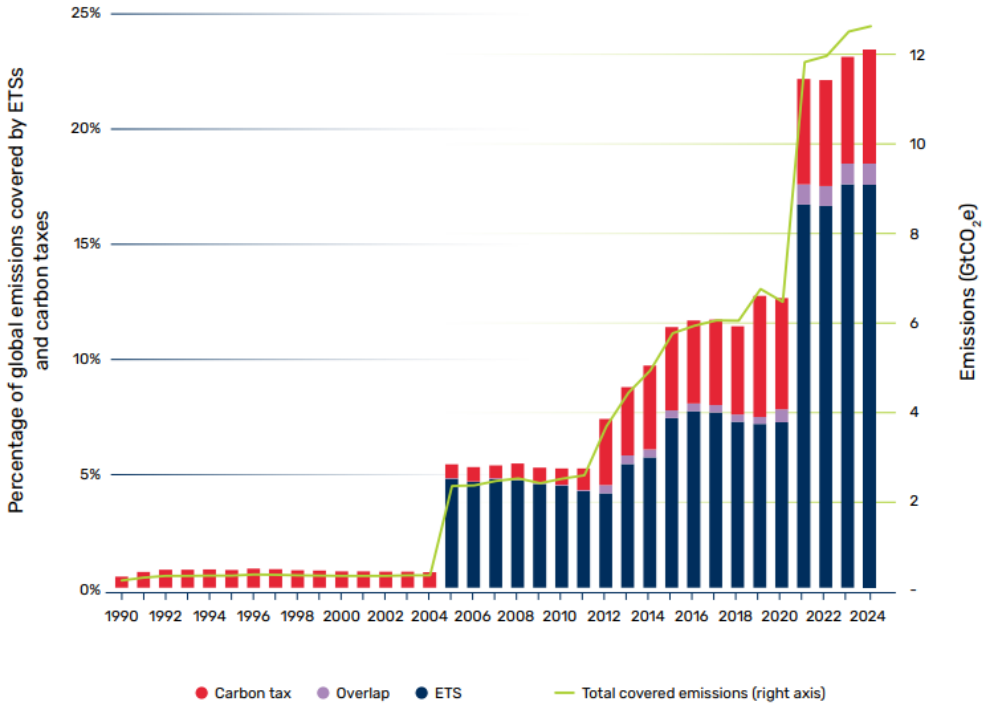
Governments also decide how emissions permits (allowances) are initially distributed to companies. Some allocation methods include Free allocation, Auctioning, and Output-based allocations (emission allowances according to their historical emissions in a base year or base period or according to performance indicators).

Total revenues from carbon taxes and ETSs

The number of emissions trading systems around the world is increasing. Besides the EU emissions trading system (EU ETS), national or sub-national systems are already operating or under development in Canada, China, Japan, New Zealand, South Korea, Switzerland, and the United States. Carbon markets have grown rapidly in recent years.

As of April 1, 2024, ETSs and carbon taxes in operation covered almost 13 gigatons of carbon dioxide equivalent, around 24% of global GHG emissions. Total revenues from carbon taxes and ETSs in 2023 was USD 104 billion.

Figure 6 Global GHG emissions covered under RCM (ETSs and carbon taxes)



Source: World Bank

Inference: As of April 2024, ETSs and carbon taxes in operation covered almost 13 gigatons of carbon dioxide equivalent, around 24% of global GHG emissions.

Governments are increasingly using multiple carbon pricing instruments in parallel to increase coverage and ambition and to deliver greater flexibility. Carbon Credit markets have seen mixed movements. Governments, particularly in middle-income countries, are increasingly including crediting frameworks in their policy mix, with a view to supporting both compliance and voluntary markets. Compliance demand is building but voluntary demand continues to dominate.

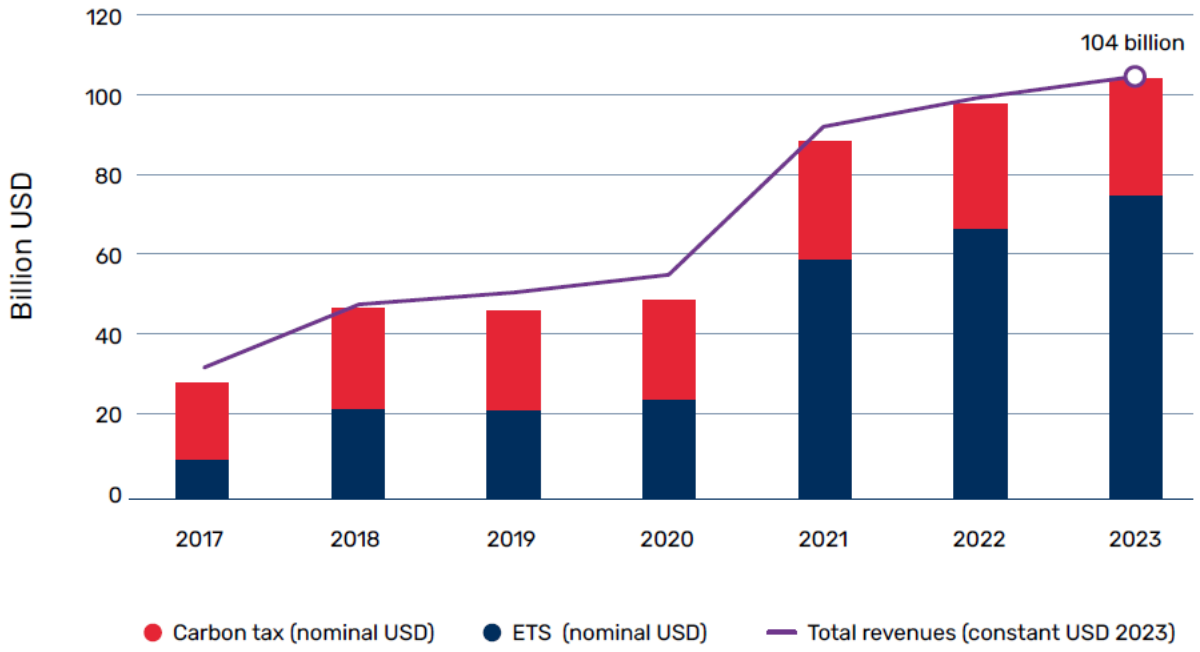
Between 2022 and 2023, several new carbon pricing mechanisms have been introduced worldwide. The number of carbon taxes and ETSs now stands at 75 globally. Middle-income countries and subnational governments are increasingly considering and implementing carbon taxes and ETSs. Besides making regular efforts to combat the climate change, governments are exploring opportunities to cover nontraditional sectors like maritime transport and waste, implementing multiple carbon pricing instruments in parallel to increase the coverage of global GHGs regulated under the pricing instrument.

The design and development of new ETS is giving rise to a generation of hybrid and innovative systems, sometimes deviating from the traditional cap-and-trade blueprint. This shift showcases the adaptability of emissions trading to diverse challenges and opportunities specific to geographical, economic, and political contexts. This new wave of ETSs also incorporates fresh design elements, blending various carbon pricing instruments as seen in Indonesia's "cap-tax-and-trade system" or mixing compliance and voluntary features, as seen in Japan and India, where voluntary systems are implemented as a first step towards the development of compliance ETSs over time.

Revenue Trend from Carbon Pricing

Relatively high price levels in several systems, coupled with an increasing use of auctioning as an allocation method, resulted in yet another record year for the collection of auctioning revenues. Revenues from carbon pricing continued to increase in 2023, exceeding the threshold of USD 100 billion for the first time. Total revenues from carbon taxes and ETSs in 2023 was USD 104 billion, representing an increase of around 4% in real terms.

Figure 7 Evolution of global revenues from RCM over time



Source: World Bank

This trend is expected to continue and expand in coming years, as ETS revenues are set to play a key role in compensating for the distributional impacts of the carbon price and in maintaining public support for ETSs.

Voluntary Carbon Market (VCM)

The voluntary carbon market (VCM) allows companies, individuals, or institutions to purchase carbon offsets optionally at their own will, without government-mandated regulations. Entities may choose to invest in a variety of projects and programs aimed at reducing or removing GHG or obtain offset credits to voluntarily offset emissions and demonstrate commitment to the environment, to help mitigate climate change, or to reach climate goals. Each offset credit traded in the voluntary market represents one ton of carbon dioxide equivalents (CO_2e) and is generated by projects, public policies, or programs that are monitored and validated at each stage before being verified by carbon standards in a jurisdiction for certification.

As both markets continue to evolve, stronger Voluntary Carbon Markets today can set the stage for robust compliance markets tomorrow. Trustworthy Voluntary Carbon Markets provides companies with the opportunity to use them to meet their voluntary climate commitments. These markets serve as a bridge to further decarbonization as companies make the transitions to low-carbon energy sources, greening supply chains and transportation fleets and investing in energy efficiency. Voluntary Carbon Markets also provide a platform space for innovation and testing of approaches that can guide design and implementation of future programs in compliance markets.

The voluntary carbon markets function alongside compliance schemes and enable companies, governments, non-profit organizations, universities, municipalities, and individuals to purchase carbon credits (offsets) on a voluntary basis. Currently, the majority of VCCs are purchased by the private sector, where corporate social responsibility goals and sustainability goals are typically the key drivers.

Carbon Registries and Standards, enabling voluntary credit trade

Carbon offset registries and standards play a pivotal role in the fight against global warming by providing a structured framework for tracking, verifying, and trading carbon credits. Carbon market accountability, credibility, and transparency are all ensured through carbon offset registries and standards. They enable trade, standardize measurements, confirm emissions reductions, and stop double counting.

Carbon offset registries and standards are platforms or databases that keep track of and verify the carbon credits produced by projects that reduce emissions. They maintain the validity and transparency of these credits, avoiding double counting, and facilitating effective trading in the carbon market. A trustworthy mechanism for tracking and confirming emissions reductions is provided through registries, which are essential in tracking the lifecycle of carbon credits from their creation to retirement.

These registries monitor credit ownership, assigning each credit a unique serial number. This information is made publicly accessible through a ledger. When a credit is purchased by an entity to offset their emissions, the registry takes swift action by retiring that credit on the ledger, ensuring it cannot be acquired by another party.

Major Registries in the Voluntary Carbon Offset Market

Verified Carbon Standard (VCS) by Verra

The Verified Carbon Standard (VCS) Program run by the non-profit Verra registry. VCS projects implement a wide variety of activities that reduce or remove greenhouse gas emissions, improve livelihoods, and protect nature. Projects are categorized by their sectoral scope, ranging from waste handling and disposal projects (such as biochar projects) to land use projects (such as improved forest management projects). All projects developed in the Program undergo a mandatory, rigorous assessment process. Certified projects issue Verified Carbon Units (VCUs), where one VCU is equal to one metric ton of carbon dioxide reduced or removed from the atmosphere. Up until the end of 2023, Verra maintains a portfolio with over 1,800 certified projects (VCUs issued: 1,243,043,468, VCUs retired: 712,597,287), contributing to a cumulative reduction or removal of over 920 million tons of greenhouse gas (GHG) emissions. This standard emphasizes projects which not only contribute to GHG reduction but also demonstrate commitments regarding social and environmental sustainability.

Gold Standard (GS)

The Gold Standard (GS) is a voluntary carbon offset program focused on progressing the United Nation's Sustainable Development Goals (SDGs) and ensuring that projects benefit their neighboring communities. The GS can be applied to voluntary offset projects and to Clean Development Mechanism (CDM) projects. It was developed under the leadership of the World Wildlife Fund (WWF), HELIO International, and SouthSouthNorth, with a focus on offset projects that provide lasting social, economic, and environmental benefits. Not only does this standard indicate carbon emission reductions; but it also emphasizes UN Sustainable Development Goals (SDGs). So far, a total of 335,017,098 credits have been issued and 173,606,461 credits have been retired under this standard.

Carbon Action Reserve (CAR)

The Climate Action Reserve was launched in 2008. It is a USA based voluntary offsets program whose projects are implemented within North America. The Climate Action Reserve (CAR) establishes standards for quantifying and verifying GHG emissions reduction projects, provides oversight to independent third-party verification bodies, and issues and tracks carbon credits, called Climate Reserve Tonnes (CRTs).

American Carbon Registry (ACR)

The American Carbon Registry (ACR), a nonprofit enterprise of Winrock International, was founded in 1996 as the first private voluntary greenhouse gas registry in the world. The American Carbon Registry Standard outlines the eligibility requirements for registration of project-based carbon offsets and includes requirements for methodology approval, project validation and verification, and other procedural requirements and information on the general use of the American Carbon Registry.

Global Carbon Council (GCC)

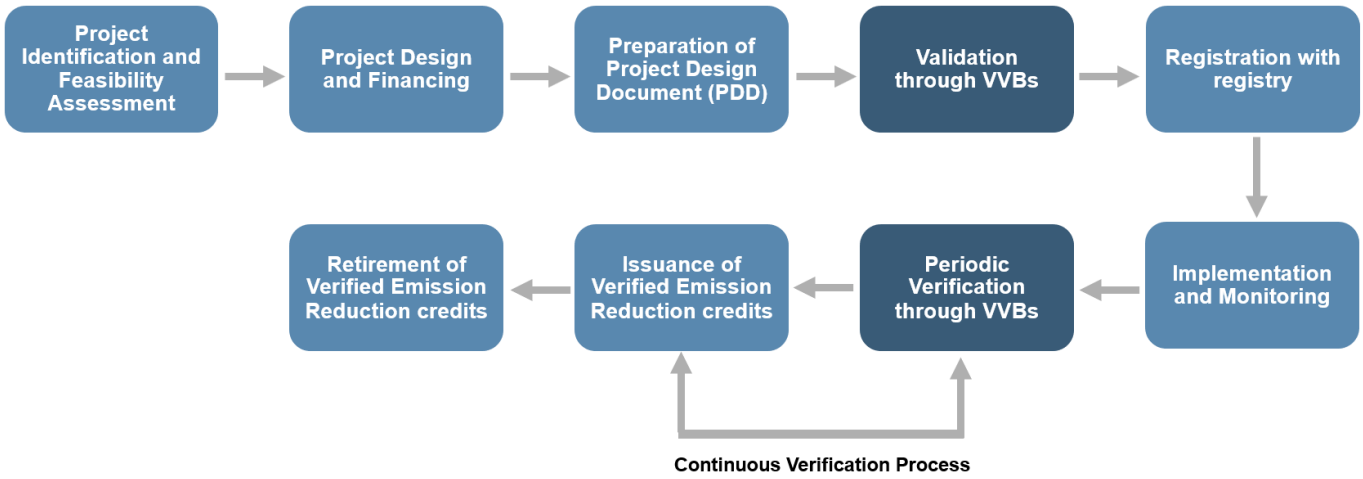
The Global Carbon Council (GCC) is the first international carbon credit and sustainable development program, based in the Global South. It was established (as Global Carbon Trust) by the Gulf Organization for Research and Development (GORD) in 2016. The GCC Program claims to contribute to a more sustainable and low-carbon future, by registering high-quality projects from around the world that have demonstrated their additionality in the reduction

or removal of greenhouse gases (GHG) emissions, while ensuring that project construction and operations do not cause any net-harm to the environment and society.

Project Identification, Verification, and Certification

The lifecycle of a carbon offset is a crucial process with each step playing a vital role in ensuring the integrity and credibility of the offset program. It ensures that the project has the potential to generate real, measurable, and additional emission reductions. Carbon offset programs create a robust system with checks and balances. This discourages greenwashing and fosters trust in the market. This also enhances buyers' confidence that the offset they purchase represents legitimate and verifiable emission reductions, contributing to real climate action.

Figure 8 Carbon Offset Lifecycle



Source: CRISIL MI&A

Project Identification and Feasibility Assessment

Project developers identify projects that reduce, avoid, or remove emissions. These developers conduct in-depth research, collect data, and analyze the project's potential to meet carbon standards. This involves assessing the project's potential for emissions reductions, its environmental impact, and its feasibility in terms of technical, financial, and regulatory requirements. These projects can range from renewable energy projects to sustainable forestry initiatives. The projects must adhere to specific methodologies and standards to ensure the environmental integrity and credibility of the generated carbon credits.

Project design, financing, and preparation of PDD

Project developers prepare a PDD that comprehensively describes the project, its activities, emissions reduction methodology, monitoring and verification procedures, and anticipated outcomes. This document serves as the foundation for validating the project's carbon credit generation potential. They also develop a financial plan to secure funding from investors or other sources.

Validation through VVBs:

Independent third-party bodies or validation and verification bodies (VVBs) verify the project's emission reductions or removals according to established standards. They review the PDD and assess the project's design, methodology, and monitoring plan. They confirm the project's potential for generating verified emissions reductions. This validation process ensures the accuracy and legitimacy of the carbon credits.

Project Registration with Carbon Registries:

Project developers submit the validated PDD to a carbon registry, such as Verra, Gold Standard, or the American Carbon Registry (ACR). The registry reviews the project's documentation and, if approved, assigns a unique project identifier. These standards set rigorous criteria for project eligibility and verification for ensuring the project's adherence to quality standards and facilitating the issuance of carbon credits.

Implementation and Monitoring:

Project developers implement the project according to the validated design document, collect data on project activities and emissions reductions, and maintain records to ensure compliance with the carbon standard's monitoring requirements.

Periodic Verification through VVBs:

Independent auditors or VVBs conduct on-site audits to verify the project's activities, monitor data, and evaluate its performance against the defined methodology. This process ensures the ongoing integrity of the project and the legitimacy of the generated carbon credits.

Issuance and Trading of Carbon Credits:

Once verified, the project generates carbon credits, representing the quantified emissions impact of the project activities. The number of credits issued corresponds to the verified amount of CO2 reduced or removed. Certified carbon credits are issued and traded on carbon markets. These markets provide liquidity and facilitate the transfer of credits between buyers and sellers.

Retirement or Trading:

Credits can be retired by the project developer, essentially removing them from circulation and permanently offsetting emissions. Alternatively, credits can be sold on a carbon market platform. Registries like Verra, Gold Standards, American Carbon Registry, and Carbon Action Reserve facilitate the trading of credits by enhancing confidence and trust of buyers through their established standards and methodologies and by maintaining registry to track all the projects operating under respective standards, including number of credits issued, who bought and retired them, and other relevant information. This transparency helps buyers and sellers to understand the market and makes it easier to trade credits.

India's Engagement with pricing carbon and environmental markets

India is planning to leverage the growing opportunity in national and global carbon markets to support its climate goals. While India does not have an explicit carbon market, it has instruments that closely resemble carbon markets, in the form of Perform, Achieve, and Trade (PAT) and Renewable Energy Certificates (REC). These are two major market-based approaches in play in India to regulate energy consumption and transition to cleaner energy, facilitated by the Ministry of Power. India also has vast experience in the international carbon trading platform, the Clean Development Mechanism (CDM), which has been implemented by the Ministry of Environment, Forest, and Climate Change (MoEFCC). Going forward, India is building on these experiences to develop its domestic carbon market.

Obligation to Purchase Renewable Energy

India has set a target to reduce the carbon intensity of the nation's economy by less than 45% by the end of the decade and to achieve 50 percent cumulative electric power installed by 2030 from renewables and achieve net-zero carbon emissions by 2070. India also aims for 500 GW of renewable energy installed capacity by 2030.

Policy support and regulatory measures to incentivize both demand and supply have been a key driver of the rapid growth in the renewable energy sector. One such regulatory measure is in the form of renewable purchase obligation. Renewable Purchase Obligations (RPO) require obligated entities to purchase a minimum percentage of electricity from renewable energy (RE) sources. Obligations under RPO are mandated by the Electricity Act (2003).

Due to the variable nature of renewables, it becomes difficult for some entities to meet these requirements set by RPO. It is here that the concept of renewable energy certificates (RECs) assumes significance.

RECs are 'green tradeable certificates' that represent the environmental attributes of power generated from RE but not the actual power itself. RECs allow the obligated entities to meet their RPO without actual procurement of RE-generated power. They can be purchased on the national energy exchanges such as Indian Energy Exchange (IEX) and Power Exchange of India Limited (PXIL) by the obligated entities like discoms to meet their RPO targets. Purchase of RECs for voluntary reasons also takes place, but volumes are negligible.

Perform, Achieve and Trade

Perform Achieve and Trade (PAT) scheme is a flagship program of Bureau of Energy Efficiency (BEE) under the National Mission for Enhanced Energy Efficiency (NMEEE). NMEEE is one of the eight national missions under the National Action Plan on Climate Change (NAPCC) launched by the Government of India in the year 2008.

The PAT Scheme is a regulatory instrument to reduce the specific energy consumption in energy intensive industries. PAT is a completely market-based mechanism, focused primarily on enhancing the energy efficiency of large energy intensive sectors through accelerated adoption of efficient and low-carbon technologies. Sectors included in PAT are Aluminum, Cement, Fertilizer, Pulp & Paper, Thermal power plant, Chlor-Alkali, Iron & Steel, Textile, Railways, Petroleum Refinery, Petrochemicals, Distribution Companies (DISCOMs), Hotels (under commercial buildings).

As per PAT rules, elected designated consumers (DCs) are given mandatory energy intensity targets over a specified period based on their relative energy intensity performance in their sector. When a DC overachieves the notified Specific Energy Consumption (SEC) targets in compliance year, the ESCerts are to be issued by Central Government for the difference of quantity between notified target and achieved SEC. The DCs with SEC higher in compliance year than the notified target is directed to purchase ESCerts equivalent to quantum of shortfall.

PAT in its first cycle was designed to reduce the SEC from 8 energy intensive sectors viz. Aluminum, Cement, Chlor-Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Thermal Power Plant and Textile. Inclusion of new sectors was carried out by BEE before the commencement of the second cycle of PAT. Three new sectors namely Refineries, Railways and DISCOMs were notified for its second cycle. Further, two new sectors, namely Petrochemicals and Commercial Buildings (Hotels) were also notified.

The PAT scheme was largely successful and met most of its targets in the completed cycles. However, the scheme faced challenges due to an oversupply of ESCerts in the market. This oversupply was possibly driven by lenient goals set in its earlier cycles, the absence of market makers or financial traders which provide liquidity and manage oversupply and deficit market situations, and no provision of carry-over of unused ESCerts to subsequent PAT cycles.

As India plans to develop its national carbon market, the PAT scheme will provide a foundational structure with a system for target setting, assessments, trading platform, etc. This ecosystem will act as a launching pad for a carbon market.

Indian Carbon Market (ICM)

India has demonstrated leadership in climate action by implementing its ambitious Nationally Determined Contributions (NDCs) to fulfil the global climate targets. The government of India has started the creation of the "Indian Carbon Market," a unified carbon market mechanism that will mobilise new opportunities for mitigation through the demand for emission reduction credits by both public and private entities. This move is intended to help the country achieve its enhanced NDC targets.

Establishing a single carbon market mechanism and incorporating the current PAT and REC markets into it is essential to developing an efficient and effective domestic carbon market mechanism in India and reaching a feasible scale of operations. The measurement of India's market mechanisms, PAT and REC, is expressed in tonnes of oil equivalent (TOE) or MWh, respectively, rather than carbon dioxide equivalent (CDE) through the metric unit of their certificates. This presents a significant difficulty. This has led to an excess of PAT and REC certifications, in addition to the problems of low targets and lax enforcement (in the case of the REC). BEE has suggested a single domestic carbon market mechanism as a solution to these problems. BEE suggests that the envisaged Carbon Credit Trading Scheme (CCTS) will build on the existing mechanisms present in the market, PAT, and REC.

In order to help India meet its NDCs, ICM aims to expedite decarbonization and mobilize resources, including money and technology. Having a single national market will simplify the accounting and verification processes, save transaction costs, increase liquidity, foster mutual understanding and focused capacity development, and strengthen a common understanding. The necessary nature of promoting market solutions to aid the gradual decarbonization of the economy stems from the difficulty of fulfilling future NDC goals. The private sector will be able to actively participate in decarbonization activities across all conceivable sectors thanks to the planned carbon market mechanism. Establishing a uniform ICM can aid in the production of qualified carbon credits, boost credit trading liquidity, and hence provide the groundwork for an effective price discovery and incentive system.

ICM is established under the purview of the Energy Conservation Act, 2001, and the Environment (Protection) Act, 1986. The Energy Conservation Act, 2001 empowers the Government of India to specify the Carbon Credit Trading Scheme (CCTS), where any entity, including the designated consumers, registered for carbon credit trading scheme

will be the registered entity (RE). The act empowers the Central Government to issue the Carbon Credit Certificates (CCC) to the REs under different mechanisms. While the Environment (Protection) Act, 1986 empowers the Government of India to specify standards for emission or discharge of pollutant for the obligated sectors.

The Carbon Credit Trading Scheme includes a Compliance Mechanism, wherein registered organizations that receive notifications under the mechanism are referred to as "Obligated Entities." The MoEFCC will inform the obliged entities of the GHG Emission Intensity Targets for each cycle of the prescribed trajectory in tonnes of carbon dioxide equivalent (tCO_2e) per unit of equivalent product. The designated GHG emission intensity targets must be met by the Obligated Entity within any trajectory period for each annual year (compliance cycle). In any compliance cycle, the obliged entity that surpasses the targeted GHG emission intensity is eligible to receive the CCCs based on the discrepancy between the targeted and achieved GHG emission intensities for the production amount in the relevant compliance cycle. The obligated entity who fails to achieve the targeted GHG emission intensity in any compliance cycle are entitled to purchase the CCCs based on the difference in the achieved GHG emission intensity and targeted GHG emission intensity for the production in the relevant compliance cycle.

State and Trends of Carbon Markets and ESG Advisory services

Climate change poses a significant global threat, driven by the gradual warming of the Earth due to increased greenhouse gas (GHG) concentrations, primarily from human activities. The United Nations Framework Convention on Climate Change (UNFCCC), established in 1992, aimed to stabilize atmospheric GHG concentrations to prevent dangerous anthropogenic interference with the climate system. Intergovernmental Panel on Climate Change (IPCC), in its Sixth Assessment Report (AR6) released in 2021 underscored the urgent need for action, emphasizing that human influence has unequivocally warmed the planet and urging immediate reductions in GHG emissions to limit global warming to 1.5 degrees Celsius. Given the longevity of CO_2 in the atmosphere, mitigation efforts require detailed planning to reduce while also exploring the best ways to achieve a net reduction of GHGs from the atmosphere. Carbon Markets is one such approach advocated as a means to reduce GHG emissions.

Article 6 of the Paris Agreement

During COP 26 in Glasgow (2021), discussions surged around the rules and guidance for Article 6 of the Paris Agreement. This article facilitates international cooperation and lays the groundwork for market mechanisms. It emphasizes the role of voluntary cooperation between countries and paves the way for non-state actors, particularly the private sector, to partake in emission reduction endeavours. The Article provides flexibility to governments to engage in voluntary cooperation in the implementation of Nationally Determined Contributions (NDCs) “to allow for higher ambition in their mitigation and adaptation actions” (Article 6.1 Paris Agreement). The article provisions the integrated and holistic approaches to assist governments in implementing their Nationally Determined Contributions (NDC) to the global response to climate change through voluntary international cooperation. This establishes a policy foundation for an emissions trading system to enable transactions of Internationally Transferred Mitigation Outcomes (ITMO) or carbon credits. The rulebook for the new market mechanism under Paris Agreement is under development. Under this mechanism (also known as article 6.4 mechanism), parties with low emissions would be allowed to sell their exceeding allowance to other parties, a mechanism alike the preceding CDM.

Article 6.2 of the Paris Agreement provides modalities and guidance to ensure that activities that transfer GHG emission reductions and removals (‘mitigation outcomes’) do not result in the double counting of GHG emission reductions and removals under more than one NDC. A host country can authorize the use of GHG emission reductions and removals generated by a VCM activity towards the NDC of another country, other international mitigation, or other purposes. In such case, the country where the mitigation action took place (the “host country”) needs to ensure that the authorized GHG emission reductions and removals are not counted towards its own NDC. This is important to ensure that the activity is in compliance with the Paris Agreement Article 6.2 implementation guidance.

Article 6.4 of the Paris Agreement defines a mechanism that can be understood as a modified and ‘improved’ version of the Clean Development Mechanism (CDM). The rules and modalities that govern Article 6.4 mechanism are still being developed. Once they are operational, the Article 6.4 supervisory body will register projects, and countries will be able to approve and authorize activities under Article 6.4.

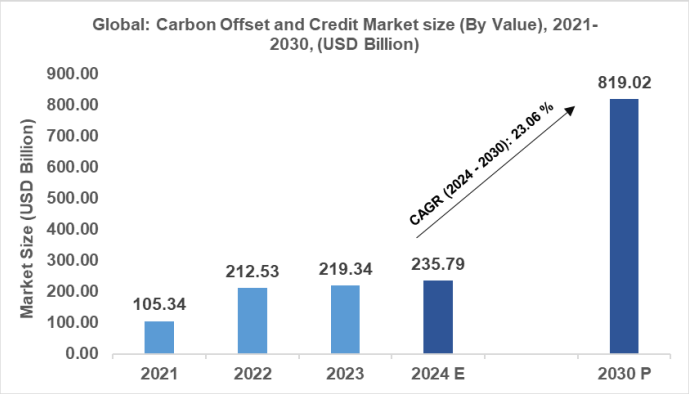
While clarity on Article 6's interaction with voluntary markets will be crucial for its ability to unlock its full potential, ongoing negotiations regarding its implementation details remain unresolved, creating uncertainty for market participants. Paris Agreement's Article 6 holds significant potential for the future of voluntary carbon markets. By

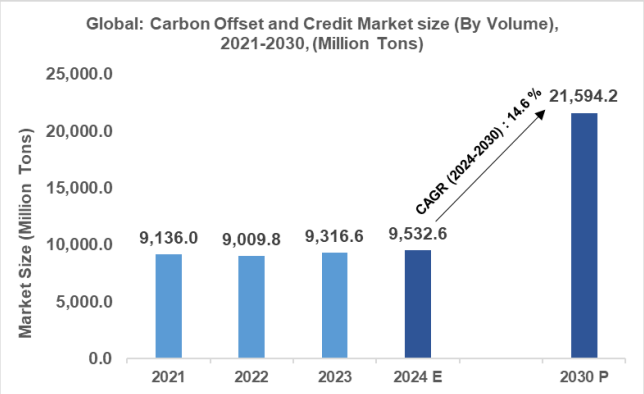
establishing a framework for international cooperation on emissions reductions, Article 6 could pave the way for the consolidation of the global voluntary market through the creation of universally recognized credit standards.

State and trends of Carbon Offset and Credit Market

While positive progress on carbon pricing continues on many levels, more is required to meet the goals of the Paris Agreement. The adoption of carbon pricing has been limited over the last year, but there are promising signs of future uptake in middle-income countries. Flexible policy designs and approaches continue to emerge, reflecting the adaptability of carbon pricing to national circumstances. Governments, particularly in middle-income countries, are increasingly including crediting frameworks in their policy mix, with a view to supporting both compliance and voluntary markets.

The global carbon offsets and credit market is projected to grow from USD 219 billion in 2023 to more than USD 800 billion by 2030 and it is estimated to grow at a CAGR of 23.06% from 2024 to 2030.





Source: Markets and Markets, CRISIL Research
Note: Data labels indicate Carbon offset and credit market size in term of Value (USD Billion) and in terms of Volume (Million Tons)
E : Estimated; P: Projected

Figure 9 Global Carbon Offset and Credit Market Size

Based on type, the carbon offsets and credit market has been categorized into the regulatory/compliance market and the voluntary market. The global compliance market accounted for the majority of the market share (99.3%) in 2023 and it is expected to record a CAGR of 23.06% from 2024 to 2030. Although the size of Voluntary Carbon Markets (VCMs) is still much smaller than Regulatory/Compliance Carbon Markets (CCMs), VCMs have experienced a remarkable expansion in recent years. Global voluntary market is expected to witness a CAGR of 25.01% from 2024 to 2030. These growth trends are attributed to the rising demand for decarbonization to manage the environmental and financial risks of climate change.

Table 3 Global Carbon Offset and Credit Market Size (Voluntary and Compliance)

Global: Carbon Offset and Credit Market size, By Type, 2021-2030, (USD Billion)						
By Type	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
Voluntary	1.07	1.64	0.59	0.71	2.71	25.01%
Compliance	104.28	210.89	218.74	235.07	816.31	23.06%

Global: Carbon Offset and Credit Market size, By Type, 2021-2030, (Million Tons)					
By Type	**2021**	**2022**	**2023**	**2024 E**	**2030 P**
Voluntary	253.5	205.9	89.9	96.0	203.4
Compliance	8,882.6	8,803.8	9,226.7	9,436.6	21,390.8

Source: Markets and Markets, CRISIL Research
Note: Data labels indicates Carbon offset and credit market size (USD billion)
E : Estimated; P: Projected

Trend (2021-2023) and outlook (2024-2030) of Regulatory & Voluntary Carbon Market by Key Regions

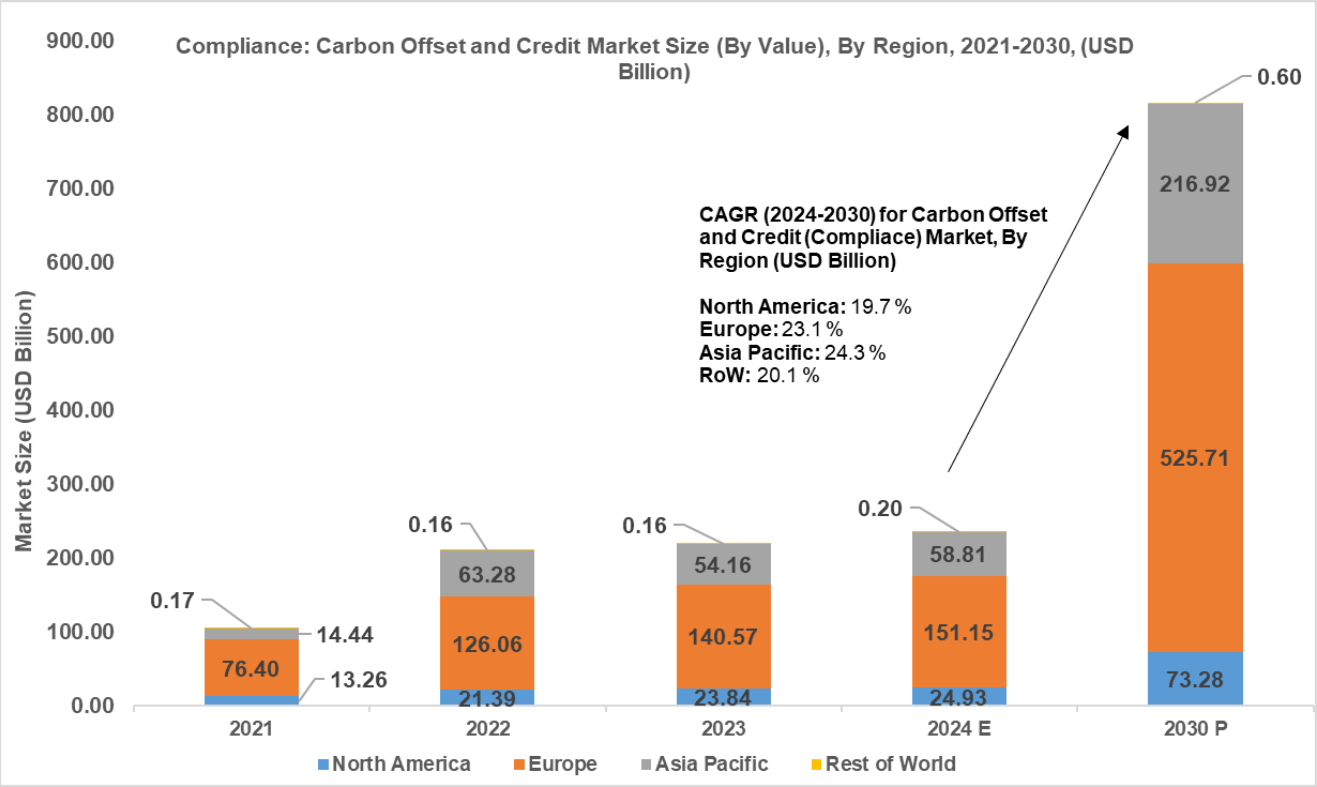
This study covers the market forecast for key regions like Asia Pacific, Europe, North America, and RoW (Rest of the World). Rest of the World include South America and Middle East & Africa region.

Europe accounted for the largest share (64.26%) of the global compliance carbon offset and credit market in 2023. The region is also expected to grow further in the global market during the forecast period. The market dominance and the growth are attributed to the largest EU emission trading system (ETS) that operates in the region. Europe's market development is anticipated to be fuelled by the government's implementation of strict rules and measures to tackle climate change. The introduction and the current transitional period for the Carbon Border Adjustment Mechanism (CBAM) introduces several new compliance and reporting requirements for importers into the European Union (EU).

Table 4 Carbon Offset and Credit (Compliance) Market Size

Compliance: Carbon Offset and Credit Market Size, By Region, 2021-2030, (USD Billion)						
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
North America	13.26	21.39	23.84	24.93	73.28	19.7%
Europe	76.40	126.06	140.57	151.15	525.71	23.1%
Asia Pacific	14.44	63.28	54.16	58.81	216.92	24.3%
Rest of World	0.17	0.16	0.16	0.20	0.60	20.1%

Compliance: Carbon offset Market Size, By Region, 2021-2030, (Million Tons)					
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**
North America	783.4	819.5	879.6	903.2	2,036.1
Europe	1,673.9	1,636.6	1,671.4	1,677.5	3,508.8
Asia Pacific	6,280.6	6,199.6	6,527.1	6,685.9	15,494.5
Rest of World	144.7	148.1	148.6	169.9	351.4



Source: Markets and Markets, CRISIL Research
Note: Rest of the World include South America and Middle East & Africa region; Data labels indicates market size (USD billion)
E: Estimated; P: Projected

Figure 10 Carbon Offset and Credit (Compliance) Market, by region

Asia Pacific (APAC) accounts for the second largest share in the market. The market growth is attributed to the APAC countries' pledge to curb their carbon emissions. Achieving these commitments will require substantial investments over the next decade. According to the report 'Unlocking Climate Finance in Asia-Pacific' released in January 2024 by International Monetary Fund (IMF), emerging and developing Asia will need at least $1.1 trillion annually for climate mitigation and adaptation investments and currently actual investment falls short by $800 billion.

Various types of carbon markets and policy measures are currently in force across APAC. Furthermore, there are several propositions under development. The world's largest regulatory carbon market by volume in Mainland China is expected to expand its scope[1]. New regulatory carbon markets are either launched to trade or are due to launch in India, Indonesia, Japan, and Malaysia.

Government-regulated compliance carbon markets are created and overseen by mandatory national, regional, or jurisdictional carbon reduction regimes. It is not optional, every facility or company covered is obliged to take part in the market. Usually operating in the form of a cap-and-trade (CaT) system, installations or bodies must hold or purchase enough credits to cover their emissions. The compliance carbon market imposes a gradually declining cap, which serves to gradually reduce a company's total emissions over time. The compliance market has been sub segmented into EU ETS, China ETS, Korea ETS, California Cap and Trade, and others. The European Union's Emissions Trading System (EU ETS) is the oldest and largest mandatory carbon market, and as such, has become a point of reference for global climate policy.

Table 5 Carbon Credit (Compliance) Market Size

Compliance: Carbon Credit Market size, By Type, 2021-2030, (USD Billion)					
Market Mechanism	**2021**	**2022**	**2023**	**2024 E**	**2030 P**
EU ETS	67.36	114.51	127.75	135.03	424.48
Korea ETS	10.01	11.60	7.00	7.52	26.12
China ETS	0.00	43.65	38.94	42.90	173.06
Others	26.90	41.12	45.06	49.62	192.65

Source: Markets and Markets, CRISIL Research
E: Estimated; P: Projected

While the primary focus rests on countries' commitments, the voluntary carbon markets has also gained prominence. However, the volume and value of the voluntary carbon market (VCM) contracted for the second year in a row from its 2021 peak, with year-on-year decline in the volume of transactions. This decline was mainly driven by negative press questioning the additionality and governance of carbon credit projects resulting in reduced issuances from the VCS and the American Carbon Registry. This trend also reflects a range of factors, including project developers delaying credit issuance applications due to high associated costs, pending the improvement of market demand and prices, as well as a potential shift in investment and demand away from traditional projects.

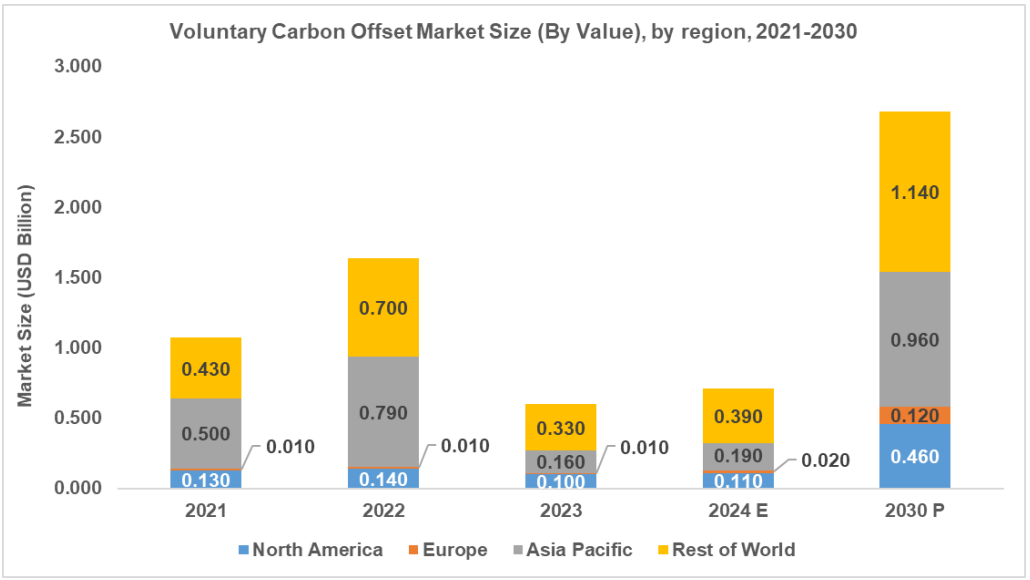
[1] asifma-white-paper-upscaling-carbon-markets-across-apac-october-2023.pdf

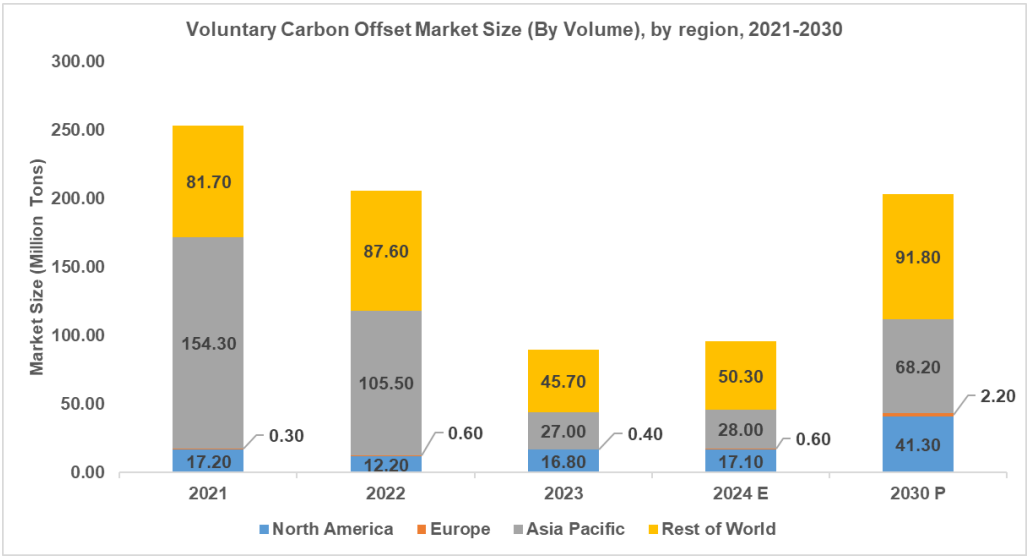
Table 6 Carbon Offset (Voluntary) Market Size

Voluntary: Carbon offset Market Size, By Region, 2021-2030, (USD Billion)						
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
North America	0.130	0.140	0.100	0.110	0.460	26.93%
Europe	0.010	0.010	0.010	0.020	0.120	34.80%
Asia Pacific	0.500	0.790	0.160	0.190	0.960	30.98%
Rest of World	0.430	0.700	0.330	0.390	1.140	19.59%

Voluntary: Carbon Offset and Credit Market Size, By Region, 2021-2030, (Million Tons)					
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**
North America	17.20	12.20	16.80	17.10	41.30
Europe	0.30	0.60	0.40	0.60	2.20
Asia Pacific	154.30	105.50	27.00	28.00	68.20
Rest of World	81.70	87.60	45.70	50.30	91.80

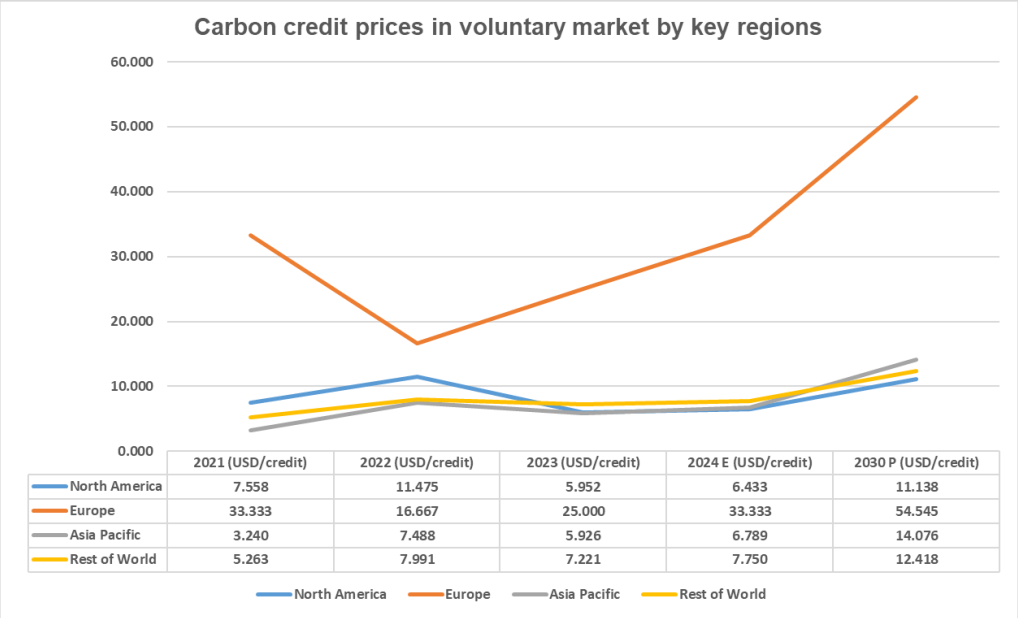
Source: Markets and Markets, CRISIL Research
Note: Rest of the World include South America and Middle East & Africa region.
E: Estimated; P: Projected





Source: Markets and Markets, CRISIL Research
Note: Rest of the World include South America and Middle East & Africa region.
E: Estimated; P: Projected

Figure 11 Carbon Offset and Credit (Voluntary) Market, by region



	2021 (USD/credit)	2022 (USD/credit)	2023 (USD/credit)	2024 E (USD/credit)	2030 P (USD/credit)
North America	7.558	11.475	5.952	6.433	11.138
Europe	33.333	16.667	25.000	33.333	54.545
Asia Pacific	3.240	7.488	5.926	6.789	14.076
Rest of World	5.263	7.991	7.221	7.750	12.418

Source: Markets and Markets, CRISIL Research
Note: Rest of the World include South America and Middle East & Africa region.
E: Estimated; P: Projected

Figure 12 Carbon Offset and credit prices in voluntary market (key regions)

The transaction volumes declined for credits from all regions in 2023, except North America. The decline in transaction volumes is attributed to pullback from REDD+ projects due to rising concerns towards, additionality and governance of carbon credit projects.

The carbon credit market has exhibited significant regional price fluctuations, driven by varying supply-demand dynamics and regulatory factors. Research suggests that in North America, prices have fallen sharply due to an influx of inexpensive industrial process emission reduction credits, leading to oversupply. In contrast, regions such as Europe and Oceania saw price increases, driven by stricter regulations and ambitious climate targets. These regional disparities highlight the absence of a unified global market and standardized pricing, contributing to variability across markets. To enhance market stability and encourage broader participation, it is essential to address these factors and create a more stable and consistent market environment.

Despite the backlash faced by the voluntary carbon offset and credit market in the past couple of years, it has emerged as a flexible mechanism for both private and public sector entities seeking to voluntarily offset emissions. Their potential to drive additional emission cuts, foster innovation, and foster collaborations among governments, corporations, and civil society has increasingly garnered acknowledgment as a pivotal force in the global climate agenda. With the urgent need to limit global temperature rise, countries are turning to ambitious NDCs, where the engagement of the private sector through VCMs becomes crucial for mobilizing mitigation finance, technology transfer, and innovation, thus contributing to multiple Sustainable Development Goals (SDGs) and aiding in meeting emissions reduction targets committed through NDCs.

Trend (2021-2023) and outlook (2024-2030) of Voluntary Carbon Market by Project type

The voluntary market includes forestry and land use, renewable energy, chemical processes/industrial manufacturing, energy efficiency/fuel switching, and others.

Forestry and land use, includes afforestation, reforestation, revegetation, and forest management. Renewable energy can take a number of forms and the most familiar are wind, hydro, and solar.

Energy efficiency projects use less energy and less fuel than a business-as-usual scenario. Examples of this type of project include converting a fleet of vehicles to a fleet of more fuel-efficient vehicles, replacing inefficient HVAC mechanical or water heating systems, renovating buildings to make them more efficient at retaining thermal energy, or replacing incandescent light bulbs with LED light bulbs.

Fuel-switching projects reduce the consumption of fossil fuels by switching to cleaner or renewable fuel sources for the same activity, thereby producing legitimate offsets. Examples of this include switching from oil to natural gas to power an on-campus electricity generating plant or powering a fleet of vehicles with ethanol instead of gasoline or biodiesel instead of fossil diesel.

Other voluntary markets include household/community devices, waste disposal, transportation, and agriculture. Enhancing waste-to-energy practices can avert the release of potent GHG, such as methane. New technologies are also used to avoid pollution or to produce biogas from organic matter, which also adds an element of circularity to the economy. Avoidance efforts can range from livestock and manure management to transport electrification and methane capture in mines. Regardless of the sector, they all aim to save GHG emissions by switching, modernizing, and improving technologies and industrial processes, thus making responsible production choices and bolstering companies' climate commitments.

Voluntary markets have the potential to channel finance into carbon removal projects and address the residual emissions of firms, but they are held back by issues of market integrity. This includes a lack of consensus on how the market credits align with science-based decarbonization pathways, the overall quality of the credits available, as well as fragmented reporting standards.

For voluntary markets to fulfill their potential, standard-setting bodies are providing guidance on the accounting and disclosure for the credits and how they relate to net-zero/carbon-neutral claims. This guidance helps remove ambiguity from the market and avoid greenwashing. Standard-setting bodies and validation and verification bodies (VVBs) assess the quality of offsets to ensure that they meet the required standards and are of high quality. By providing transparency and clarity surrounding the quality of credits, participants can actively participate in the market with reliability. Additionally, development of global registries will reduce the fragmentation of the voluntary credit market across regions. A unified registry will enable more seamless transactions and enable authorities to track global progress toward the Paris Agreement goals. This would also allow them to identify the necessary steps to accelerate the global transition.

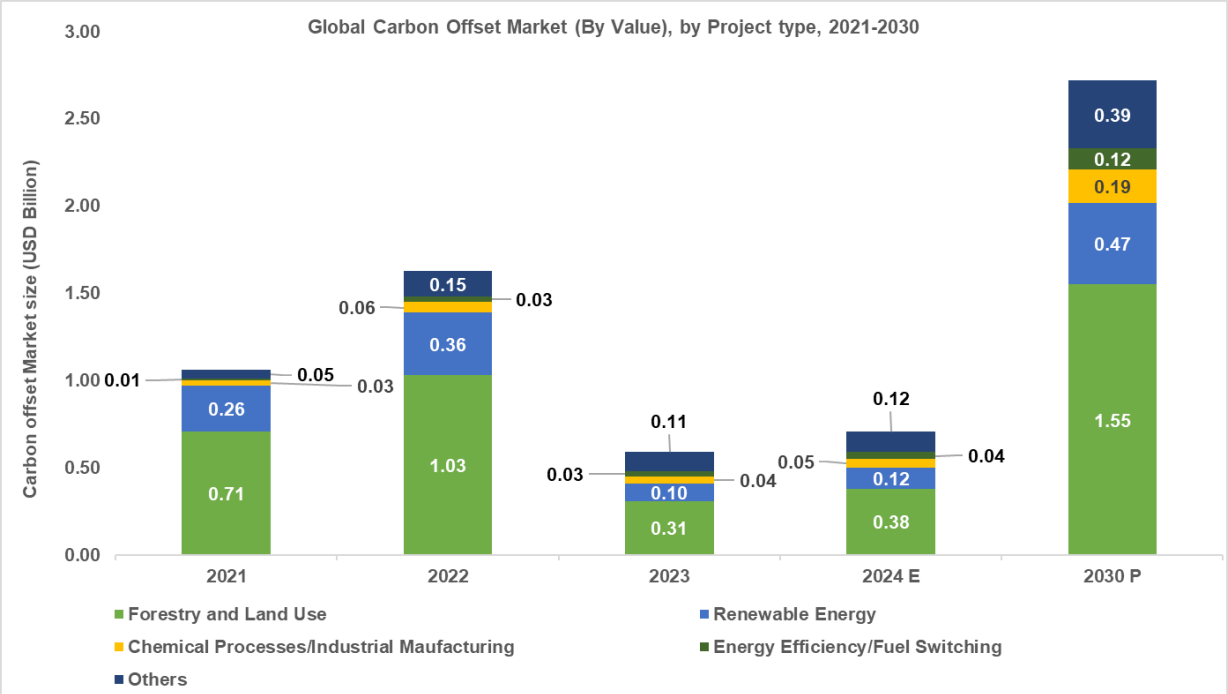
Despite market headwinds, as of May 2024, the total number of new registered projects grew led by Household/Community Devices projects. Forestry and Land Use, Renewable Energy, Agriculture, and Waste Disposal project registrations also grew year-on-year.

Table 7 Global Carbon Offset and Credit Market Size by project type

Global: Carbon offset Market size, By Type, 2021-2030, (USD Billion)						
Voluntary Market Type	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
Forestry and Land Use	0.71	1.03	0.31	0.38	1.55	26.4%
Renewable Energy	0.26	0.36	0.10	0.12	0.47	25.5%
Chemical Processes/Industrial Maufacturing	0.03	0.06	0.04	0.05	0.19	24.9%
Energy Efficiency/Fuel Switching	0.01	0.03	0.03	0.04	0.12	20.1%
Others	0.05	0.15	0.11	0.12	0.39	21.7%

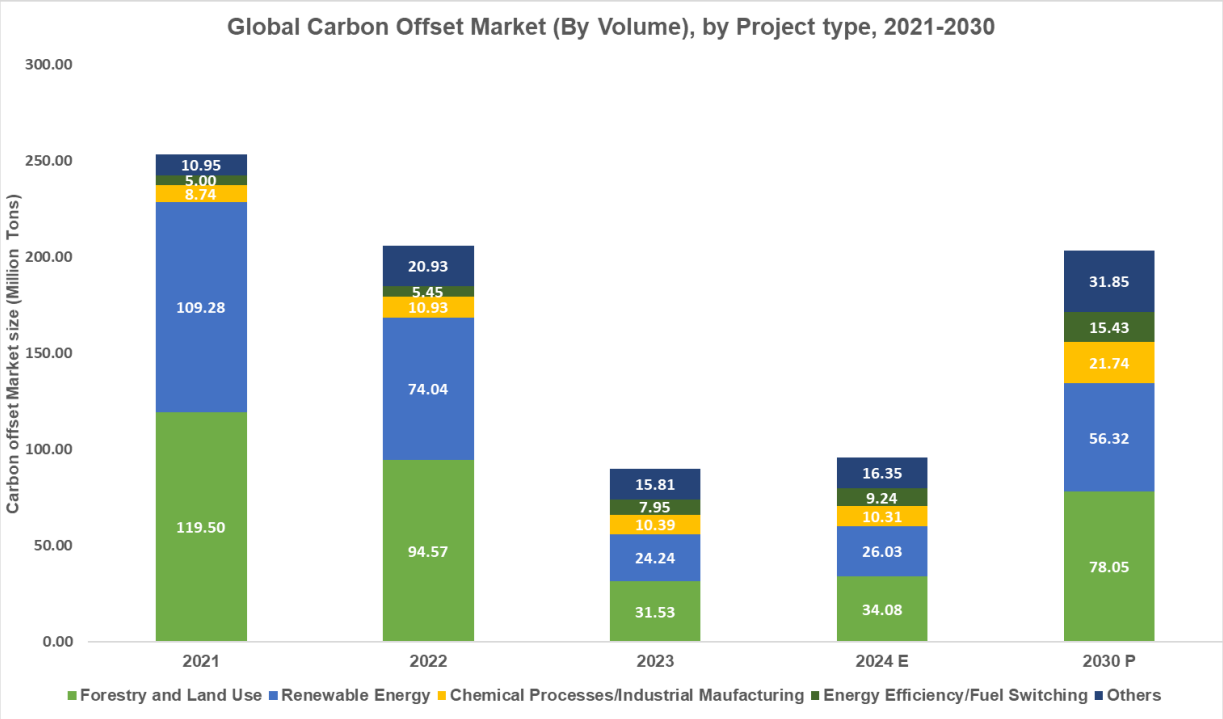
Global: Carbon offset Market size, By Type, 2021-2030, (Million Tons)					
Voluntary Market Type	**2021**	**2022**	**2023**	**2024 E**	**2030 P**
Forestry and Land Use	119.50	94.57	31.53	34.08	78.05
Renewable Energy	109.28	74.04	24.24	26.03	56.32
Chemical Processes/Industrial Maufacturing	8.74	10.93	10.39	10.31	21.74
Energy Efficiency/Fuel Switching	5.00	5.45	7.95	9.24	15.43
Others	10.95	20.93	15.81	16.35	31.85

Source: Markets and Markets, CRISIL Research
Note: Other include household/community devices, waste disposal, transportation, and agriculture
E: Estimated; P: Projected



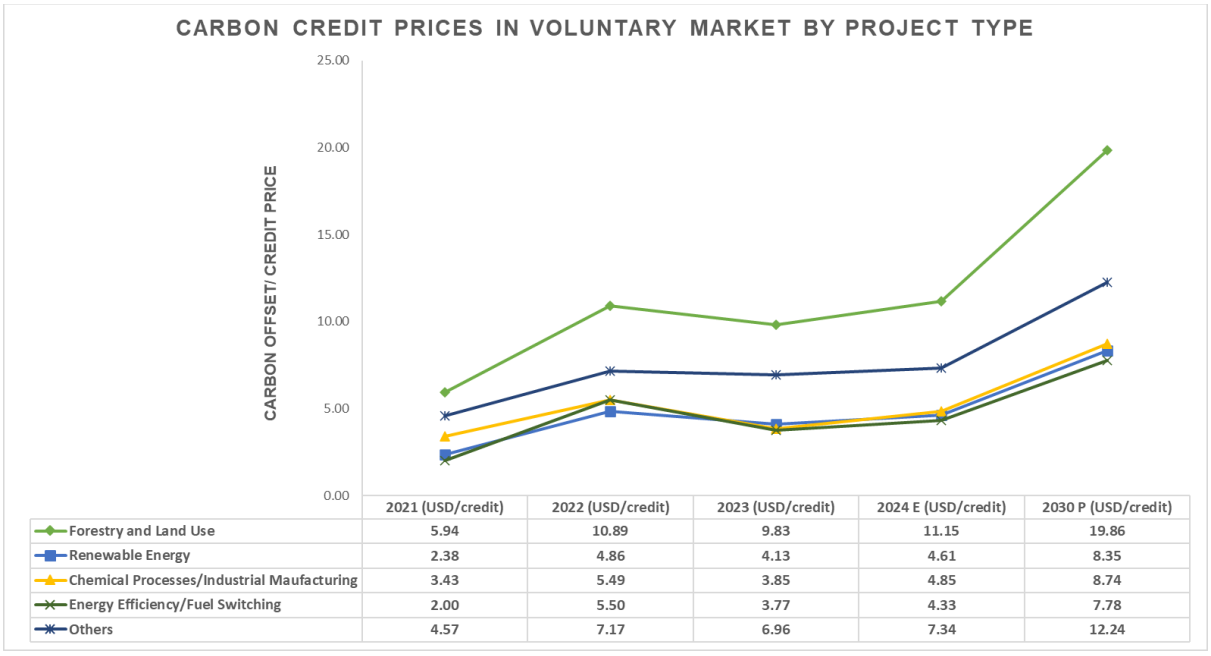
Source: Markets and Markets, CRISIL Research
Note: Other include household/community devices, waste disposal, transportation, and agriculture
E: Estimated; P: Projected

Figure 13 Global Carbon Offset Market (by value), By Project type



Source: Markets and Markets, CRISIL Research
Note: Other include household/community devices, waste disposal, transportation, and agriculture
E: Estimated; P: Projected

Figure 14 Global Carbon Offset Market (by volume), By Project type



	2021 (USD/credit)	2022 (USD/credit)	2023 (USD/credit)	2024 E (USD/credit)	2030 P (USD/credit)
Forestry and Land Use	5.94	10.89	9.83	11.15	19.86
Renewable Energy	2.38	4.86	4.13	4.61	8.35
Chemical Processes/Industrial Maufacturing	3.43	5.49	3.85	4.85	8.74
Energy Efficiency/Fuel Switching	2.00	5.50	3.77	4.33	7.78
Others	4.57	7.17	6.96	7.34	12.24

Source: Markets and Markets, CRISIL Research
Note: Other include household/community devices, waste disposal, transportation, and agriculture
E: Estimated; P: Projected

Figure 15 Carbon Offset and credit prices in voluntary market (project type)

Although transaction volumes for forestry and land use projects have decreased, they continue to dominated the voluntary carbon credit market, underscoring demand for nature-based solutions (NbS). Renewable energy remains the second most popular, but expected rise in prices for credits in the forestry and land use reflect growing interest in carbon removal initiatives. Research suggests that categories such as energy efficiency and chemical processes/industrial manufacturing, experienced price declines due to oversupply.

Overview of projects undertaken within Voluntary Carbon Offset Market in 2023

Agriculture

The agriculture category includes project types focused on the sustainable management of farmland and pasture, including soil carbon sequestration through sustainable farmland or pasture management, livestock waste methane management, conservation of grassland habitats, and avoidance of methane production in rice cultivation. The volume of Agriculture credit transactions continued to grow in 2023, marking a fourth consecutive year of growth since 2019. Among the trading credits issued by seven different standards, credits from VCS projects made up the largest proportion by far. Projects in Asia contributed the largest share of the volume of Agriculture credits traded in 2023, followed by Latin America and the Caribbean.

Chemical Process/ Industrial Manufacturing

Chemical Processes/Industrial Manufacturing is the category with the third largest volume of transactions in 2023. These projects focus on eliminating greenhouse gas production or reducing the volume of greenhouse gases used in industrial applications. Representative project types in 2023 include nitrous oxide destruction in chemical production; reclamation and replacement of hydrofluorocarbons in applications, including refrigerants and foam production; fugitive emissions capture and destruction, including methane from coal mines; and other industrial process emissions reduction activities. American Carbon Registry (ACR) recorded highest number of credits from the transactions in 2023, followed by Climate Action Reserve (CAR), and then VCS. North America grew to become the largest source for Chemical Processes/Industrial Manufacturing credits traded in 2023, followed by Asia at a distant second position.

Energy Efficiency/ Fuel Switching

Projects in the Energy Efficiency/Fuel Switching category reduce consumption of fossil fuels by increasing the efficiency of industrial processes and residential and commercial heating and lighting and by switching power and heat generation from fossil fuels to biomass or less carbon-intensive fuels, such as natural gas. This category grew the most in 2023, mostly driven by an increase in the volume of industrial energy efficiency credits. The largest share of credits traded originated from projects in North America, followed by Asia. The most prevalent standard was ACR, followed by VCS.

Forestry and Land Use

Forestry and Land Use remains the largest category of carbon credits by transaction volume, despite 2023 volumes declining from 2022. REDD+ project types made up the majority of credits traded in this category, while Afforestation-Reforestation and Revegetation (ARR) and Improved Forest Management (IFM) credits also managed their small share in the market. Credits from projects in Latin America and the Caribbean constituted around one-third of transaction volume for Forestry and Land Use, followed by Africa and Asia. This category saw credits traded from the greatest number of countries in 2023. While VCS remains the most popular standard for Forestry and Land Use credits, this category included the greatest variety of standards for traded credits.

Household/ Community Devices

This category includes all projects that focus on reducing carbon emissions at the household or community level, rather than through land-use practices or large-scale industrial processes. Popular project types in this category include efficient cookstove and water purification device distribution, which mitigate greenhouse gas emissions caused by deforestation for fuel in rural areas; community energy efficiency projects; and biogas infrastructure for fossil-fuel free heating and cooking in rural communities. The volume of Household/Community Devices credits traded grew from 2022, with an increase in transactions of clean cookstove credits responsible for almost all of this growth. The majority of Household/Community Devices projects took place in Africa, followed by Asia. More than half of the volume of credits traded in this category in 2023 were from a Gold Standard project, followed by VCS projects.

Renewable Energy

Renewable Energy projects were the second-largest category by transaction volume. These projects mitigate carbon emissions by using renewable energy to displace fossil fuel consumption. Project types include electricity and heat generation using wind, solar, hydropower, geothermal energy, biogas from the decomposition of organic waste, and renewable biomass. Renewable Energy credits were traded from the widest variety of projects in 2023. Of those credits, more than one-third of the traded volume came from projects in Asia, followed by projects in Latin America and the Caribbean. VCS was the largest source for credits in this category, followed by Gold Standard and CDM.

Waste Disposal

Waste Disposal projects reduce greenhouse gas emissions by capturing and destroying methane from decaying organic material (except when this methane is used to generate heat or electricity; these project types are included in the Renewable Energy category), recycling old materials to avoid emissions associated with new manufacturing, and composting organic waste to prevent methane production. While the volume of Waste Disposal transactions fell from 2022, prices held steady year-on-year, unlike all other project categories, which may indicate an ongoing shift towards higher-quality Waste Disposal project methodologies. North America was host to the greatest share of projects with credits traded in 2023, followed by Latin America and the Caribbean.

The rapid rise in voluntary purchases of emissions credits, even in uncertain times, reflects companies' commitment to reaching net zero and the growing importance of the carbon market.

State and trends of Carbon Offset/Credit Validation, Verification and Certification Market

The carbon offset and credit market plays a crucial role in the global fight against climate change. It allows organizations to offset their emissions by investing in projects that demonstrably reduce greenhouse gases. However, ensuring the credibility and integrity of these offsets necessitates a robust validation, verification, and certification (VVC) process. Understanding these service segments is critical for stakeholders across the carbon credit market ecosystem.

Validation serves as the essential foundation upon which the entire carbon credit lifecycle is built. It acts as a rigorous pre-assessment for proposed carbon offset projects, ensuring their adherence to established standards and methodologies before they proceed to verification and certification. During validation, independent experts evaluate the project design document (PDD). PDD is assessed against established carbon credit standards like Verra's Verified Carbon Standard (VCS) or the Gold Standard. As governments implement stricter regulations to curb greenhouse gas emissions, companies are expected to be turning to carbon offsets to meet compliance requirements and sustainability goals. This rise in project development necessitates the implementation of thorough validation procedures to ensure the credibility and integrity of the carbon credits generated.

Verification acts as the cornerstone of trust and quality within the carbon offset and credit market. Following the initial validation step, verification involves a rigorous audit conducted by independent, third-party experts or VVBs. These bodies examine all project documentation, monitoring reports, and emissions reduction data. The primary objective is to ensure the project has been implemented as planned, delivering the promised emissions reductions. They verify that the claimed reductions are accurate, measurable, and directly attributable to the project's activities. Additionally, verifiers confirm the project's ongoing adherence to the chosen carbon credit standard's methodologies and requirements. Several key drivers are propelling the growth of the verification segment. Companies and investors increasingly prioritize high-quality carbon credits to achieve their sustainability objectives. Verification provides a critical layer of assurance that the offsets they purchase represent genuine emissions reductions, justifying their investment.

One of the key requirements for high-quality carbon credits is additionality - the emissions reductions or removals must not have occurred without the incentive provided by carbon credit revenues. An independent VVB plays a vital role in rigorously evaluating a project's additionality by assessing barriers, baseline scenarios, and legal surplus. High-quality carbon projects shall also deliver meaningful co-benefits beyond just emissions reductions, such as positive impacts on local communities and biodiversity. This provides confidence that the credits represent real, additional emissions reductions. As the demand for high-quality carbon offsets intensifies, VVBs will play a critical role in guaranteeing an offset/credit’s legitimacy and value.

Certification serves as the final checkpoint and official recognition within the carbon credit lifecycle. Following successful verification, certification bodies formally issue carbon credits, signifying that the project's verified emissions reductions meet the rigorous requirements of a specific carbon credit standard. These certified credits then become tradable assets on carbon credit exchanges or platforms, allowing project developers to monetize their environmental benefits. The certification segment is intricately linked to the overall health of the carbon credit market. As the demand for verified offsets and credits surges, robust validation, verification and certification processes become even more critical to ensure the credibility and legitimacy of these tradable instruments.

Despite the clear benefits, challenges remain. The cost of validation, verification and certification can be a barrier for some project developers, particularly those involved in smaller-scale projects. Additionally, finding qualified validators with expertise in specific project types and methodologies can be difficult, especially in emerging markets. Looking ahead, technological advancements in data analysis and remote monitoring hold promise for streamlining validation processes and potentially reducing costs.

Validation, Verification, and Certification in Regulatory and Voluntary Carbon Market

The global carbon offset and credit validation, verification, and certification (VV&C) market caters to two distinct market segments based on the type of carbon credits being traded: Voluntary and Compliance. Understanding these segments is crucial for stakeholders in the VV&C landscape. Companies and individuals can purchase voluntary carbon credits to offset their emissions and contribute to climate action projects. This market offers greater flexibility in terms of project types and methodologies, but also faces challenges with standardization and transparency. This market demands rigorous VV&C processes to ensure the credibility of traded credits.

The voluntary carbon credit market is experiencing a period of dynamic growth, driven by a confluence of factors. This demand has propelled the market value to nearly USD 163.6 million in 2023, marking a significant increase from just a few years prior.

Table 8 Global Carbon Offset/ Credit VVC Market Size

Global: Carbon Credit Validation, Verification & Certification Market size, By Type, 2021-2030, (USD Million)						
By Type	2021	2022	2023	2024 E	2030 P	CAGR (2024-2030)
Compliance	21.71	21.98	23.68	28.11	96.42	22.8%
Voluntary	147.14	150.24	163.64	198.54	788.10	25.8%

Global: Carbon Credit Validation, Verification & Certification Market size, By Type, 2021-2030, (Milion Tons)					
By Type	2021	2022	2023	2024 E	2030 P
Compliance	101.02	150.46	78.43	89.81	266.43
Voluntary	362.00	353.00	308.00	366.52	1,270.18

Source: Markets and Markets, CRISIL Research
Note: E : Estimated; P: Projected

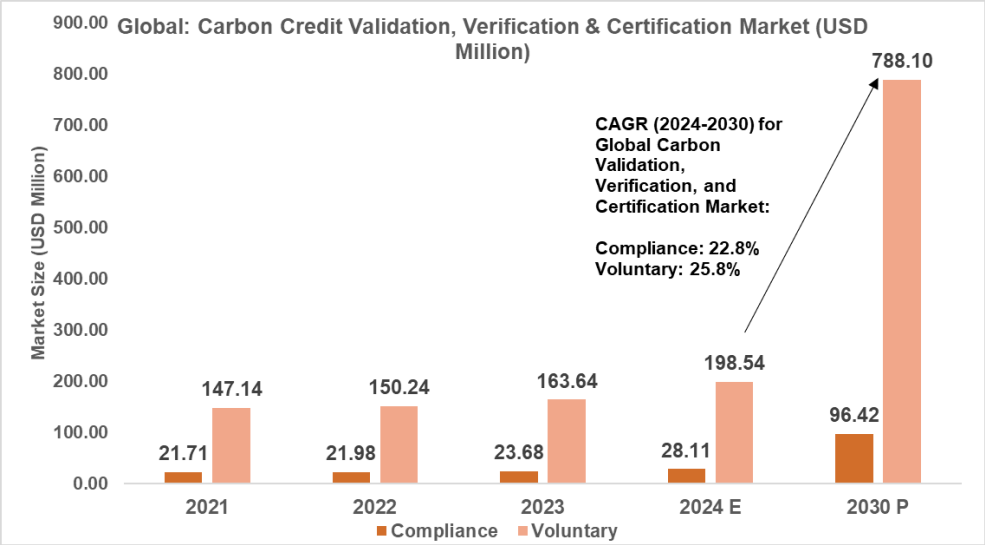
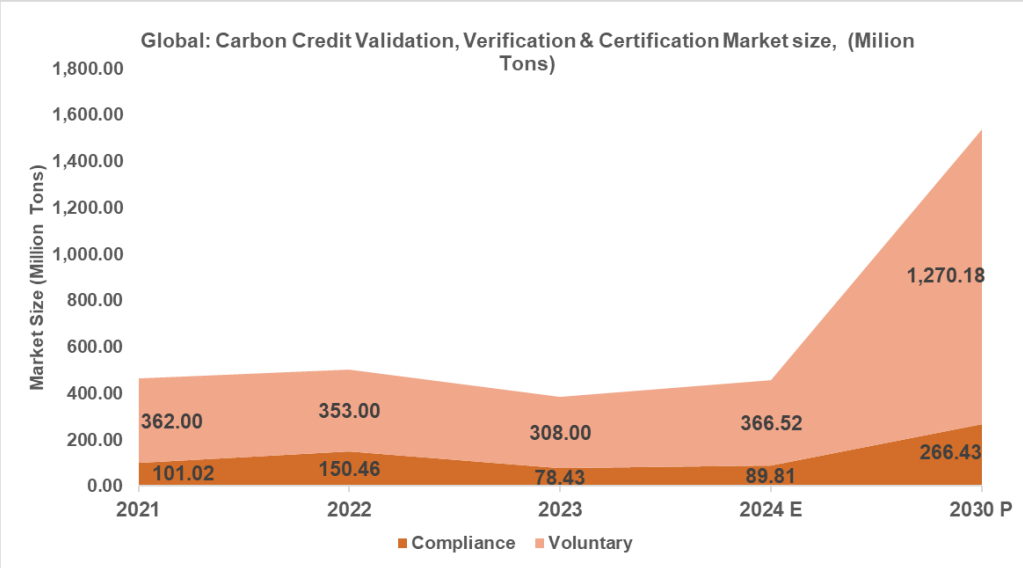


Figure 16 Global Carbon Offset/ Credit VVC Market Size (USD Million)



Source: Markets and Markets, CRISIL Research
Note: Data labels indicate Carbon offset and credit market size in term of Value (USD Billion) and in terms of Volume (Million Tons)
E : Estimated; P: Projected

Figure 17 Global Carbon Offset/ Credit VVC Market Size (Million Tons)

The evolving voluntary carbon market (VCM) landscape is giving rise to new price drivers in 2024. Notably, credits from projects that achieve negative emissions by actively removing carbon from the atmosphere are expected to command a premium, as they are perceived as higher-value credits. This trend is consistent with 2023, when VCM buyers were willing to pay more for credits from projects that generated removals rather than just reductions.

The Voluntary market accounts for the majority of market share in the global carbon offset and credit validation, verification and certification market. VVC market in the voluntary market is expected to record a CAGR of 25.80% from 2024 to 2030. This growth is attributed to implementation of various initiatives to improve the functionality and integrity of the voluntary carbon credit market and several others under development.

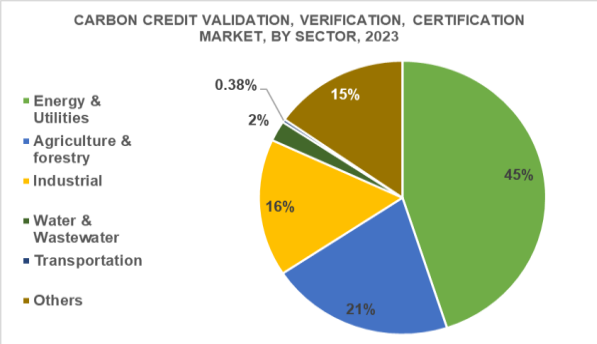
Initiatives like the EU Carbon Removal Certification Framework and the London Stock Exchange's Voluntary Carbon Market Designation aim to establish clear criteria for project qualification and credit verification. Governments are also playing an increasingly active role in shaping the landscape of voluntary carbon markets. This involvement takes various forms. Australia's Carbon Exchange and Japan's GX League exemplify efforts to drive market centralization by creating dedicated trading platforms. These efforts try to enhance the credibility of the market and provide companies with greater confidence in the emissions reductions they are financing. Evolving carbon credit standards and methodologies necessitate ongoing expertise from validation, verification, and certification bodies.

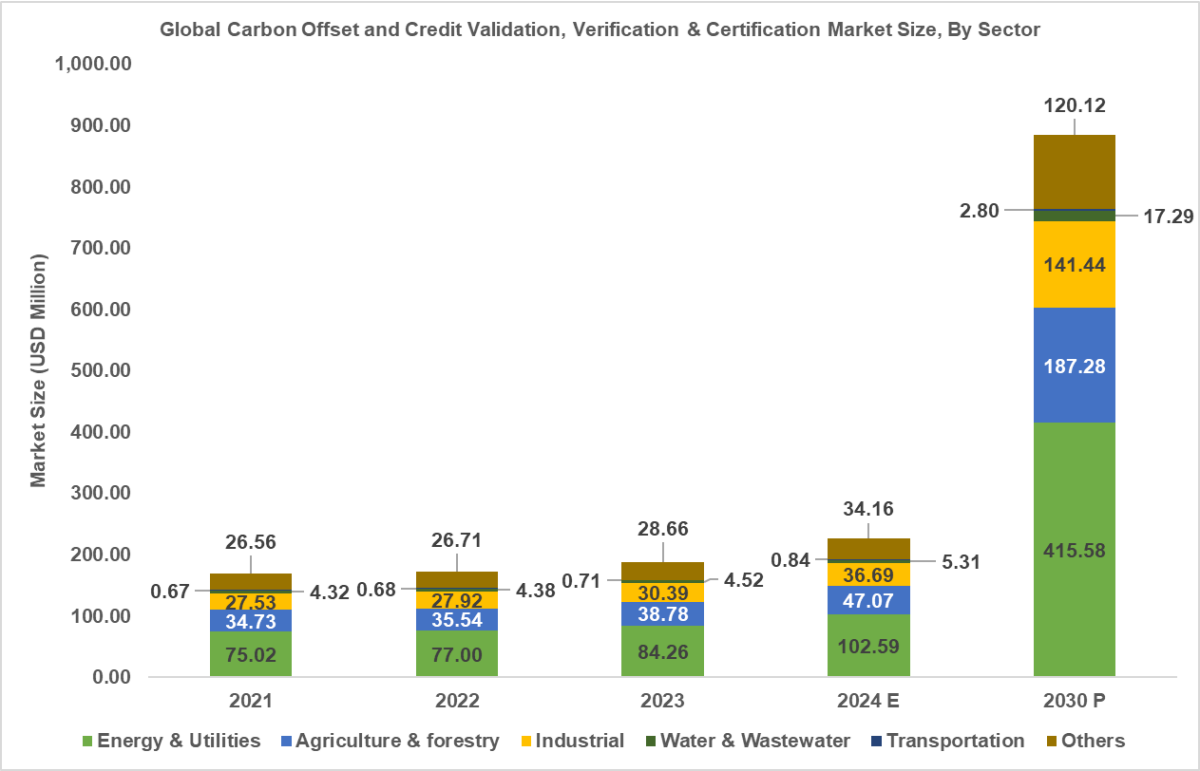
Trend (2021-2023) and outlook (2024-2030) of Global Carbon Offset/ Credit VVC Market by Key Sector

The By Sector segment in the global carbon credit validation, verification, and certification market categorizes initiatives based on various industries' contributions to carbon dioxide emissions and their potential for emissions reduction. This segmentation includes sectors such as Energy & Utilities, Transportation, Agriculture & Forestry, Water & Wastewater, Industrial, and Others (including Building & Construction, Aviation, and Waste Disposal). Each sector presents unique challenges and opportunities for implementing carbon reduction projects, ranging from renewable energy adoption and sustainable land management practices to energy efficiency improvements and the adoption of low-carbon technologies. Effective validation, verification, and certification processes ensure transparency and credibility in documenting emissions reductions across these diverse sectors.

Table 9 Global Carbon Offset/ Credit VVC Market Size, By Sector

Global: Carbon Credit Validation, Verification & Certification Market Size, By Sector, 2021-2030, (USD MIllion)						
By Sector	2021	2022	2023	2024 E	2030 P	CAGR (2024-2030)
Energy & Utilities	75.02	77.00	84.26	102.59	415.58	26.3%
Agriculture & forestry	34.73	35.54	38.78	47.07	187.28	25.9%
Industrial	27.53	27.92	30.39	36.69	141.44	25.2%
Water & Wastewater	4.32	4.38	4.52	5.31	17.29	21.7%
Transportation	0.67	0.68	0.71	0.84	2.80	22.2%
Others	26.56	26.71	28.66	34.16	120.12	23.3%





Source: Markets and Markets, CRISIL Research
Note: Other include Building & Construction, Aviation, and Waste Disposal; E: Estimated; P: Projected

Figure 18 Global Carbon Offset/ Credit VVC Market Size, By Sector

The Energy & Utilities sector is a significant component of the global carbon credit market, driven by the urgent need to mitigate greenhouse gas (GHG) emissions from energy production and consumption. This sector encompasses a broad range of projects, including renewable energy generation, energy efficiency improvements, and waste-to-energy initiatives. Each project type undergoes rigorous validation, verification, and certification processes to ensure that the emissions reductions are real, measurable, and permanent. This category held largest market share of 45% in 2023 in Global Carbon offset/credit validation, verification and certification market across different sectors and it is also expected to grow at a CAGR of 26.30% from 2024 to 2030. According to the World Economic Forum (WEF), the world added 50% more renewable capacity in 2023 compared to 2022. According to the report 'Renewable Capacity Statistics-2024, released by International Renewable Energy Agency (IRENA), 2023 set a new record in renewables deployment in the power sector by reaching a total capacity of 3870 Gigawatts (GW) globally. Looking ahead, IRENA's World Energy Transitions Outlook 1.5°C Scenario predicts that capacity will need to more than triple to 7.2 Terawatts (TW) by 2030 to meet climate goals.

The Agriculture and Forestry sector also holds a significant share in the voluntary carbon offset/credit VVC market. VVC market in this sector is expected to grow at a CAGR of 25.9% from 2024 to 2030, given its substantial potential for carbon sequestration and emissions reduction. This sector includes a diverse array of projects such as reforestation, afforestation, sustainable agricultural practices, and soil carbon sequestration. These initiatives not only contribute to mitigating climate change but also enhance biodiversity, improve soil health, and promote sustainable land management practices. Forestry and Land Use remains the largest category of carbon credits by transaction volume, despite the overall volumes declining in 2023. The volume of Agriculture credit transactions also continued to grow in 2023, marking a fourth consecutive year of growth since 2019. The sustained growth in this sector is attributed to the rising demand of credits that offer co-benefits. In 2023, VCM buyers continued to place a premium on carbon credits from projects that offer "beyond carbon" environmental and social co-benefits, such as preserving and restoring biodiversity, contributing to water security, or supporting sustainable local economies. This indicates how much more buyers value removal credits over credits that represent emissions reductions only.

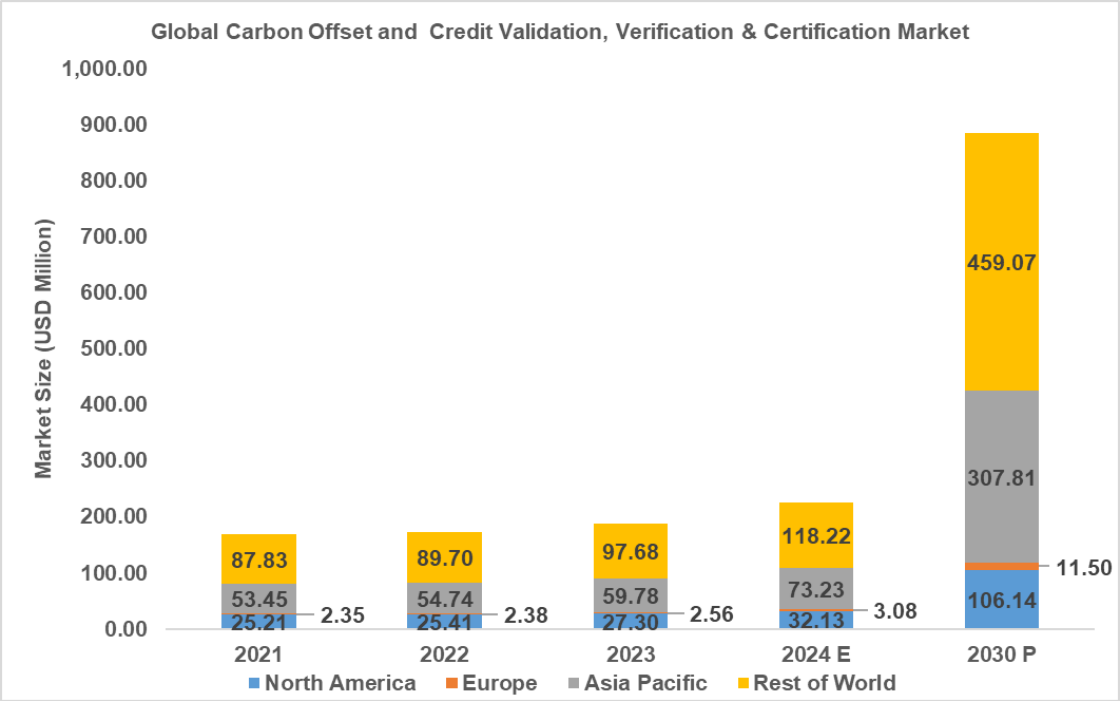
Despite low share in the market, the transportation sector is also witnessing a growing adoption of sustainable transportation solutions and expanding infrastructure for electric vehicles to curb emissions from transportation.

Trend (2021-2023) and outlook (2024-2030) of Global Carbon Offset/ Credit VVC Market by Key Regions

The Region segment in the global carbon credit validation includes North America, Europe, Asia Pacific, and RoW (Rest of the World). Rest of the World include South America and Middle East & Africa region.

Table 10 Global Carbon Offset/ Credit Market Size, By Region

Global: Carbon Credit Validation, Verification & Certification Market Size, 2021-2030, (USD Million)						
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
North America	25.21	25.41	27.30	32.13	106.14	22.0%
Europe	2.35	2.38	2.56	3.08	11.50	24.6%
Asia Pacific	53.45	54.74	59.78	73.23	307.81	27.0%
Rest of World	87.83	89.70	97.68	118.22	459.07	25.4%



Source: Markets and Markets, CRISIL Research
Note: Rest of the World include South America and Middle East & Africa region.
E: Estimated; P: Projected

Figure 19 Global Carbon Offset/ Credit Market Size, By Region

Asia-Pacific is expected to be the fastest growing region in the global economy. This presents the challenge of balancing economic growth with tackling climate change. The region is witnessing significant growth in carbon credit projects aimed at reducing greenhouse gas emissions and promoting sustainable development practices. APAC is currently the world's largest producer of carbon offsets. It had produced around 44 percent of the USD 2 billion global market in 2021. The region held largest market share of 31.9% in 2023 in Global Carbon offset/credit validation, verification and certification market across different project types which shows how the region is prioritizing the growth of green economy. Stringent environmental regulations will further fuel the growth of the VVC market in this region.

North America region is also holding a significant share in the market. The region encompasses the US and Canada, each contributing uniquely to carbon credit initiatives aimed at reducing greenhouse gas emissions and promoting environmental stewardship. Both the US and Canada have implemented comprehensive regulatory frameworks to address climate change and support carbon credit projects. In the United States, various states have implemented cap-and-trade programs, such as the Regional Greenhouse Gas Initiative (RGGI) in the Northeast and California's cap-and-trade program, aimed at reducing emissions from the energy sector.

The European Union (EU) and its member states have implemented comprehensive policies and initiatives to mitigate greenhouse gas emissions, drive sustainable development, and promote the transition to a low-carbon economy. The EU has established the world's largest emissions trading system (EU ETS). The EU ETS operates on a cap-and-trade principle, setting a limit on the total amount of greenhouse gases that can be emitted annually. In 2021, the EU introduced the Fit for 55 package, aiming to further reduce emissions by at least 55% by 2030 and achieve climate neutrality by 2050.

The Rest of World region encompasses countries outside North America, Europe, and Asia Pacific, each with unique challenges and opportunities in the global carbon credit validation, verification, and certification market. This diverse region includes emerging economies in Latin America, Africa, and the Middle East, as well as smaller economies in Oceania and other regions. While regulatory frameworks and market maturity vary widely across these countries, there is a growing recognition of the importance of mitigating greenhouse gas emissions and promoting sustainable development practices.

Validation, Verification, and Certification Market in Asia Pacific, By sector

Asia Pacific represents a dynamic and rapidly evolving region in the global carbon credit validation, verification, and certification market. Governments and industries are increasingly focusing on regulatory frameworks, renewable energy deployment, and carbon credit projects to mitigate climate change impacts and foster sustainable growth.

Table 11 Carbon Offset/ Credit VVC Market Size in APAC region

Asia Pacific: Carbon Credit Validation, Verification & Certification Market size, By Sector, 2021-2030, (USD Million)						
By Sector	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
Energy & Utilities	23.84	24.55	26.96	33.21	144.36	27.7%
Transportation	0.20	0.20	0.22	0.26	0.95	24.1%
Agriculture & forestry	10.75	11.04	12.09	14.84	63.41	27.4%
Water & Wastewater	1.47	1.47	1.57	1.87	6.77	23.9%
Industrial	8.89	9.12	9.97	12.22	51.71	27.2%
Others	8.30	8.36	8.98	10.82	40.60	24.7%

Source: Markets and Markets, CRISIL Research
Note: Other include Building & Construction, Aviation, and Waste Disposal
E: Estimated; P: Projected

The region is experiencing rapid growth in renewable energy investments and clean technology adoption. Countries like China, India, Japan, and South Korea are investing heavily in solar, wind, hydroelectric, and biomass energy projects to diversify their energy mix and reduce reliance on fossil fuels. According to the report 'Renewable Capacity Statistics-2024, released by International Renewable Energy Agency (IRENA), 473 GW of renewables expansion was led by Asia with a 69% share (326 GW). Majority of the REDD+ projects under the Forestry and Land Use Project category are located in this region.

Validation, Verification, and Certification Market in North America, By sector

North America hosts a diverse range of carbon credit projects across sectors including energy, agriculture, forestry, and industrial processes. These projects focus on emissions reductions through energy efficiency improvements, renewable energy deployment, sustainable agricultural practices, and forest conservation initiatives. Rigorous validation, verification, and certification processes ensure the credibility and transparency of these projects, attracting investments from businesses, financial institutions, and international markets.

Table 12 Carbon Offset/ Credit VVC Market Size in North-America region

North America: Carbon Credit Validation, Verification & Certification Market size, By Sector, 2021-2030, (USD Million)						
By Sector	**2021**	**2022**	**2023**	**2024E**	**2030P**	**CAGR (2024-2030)**
Energy & Utilities	10.98	11.11	11.98	14.15	47.87	22.5%
Transportation	0.12	0.12	0.13	0.15	0.44	19.9%
Agriculture & forestry	5.01	5.06	5.44	6.42	21.44	22.3%
Water & Wastewater	0.73	0.75	0.76	0.87	2.45	18.7%
Industrial	4.05	4.05	4.32	5.04	15.92	21.1%
Others	4.32	4.32	4.67	5.49	18.02	21.9%

Source: Markets and Markets, CRISIL Research
Note: Other include Building & Construction, Aviation, and Waste Disposal
E: Estimated; P: Projected

Through innovative policies, technological advancements, and diverse carbon credit projects, the region continues to make strides in reducing greenhouse gas emissions, fostering clean energy adoption, and promoting environmental stewardship. Both the United States and Canada have made significant investments in renewable energy infrastructure, grid modernization, and energy storage solutions to facilitate the transition to a low-carbon economy. The United States is the second-largest producer of wind energy globally after China and continues to expand its solar photovoltaic capacity.

Validation, Verification, and Certification Market in Europe, By sector

Europe stands as a pioneering region, renowned for its ambitious climate targets, robust regulatory frameworks, and leadership in adopting policies and initiatives to mitigate greenhouse gas emissions, drive sustainable development, and promote the transition to a low-carbon economy.

Table 13 Carbon Offset/ Credit VVC Market Size in Europe region

Europe: Carbon Credit Validation, Verification & Certification Market size, By Sector, 2021-2030, (USD Million)						
By Sector	**2021**	**2022**	**2023**	**2024E**	**2030P**	**CAGR (2024-2030)**
Energy & Utilities	1.02	1.04	1.13	1.36	5.29	25.3%
Transportation	0.01	0.01	0.01	0.01	0.04	26.0%
Agriculture & forestry	0.47	0.48	0.52	0.62	2.36	24.9%
Water & Wastewater	0.07	0.07	0.07	0.08	0.26	21.6%
Industrial	0.38	0.38	0.40	0.48	1.74	23.9%
Others	0.40	0.40	0.43	0.52	1.81	23.1%

Source: Markets and Markets, CRISIL Research
Note: Other include Building & Construction, Aviation, and Waste Disposal
E: Estimated; P: Projected

In 2022, the EU Commission published the RePower EU, which set out a series of measures to rapidly reduce the EU's dependence on fossil fuels well before 2030 by accelerating the clean energy transition. To further and accelerate the deployment of renewables, European Investment Bank (EIB) group committed to financing and supporting renewable projects for EU energy security and green economy.

Europe is driving significant emissions reductions, fostering innovation, and promoting environmental stewardship. The region's rigorous validation, verification, and certification mechanisms ensure transparency and accountability, making Europe a key player in shaping the future of global climate action and sustainable finance.

Validation, Verification, and Certification Market in RoW (Rest of the World), By sector

The Rest of World region encompasses countries outside North America, Europe, and Asia Pacific. This diverse region includes emerging economies in Latin America, Africa, and the Middle East, as well as smaller economies in Oceania and other regions.

While regulatory frameworks and market maturity vary widely across these countries, there is a growing recognition of the importance of mitigating greenhouse gas emissions and promoting sustainable development practices. Many countries in the region are in the process of developing or enhancing their regulatory frameworks to address climate change and support carbon credit initiatives. Some countries have implemented emissions trading schemes, carbon pricing mechanisms, and renewable energy targets to incentivize emissions reductions and promote clean energy investments. However, regulatory uncertainty and political stability issues in certain regions can pose challenges to the adoption and implementation of carbon credit projects.

Table 14 Carbon Offset/ Credit VVC Market Size in RoW region

Rest of World: Carbon Credit Validation, Verification & Certification Market size, By Sector, 2021-2030, (USD Million)						
By Sector	**2021**	**2022**	**2023**	**2024**	**2030**	**CAGR (2024-2030)**
Energy & Utilities	39.19	40.30	44.19	53.86	218.06	26.2%
Transportation	0.34	0.34	0.36	0.42	1.38	21.8%
Agriculture & forestry	18.50	18.96	20.73	25.19	100.08	25.9%
Water & Wastewater	2.05	2.09	2.12	2.48	7.80	21.1%
Industrial	14.22	14.38	15.71	18.94	72.07	24.9%
Others	13.54	13.62	14.57	17.33	59.68	22.9%

Source: Markets and Markets, CRISIL Research
Note: Other include Building & Construction, Aviation, and Waste Disposal
E: Estimated; P: Projected

The Rest of World region presents significant opportunities for technological adoption and investment in clean energy technologies and carbon credit projects. There is increasing interest from international investors, development banks, and multilateral organizations in supporting renewable energy deployment, energy efficiency improvements, and sustainable development initiatives across these regions.

State and trends of ESG Advisory Services Landscape

The ESG Advisory market offers diverse services to address the multifaceted needs of companies aiming to enhance their environmental, social, and governance (ESG) performance. These services are crucial for organizations seeking to align with sustainability goals and regulatory requirements while also meeting the expectations of investors and other stakeholders. Comprehensive strategy and planning services lay the foundation of a company's ESG journey. ESG advisory service providers in this segment work collaboratively with organizations to develop clear, measurable, and ambitious ESG goals that align with the overall business strategy. They help integrate ESG considerations into core business operations, decision-making processes, and long-term planning. This integration ensures that ESG principles are not just add-ons but are embedded into the company's fabric.

Key services in this market includes creating detailed ESG roadmaps, outlining the steps necessary to achieve these goals. These roadmaps include timelines, resource allocation, and key milestones, providing a structured approach to ESG implementation. Objectively assessing a company's ESG performance is critical, and this is where testing, auditing, and verification services come into play. These services involve conducting comprehensive ESG performance assessments against established standards and frameworks, such as the Global Reporting Initiative (GRI) Standards. Service providers verify the accuracy and integrity of the ESG data reported by companies, ensuring transparency and accountability.

Effective communication of a company's ESG efforts is essential for attracting stakeholders and building trust. Sustainability marketing services focus on developing comprehensive sustainability communication strategies. These strategies are designed to clearly convey a company's ESG commitments, achievements, and impact to stakeholders. Service providers assist in preparing sustainability reports that are transparent, comprehensive, and aligned with relevant frameworks.

Addressing specific ESG issues often requires specialized expertise provided through technical support services. These services cover a range of technical aspects, including carbon footprint measurement and management. Service providers help companies measure their carbon footprint accurately and develop effective strategies to reduce greenhouse gas emissions. They also provide guidance on implementing sustainable waste management practices, promoting efficient resource use, and minimizing environmental impact. Additionally, technical support includes assisting companies in transitioning towards a circular economy model, which focuses on minimizing waste and maximizing resource reuse. This transition is critical for achieving long-term sustainability and resource efficiency.

Stricter regulations around ESG disclosure and reporting requirements are driving companies to seek advisory services to ensure compliance. Investors, customers and other stakeholders are placing grater emphasis on ESG performance, compelling companies to invest in ESG advisory services. Companies are setting ambitious sustainability goals and need expert guidance to develop and implement effective ESG strategies.

The rapid growth in the market due to changes in ESG-related regulations and standards comes with challenges including hurdle to access reliable and consistent ESG data, shortage of qualified sustainability professionals, and the risk of green washing making misleading claims. ESG Advisory services are needed to help companies navigate through these challenges.

Table 15 Global ESG Advisory Market Size, By Region

Global: ESG Advisory Market Size, By Region 2021-2030, (USD Million)						
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
North America	3,081	3,603	4,374	4,780	16,391	22.8%
Europe	2,850	3,259	3,863	4,233	11,312	17.8%
Asia Pacific	1,947	2,482	3,266	3,624	20,887	33.9%
Middle East & Africa	638	782	994	1,109	5,255	29.6%
South America	1,227	1,420	1,704	1,875	5,743	20.5%

Source: Markets and Markets, CRISIL Research
Note: E : Estimated; P: Projected

The ESG and Sustainability consulting market has grown substantially, reaching USD 14 billion in 2023 and projected to reach around USD 60 billion by 2030. This growth indicates strong demand for ESG advisory services.

Strategic acquisitions fueling the growth and competitiveness in the market

The ESG advisory market has experienced a notable trend of acquisitions as firms seek to broaden their service offerings and expand their geographic reach. This trend is driven by the increasing demand for sustainability solutions and compliance with stringent environmental regulations from corporates. ERM's recent acquisitions of NINT, Point Advisory, and Stratos Inc. reflect a strategic focus on bolstering capabilities in, carbon management and ESG advisory, climate change consultancy, and other sustainability services. Similarly, other firms like TÜV SÜD and LRQA have made significant acquisitions to strengthen their positions in the carbon management and sustainability sectors. As the market is projected to grow, driven by heightened awareness of environmental issues and regulatory pressures, these strategic acquisitions will become essential for firms aiming to remain competitive. The mergers and acquisitions within the industry not only allow companies to diversify their expertise but also positions them to better address the complex challenges associated with environmental sustainability, ultimately enhancing their ability to serve clients effectively in an evolving landscape.

Trend (2021-2023) and outlook (2024-2030) of ESG Advisory Market by Service type and Key Regions

The ESG Advisory Service market offers various types of services. These services are segmented by service type into Strategy and Planning, Testing, Auditing & Verification, Sustainability Marketing, and Technical Support.

Table 16 Global ESG Advisory Market Size, By Service Type

Global: ESG Advisory Market size, By Service Type, 2021-2030, (USD Million)						
By Type	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
Strategy & planning	2,743	3,323	4,175	4,645	20,370	27.9%
Testing	1,014	1,178	1,420	1,544	5,117	22.1%
Auditing & verification	2,265	2,693	3,323	3,657	14,216	25.4%
Sustainability marketing	2,826	3,302	4,005	4,367	14,922	22.7%
Technical support	895	1,050	1,278	1,408	4,962	23.4%

Source: Markets and Markets, CRISIL Research
Note: E : Estimated; P: Projected

Strategy and Planning

Strategy & planning captured 29.4 % of the market in 2023. The strategy & planning segment is the cornerstone of the ESG Advisory market, serving as the foundation for a company's entire ESG journey. This segment is projected to hold the largest market share within the ESG Advisory market due to its fundamental nature, setting the direction for all other ESG activities. The high growth anticipated in this segment is driven by the increasing number of companies embarking on their ESG initiatives. Many companies lack the internal expertise required to develop a comprehensive ESG strategy, relying heavily on external advisory to fill this gap. The complexity of ESG considerations, encompassing a wide range of environmental, social, and governance factors, necessitates expert guidance to navigate and prioritize these issues effectively. Additionally, companies must ensure that their ESG strategies align with their overall business goals and risk management frameworks, making strategy and planning essential.

Key services offered within the strategy and planning segment include materiality assessments identifying the most significant ESG issues impacting the company, its stakeholders, and the environment. This process involves engaging with stakeholders, conducting industry analyses, and performing life cycle assessments to determine the critical focus areas. ESG goal setting is another vital service involving the development of SMART goals—Specific, Measurable, Achievable, Relevant, and Time-bound—for ESG performance. These goals must be ambitious yet achievable, considering the company's current baseline and industry benchmarks to ensure they are both challenging and realistic.

Crafting a comprehensive ESG strategy is central to the planning process. This strategy outlines the company’s approach to addressing material ESG issues, including defining long-term goals, outlining key initiatives, and assigning responsibilities. By integrating ESG considerations into core business operations and decision-making processes, companies can embed sustainability into their investment criteria, supply chain management practices, and product development processes. Scenario planning and risk assessment are also crucial components of the strategy and planning segment. These services involve identifying potential ESG risks and opportunities related to climate change, social unrest, resource scarcity, etc. Companies develop mitigation strategies for these risks and capitalize on opportunities to enhance their resilience and create competitive advantages. A well-developed

stakeholder engagement strategy is essential for effective communication and engagement with various stakeholders, including investors, employees, communities, and regulators, on ESG issues. This ensures the company maintains transparency and builds trust with its stakeholders, fostering stronger relationships and a better reputation.

Table 17 ESG Advisory (Strategy & Planning) Market, By Region

Strategy & planning: ESG Advisory Market, By Region, 2021–2030 (USD Million)						
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
North America	800	963	1,202	1,332	5,497	26.7%
Europe	822	957	1,155	1,282	3,878	20.3%
Asia Pacific	595	769	1,028	1,149	7,357	36.3%
Middle East & Africa	191	237	305	342	1,752	31.3%
South America	336	396	485	540	1,887	23.1%

Source: Markets and Markets, CRISIL Research
Note: E : Estimated; P: Projected

Testing

Testing captured 10.0 % of the market in 2023. The testing segment within the ESG Advisory market plays a vital role in verifying the authenticity of a company's ESG claims and ensuring the credibility of its sustainability efforts. ESG testing involves independently verifying a company's ESG performance against specific standards or frameworks. This process includes validating the accuracy and completeness of reported ESG data, assessing the effectiveness of ESG management systems, and ensuring compliance with relevant ESG regulations and industry standards. There are several types of ESG testing. Third-party verification involves independent verification by accredited bodies to enhance a company's credibility and transparency. Internal audits are self-assessments conducted by companies to identify gaps and areas for improvement in their ESG practices. Gap analysis involves comparing a company's practices against best practices or specific ESG frameworks to identify areas needing enhancement.

The demand for ESG testing is growing significantly due to increasing scrutiny from investors, regulatory pressures, and stakeholder concerns about greenwashing. Despite this growing demand, the pool of qualified ESG auditors and verifiers is currently limited, which could impact service availability and pricing. The lack of universal ESG standards also presents challenges in establishing consistent testing methodologies across different sectors and regions. Key services offered in the ESG testing segment include ESG data verification, which ensures the accuracy and completeness of reported data across various metrics, such as environmental (emissions, waste), social (employee diversity, labour practices), and governance (board composition, anti-corruption measures). ESG management system verification assesses the effectiveness of a company's systems in identifying, managing, and mitigating ESG risks. Sustainability reporting verification ensures that sustainability reports comply with relevant frameworks like GRI Standards or SASB Standards. ESG gap analysis identifies discrepancies between a company's current practices and best practices or specific frameworks.

For companies, ESG testing offers several benefits. Independent verification enhances the credibility of their ESG claims, building trust with stakeholders. It also promotes transparency in sustainability reporting, demonstrating a company's commitment to ESG principles. By reducing the risk of greenwashing accusations, companies can protect themselves from potential reputational damage. Moreover, ESG testing helps identify areas for improvement,

enabling companies to enhance their overall ESG performance. Several challenges and considerations will shape the future of ESG testing. Developing universal ESG standards and harmonized verification methodologies is crucial for ensuring consistent and reliable testing. Ensuring a sufficient pool of qualified ESG auditors with industry-specific knowledge will be necessary to meet the growing demand for these services. Additionally, leveraging technological advancements for data collection, analysis, and reporting can improve the efficiency and transparency of the testing process, further strengthening the integrity of ESG verification efforts.

Table 18 ESG Advisory (Testing) Market, By Region

Testing: ESG Advisory Market, By Region, 2021–2030 (USD Million)						
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
North America	308	345	399	421	922	13.9%
Europe	334	384	458	504	1,397	18.6%
Asia Pacific	158	203	269	300	1,832	35.3%
Middle East & Africa	69	83	104	115	474	26.5%
South America	145	163	190	204	491	15.7%

Source: Markets and Markets, CRISIL Research
Note: E : Estimated; P: Projected

Auditing and Verification

Auditing & verification captured 23.4 % of the market in 2023. The auditing & verification segment within the ESG advisory market is integral to maintaining the credibility and transparency of corporate ESG performance. These services are essential for ensuring that a company's ESG claims are accurate and reliable, fostering stakeholder trust.

Auditing and verification in the ESG context encompass a range of services designed to scrutinize and authenticate a company’s ESG data and practices. One of the primary services offered is the independent verification of ESG reports, where a company’s ESG data and claims are assessed against established standards such as the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB). This ensures that the information disclosed is accurate and adheres to recognized guidelines. Moreover, verification can target specific ESG aspects, such as greenhouse gas emissions, social responsibility practices, or the sustainability of supply chains. This targeted approach helps companies address areas of concern and improve their overall ESG performance. Another critical service is assurance engagements, which provide a more rigorous examination compared to basic verification. Assurance engagements involve offering an expert opinion on the fairness and accuracy of a company’s ESG disclosures, thereby enhancing the credibility of the reported information.

Several factors are driving the demand for ESG auditing and verification services. A significant driver is the growing demand for verified ESG data from investors. Investors are increasingly using ESG data to inform their investment decisions, and verified data provides confidence that the information is reliable. Additionally, regulatory pressures are mounting, with directives like the EU Corporate Sustainability Reporting Directive (CSRD) mandating sustainability reporting and verification for certain companies. This regulatory landscape is compelling companies to adopt verified ESG reporting practices. Enhanced stakeholder trust is another crucial driver. Verified ESG reports help build trust with various stakeholders, including customers, non-governmental organizations (NGOs), and employees, who are all increasingly concerned with corporate sustainability practices.

The ESG auditing and verification market is witnessing several notable trends. One such trend is the standardization of verification methodologies. Technological advancements are also playing a significant role in transforming the verification process. Innovations in data analytics and blockchain technology are being utilized to streamline verification processes, enhance data security, and reduce the potential for errors. These technologies enable more efficient handling and analysis of large datasets, which is crucial for accurate ESG verification. Additionally, there is an increased demand for third-party verification services. As greenwashing concerns grow, companies increasingly seek independent verification to substantiate their ESG claims and avoid reputational risks.

Table 19 ESG Advisory (Auditing and Verification) Market, By Region

Auditing and Verification: ESG Advisory Market, By Region, 2021–2030 (USD Million)						
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
North America	699	828	1,018	1,120	4,183	24.5%
Europe	631	717	845	921	2,346	16.8%
Asia Pacific	502	636	832	920	5,065	32.8%
Middle East & Africa	156	192	244	273	1,322	30.1%
South America	277	320	385	423	1,301	20.5%

Source: Markets and Markets, CRISIL Research
Note: E : Estimated; P: Projected

Sustainability Marketing

Sustainability marketing captured 28.2 % of the market in 2023. Sustainability marketing is an increasingly important facet of the ESG advisory market, assisting companies in effectively communicating their environmental, social, and governance initiatives to stakeholders. This type of marketing is crucial for building public trust and fostering strong relationships with consumers, investors, and other key audiences. Below, we explore the services provided, market drivers, regulatory landscape, trends, and challenges of sustainability marketing. Sustainability marketing offers a suite of services designed to enhance a company's communication about its ESG initiatives. One of the primary services is developing a comprehensive sustainability marketing strategy. This involves aligning the company's marketing goals with its broader ESG objectives and identifying target audiences most likely to value its sustainability efforts.

Another key service is creating compelling sustainability messaging. This entails crafting clear and impactful communications that effectively highlight the company's ESG initiatives and achievements. Well-crafted messaging ensures that the company's sustainability efforts resonate with stakeholders. In addition to strategy and messaging, sustainability marketing also involves developing sustainability-focused content. This can range from engaging website content and social media campaigns to detailed annual sustainability reports. These content forms are critical for keeping stakeholders informed and engaged with the company's ongoing ESG efforts. Moreover, sustainability marketing includes measures to avoid greenwashing. Companies must ensure that all marketing claims are accurate and supported by verifiable data. This helps prevent accusations of misleading stakeholders and maintains the company's credibility.

Several factors are fuelling the growth of sustainability marketing. One primary driver is the increasing consumer demand for sustainable products and services. Modern consumers are more likely to base their purchasing decisions on a company's environmental and social responsibility. Consequently, companies that effectively communicate their sustainability efforts can attract and retain more customers. Investors focusing on ESG factors is another significant

driver. Investors are increasingly looking at companies with strong sustainability practices as more attractive investment opportunities. Effective sustainability marketing helps these companies stand out in the eyes of investors. Additionally, sustainability marketing provides a competitive advantage. Companies that successfully highlight their ESG efforts in a crowded marketplace can differentiate themselves from their competitors, thus gaining a market edge. The regulatory landscape for sustainability marketing includes several essential considerations. Regulations against greenwashing, for example, exist in various regions to prevent companies from making misleading claims about their environmental benefits. Understanding and complying with these regulations is crucial for effective and lawful sustainability marketing.

Consumer protection laws also play a significant role. Companies must ensure that their marketing claims are truthful and not deceptive, as any false claims can lead to legal consequences and damage the company's reputation. Consumers increasingly demand transparency and traceability. Solid data should back marketing messages and include traceable claims to meet these demands. Providing transparent information helps build trust and credibility with stakeholders. Data-driven marketing is another emerging trend. Companies are using data to measure the impact of their sustainability marketing campaigns. This data-driven approach allows companies to refine their strategies and demonstrate the effectiveness of their efforts. The integration with social media is also significant. Social media platforms offer powerful tools for companies to communicate their sustainability stories to a wide audience. These platforms enable real-time engagement and allow companies to foster a dialogue with their customers. A focus on customer engagement is becoming increasingly important. Sustainability marketing is evolving from one-way communication to fostering meaningful interactions with customers. Engaging customers in the company's sustainability journey helps build long-term loyalty and advocacy.

Table 20 ESG Advisory (Sustainability Marketing) Market, By Region

Sustainability Marketing: ESG Advisory Market, By Region, 2021–2030 (USD Million)						
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
North America	924	1,072	1,289	1,401	4,484	21.3%
Europe	836	940	1,096	1,185	2,779	15.2%
Asia Pacific	516	648	840	925	4,738	31.3%
Middle East & Africa	175	213	270	300	1,367	28.7%
South America	376	430	510	556	1,555	18.6%

Source: Markets and Markets, CRISIL Research
Note: E : Estimated; P: Projected

Technical Support

Technical support captured 9.0 % of the market in 2023. The technical support segment within the ESG advisory market is vital for helping companies implement and sustain their ESG practices effectively. This segment provides essential services that facilitate the collection, analysis, and reporting of ESG data, ensuring that companies meet regulatory requirements and stakeholder expectations. Below, we delve into the services offered, market drivers, regulatory considerations, and key facts surrounding technical support in ESG. Technical support in the ESG realm encompasses a variety of services that assist companies in managing their ESG initiatives. One critical service is ESG data management. This involves helping companies efficiently collect, analyze, and report ESG data. Technical support providers set up data management systems, define data collection protocols, and ensure data quality, allowing companies to maintain accurate and reliable ESG records. Another key service is ESG software implementation. Technical support teams assist companies in selecting and deploying software solutions tailored to

managing ESG performance. These solutions might include tools for tracking carbon footprints, managing waste, or measuring social impact. Companies can streamline their ESG processes and enhance data accuracy by implementing these software solutions. Sustainability reporting assistance is also a significant component of technical support. This service guides companies through preparing and publishing ESG reports, ensuring compliance with established frameworks such as the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB). Technical support teams provide the expertise needed to navigate these complex reporting standards. Furthermore, technical training is an essential service provided by technical support teams. They offer training programs for employees on various aspects of ESG, including greenhouse gas accounting and social responsibility practices. This training ensures that employees are knowledgeable and competent in executing the company's ESG strategies.

Several factors drive the demand for technical support in the ESG advisory market. One significant driver is the growing complexity of ESG reporting. As ESG reporting frameworks evolve and become more intricate, companies face challenges in maintaining compliance without the expertise provided by technical support. Additionally, there is an increased focus on data-driven ESG management. Companies are recognizing the importance of collecting and analysing data to make informed ESG decisions. Technical support facilitates this process by providing the tools and expertise to handle vast amounts of ESG data. The need for efficient data management is another crucial driver. Large companies often generate extensive amounts of ESG data, requiring robust systems to manage and analyze this information. Technical support ensures these systems are in place, enabling companies to maintain high standards of data integrity and accessibility. In the realm of ESG technical support, several regulatory considerations must be considered. Data privacy regulations, such as the General Data Protection Regulation (GDPR), are paramount. Technical support providers must ensure that their data handling practices comply with these regulations to protect sensitive ESG data. Cybersecurity concerns are also significant. As companies store and manage large volumes of ESG data, they become targets for cyber threats. Technical support providers must implement robust security protocols to safeguard against data breaches and ensure the integrity of ESG information.

Table 21 ESG Advisory (Technical Support) Market, By Region

Technical Support: ESG Advisory Market, By Region, 2021–2030 (USD Million)						
Region	**2021**	**2022**	**2023**	**2024 E**	**2030 P**	**CAGR (2024-2030)**
North America	349	396	466	506	1,305	17.1%
Europe	228	261	309	342	912	17.8%
Asia Pacific	177	226	297	331	1,896	33.8%
Middle East & Africa	47	57	71	79	340	27.5%
South America	94	110	135	151	510	22.5%

Source: Markets and Markets, CRISIL Research
Note: E : Estimated; P: Projected

ESG is no longer seen as an add-on but as a fundamental component of business strategy. Several factors are driving the importance of ESG integration and strategy formulation. Regulatory pressure is increasing, with more regulations mandating sustainability reporting and disclosures, necessitating a well-defined ESG strategy for compliance. Additionally, there is a growing focus on stakeholder capitalism, where companies consider the interests of all stakeholders, not just shareholders. Investors are also placing greater emphasis on ESG performance, with many prioritizing companies that demonstrate a strong commitment to sustainability. This makes a robust ESG strategy

essential for attracting capital. Furthermore, a well-defined ESG strategy can enhance a company's brand reputation and build trust with customers and stakeholders, providing a competitive edge in the market. Managing ESG-related risks is another critical driver, as these factors can pose significant threats to a company's operations and long-term sustainability. This necessitates the ESG Advisory services that addresses the concerns of diverse groups, promoting a more inclusive and sustainable approach to business.

Carbon Market: A maturing Landscape amid Opportunities and Obstacles

Coordinated global climate action are expected to boost the carbon market growth

More countries and regions are developing their own carbon pricing mechanisms, leading to an expansion of the global carbon market. According to the World Bank Carbon Pricing Dashboard, as of June 2024, 110 carbon pricing instruments (36 ETSs, 39 carbon taxes, and 35 governmental crediting mechanisms) have been implemented in 53 national jurisdictions and 40 sub-national jurisdictions, with more planning to implement them in the future. This growth is attributed to positive developments during COP26 around Article 6 of the Paris Agreement, whereby carbon credits can be traded to meet countries' Nationally Determined Contributions (NDCs), as well as growth in the self-regulated Voluntary Carbon Markets (VCM), driven by demand from companies to meet their voluntary climate commitments. Domestic compliance market instruments, namely Emission Trading Systems and carbon taxes, have also been growing.

Compliance and Article 6 markets are key to enhancing long-term goals. On the other hand, VCMs play a pivotal role in directing immediate climate finance. Well-designed Voluntary Carbon Markets will be instrumental in facilitating payments for emission reductions, offering a source of financing for climate actions. These also help build capacity to support compliance and Article 6 implementation.

Investor push and stringent regulations to drive corporate action

Demand for voluntary carbon offset is predominantly driven by companies with a sustainability infused corporate strategy as a core driver. When it comes to driving sustainability, investors worldwide have put corporations and regulators on notice. Consumer awareness and preferences is another factor influencing sustainable industrial practices. In that light, growing recognition of environmental responsibility and the commitments made by companies worldwide to achieve net-zero emission targets and invest in the decarbonization ecosystem will continue to drive growth of the voluntary markets.

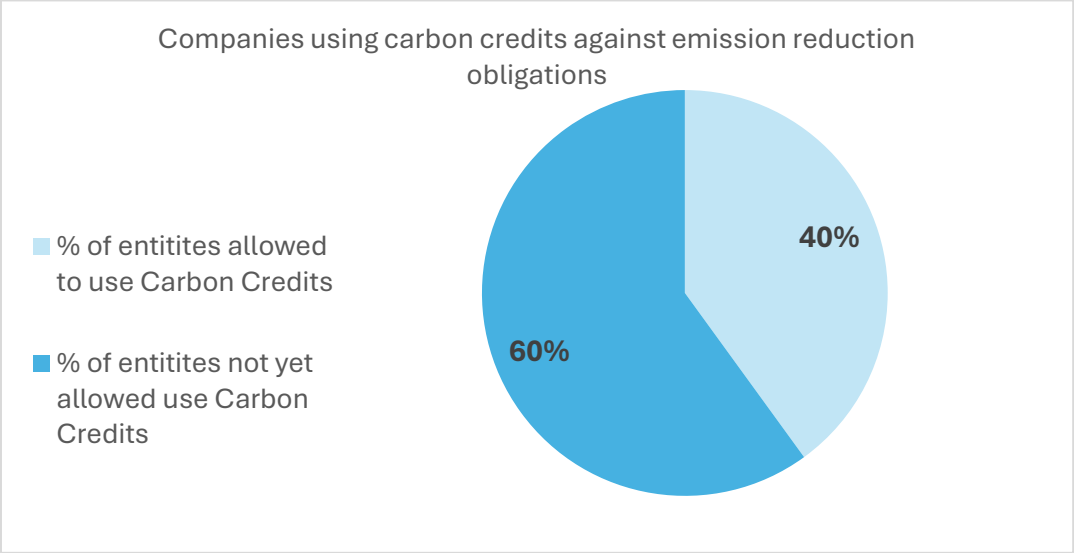
CBAM expected to incentivize corporations to participate in the carbon markets

EU's CBAM (Carbon Border Adjustment Mechanism), introduced in 2023, is expected to speed up the introduction of carbon emission pricing in other nations. CBAM aims to prevent carbon leakage by putting a price on the embedded carbon footprint of imported goods, thereby incentivizing cleaner production in non-EU countries and safeguarding competitiveness of industries operating in EU. Since the launch, companies exporting to the EU have to report on the emissions that are caused by the production and transportation of certain goods - their 'embedded emissions'. From January 1, 2026, they will have to pay for these emissions. Initial sectors covered by CBAM are electricity, hydrogen, cement, fertilizers, aluminum, iron, and steel. This is set to be expanded to include aviation, maritime, lime, oil refining, all metals, pulp and paper, glass and ceramics, acids, and organic chemicals by 2030. This, in turn, is expected to lead to an increase in demand for verified carbon credits as businesses seek to offset their emissions to comply with CBAM regulations. The UK has already announced that it will introduce a CBAM scheme of its own from 2027.

Allowing use of carbon credits generated outside the country against obligations to support growth in carbon markets

Governments allow regulated entities to use carbon credits toward their GHG obligations to increase flexibility, lower compliance costs, and extend the carbon price signal to uncovered sectors. As of January 2024, around 40% of carbon pricing instruments in operation (7 carbon taxes and 23 ETSs), allow for the use of carbon credits to offset

liabilities. Almost all jurisdictions only permit the use of domestically generated carbon credits. Singapore began allowing businesses liable to pay the carbon tax to use international carbon credits that meet defined environmental integrity criteria to offset up to 5% of their taxable emissions in January 2024. Carbon taxes permitting the use of domestically generated carbon credits to offset tax liabilities include Chile, Colombia, and South Africa. Among ETSs, California, Mexico, and the Republic of Korea, as well as others, allow for the limited use of carbon credits from specified crediting mechanisms. This will expand the availability of carbon credits markets to the entities in these geographies.



Source: World Bank.

Note: As of April 2024, Carbon taxes that allow regulated entities to use carbon credits include: Chile CT, Mexico CT, Colombia CT, Queretaro CT, South Africa CT, Switzerland CT, and Singapore.
Emission trading schemes that allow regulated entities to use carbon credits against obligations include: Australia ETS, Indonesia ETS, Kazakhstan ETS, Saitama ETS, Tokyo ETS, Canada Federal ETS, Alberta ETS, British Colombia ETS, Shenzhen pilot ETS, Fujian pilot ETS, Guangdong pilot ETS, Hubei pilot ETS, Mexico pilot ETS, Tianjin pilot ETS, Chongqing pilot ETS, Washington ETS, Beijing pilot ETS, China national ETS, RGGI, Shanghai pilot ETS, Quebec ETS, California ETS, Rep. of Korea ETS.

SEC adopts rules to enhance and standardize climate-related disclosures for investors

In March 2024, the SEC issued final rules to mandate companies to disclose climate-related information, including the use of carbon credits. The final rules will require a registrant to disclose the capitalized costs, expenditures expensed, and losses related to carbon offsets and renewable energy credits or certificates (RECs) if used as a material component of a registrant's plans to achieve its disclosed climate-related targets or goals, disclosed in a note to the financial statements. This is expected to standardize the businesses to comprehensively disclose their emissions and carbon credit usage.

SEBI's Proposal to include Green Credit Program under BRSR Framework

In the Union Budget for FY24, the Green Credit Program (GCP) was proposed to be notified under the Environment (Protection) Act, 1986 to encourage behavioral change by incentivizing environmentally sustainable and responsive actions by companies, individuals and local bodies and help mobilize additional resources for these activities.

SEBI's recent consultation paper, published on May 22, 2024, proposes a new incentive for listed companies and their value chains to embrace environmentally sustainable practices. SEBI has proposed that 'green credits'

generated by the listed company and the value chain partners can be added as a leadership indicator under Principle 6 of Business Responsibility and Sustainability Reporting (BRSR) framework, which states that businesses should respect and make efforts to protect and restore the environment. The Green Credits can be generated by a listed company and its value chain partners through plantations of trees on waste or degraded lands and river catchment areas. Inclusion of green credit disclosures in BRSR is expected to drive demand for these credits. Companies and their value chain partners seeking to demonstrate leadership will be incentivized to participate in generation or acquiring green credits through verified projects. This move from SEBI is expected to spur the need for independent verification of the environmental claims by the listed companies.

Concessions from SBTi expected to help carbon markets

The Science Based Targets initiative (SBTi), a leading framework for companies to set science-based targets beyond supply chain emissions, has recently made a significant shift by allowing the use of verified carbon credits to achieve these targets. The SBTi board has allowed a statement to say that they are considering a change of policy for use of credits in Scope 3 abatement. As of May 2024, SBTi is working with more than 8,000 companies to set science-based targets and more than 5,500 of those companies already have an approved target. The decision to use VCM credits to offset some Scope 3 emissions could drive a major increase in the demand for VCM credits, given the high volume of emissions typically associated with Scope 3. This will further lead to a surge in demand for credible verification of carbon credit projects to ensure they contribute meaningfully to emissions reductions and meet SBTi criteria.

World Bank intervention to help boost supply and add further credibility to the market

The World Bank has laid out ambitious plans for the growth of high integrity global carbon markets. Under this plan, 15 countries are set to earn income from the sale of carbon credits generated from preserving their forests. It is expected that, by the end of 2024, these countries will have produced over 24 million credits, and as many as 126 million by 2028. These credits could earn up to $2.5 billion in the right market conditions. Thriving carbon markets have the potential to do the same for other countries in the long-term. The 15 countries-Chile, Costa Rica, Cote d'Ivoire, Democratic Republic of Congo, Dominican Republic, Fiji, Ghana, Guatemala, Indonesia, Lao PDR, Madagascar, Mozambique, Nepal, Republic of Congo, and Viet Nam-are part of the World Bank's Forest Carbon Partnership Facility (FCPF). This is expected to increase the supply of carbon credits and lend credibility to the market.

New Carbon Exchanges expected to enhance access to markets

The Asia region is witnessing an emergence of new carbon exchanges in response to the growing attention towards VCM. In India, Power Exchange India Ltd (PXIL), promoted by NSE and NCDEX, is expected to launch its carbon-credit trading platform by the second quarter of FY25, to support the emerging Green Credit Trading Scheme (GCTS). Other examples within Asia include the introduction of Malaysia's National Voluntary carbon market, Thailand's first VCM credit exchange, and Climate Impact X, a carbon trading hub hosted by Singapore.

New crediting mechanisms to boost supply outlook, balancing recent fall in issuances

New and planned crediting mechanisms and approaches are expected to improve the supply outlook, targeting different demand segments across the domestic-international and voluntary-compliance spectrums. Demand for carbon credits continues to be mostly driven by voluntary purchases, although compliance demand is emerging.

Governments, particularly in middle-income countries, are increasingly including crediting frameworks in their policy mix, with a view to supporting both compliance and voluntary markets.

Some middle-income countries see the development and expansion of domestic carbon credits as a springboard for participation in international carbon markets, which can serve as a vehicle to fund the low-carbon transition. Others are focused on domestic use instead of selling carbon credits on international markets. These two motivating factors have generated significant progress on crediting mechanisms across several jurisdictions in the last year.

VRE Program supports purchase of Voluntary credits for Cap-and-Trade Program

The Voluntary Renewable Electricity (VRE) Program allows purchasers of eligible voluntary renewable electricity to request retirement of allowances on their behalf under the Cap-and-Trade Program. The VRE Program supports purchases of renewable electricity and renewable energy credits (RECs) that are not mandated by the Renewables Portfolio Standard and provides a mechanism for the recognition of voluntary purchases of renewable electricity or RECS in the California Cap-and-Trade Program. This is expected to further boost demand for the RECs.

CORSIA to help boost growth in VCM

Aviation is a difficult sector to abate because of the lack of alternative fuels. While aeroplane operators are considering scaling up adoption of sustainable aviation fuels and technological advancements to help reduce emissions, this remains a long-term goal. In the short to medium term, these emissions will need to be offset. To realise this opportunity, International Civil Aviation Organisation (ICAO) created The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), a systematic effort to measure, report, and verify (MRV) emissions from the aviation sector in each of its member states.

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) has been an important driver of demand. The commercial aviation sector has historically been one of the most significant purchasers of carbon credits on the VCM. During 2021-2023, pilot phase for implementation of CORSIA, airlines have been able to voluntarily buy eligible carbon credits from certain standards and project types including American Carbon Registry (ACR), Architecture for REDD+ Transactions (ART), BioCarbon Fund for Sustainable Forest Landscapes (ISFL), China GHG Voluntary Emission Reduction Program, Clean Development Mechanism (CDM), Climate Action Reserve (CAR), Forest Carbon Partnership Facility (FCPF), Global Carbon Council (GCC), The Gold Standard (GS), SOCIALCARBON, Verified Carbon Standard (VCS), to offset their carbon emissions from international flights. With 126 countries signed up to comply with the scheme, the market is expected to see a significant increase in demand for carbon credits from airlines, and a further increase from the start of the second phase in 2027.

Efforts have been initiated globally to build confidence around the VCMs and help avoid Greenwashing

A trustworthy Voluntary Carbon Market will increasingly provide companies with the opportunity to use them to meet their voluntary climate commitments. Recently, several initiatives in the Voluntary Carbon Markets (VCM) have aimed to enhance market integrity by establishing common frameworks and standardizing carbon credit verification and certification.

The Integrity Council for the Voluntary Carbon Market

The Integrity Council for the Voluntary Carbon Market (ICVCM) is multi-stakeholder led independent governance body that sets a quality threshold for carbon credits. It establishes and maintains the highest standards of ethics, sustainability, and transparency for the global voluntary carbon market.

To delineate high-quality credits in support of scaling the carbon market, it released its full global benchmark for high-integrity carbon credits, with the final versions of the Core Carbon Principles (CCPs), Assessment Framework, and Assessment Procedure, in 2023. The CCPs will act as a global benchmark for carbon credits that meet rigorous thresholds of the CCP criteria. The CCPs will provide a means of identifying carbon credits that create real climate impact based on best practices. This is seen as a step in the right direction to ensure the credibility of carbon credits. Carbon crediting programmes issuing credits for voluntary buyers can already apply for CCP assessment, which will confirm whether they meet the program criteria set out in the Assessment Framework.

The Integrity Council for the Voluntary Carbon Market announced in January 2024 that it will begin assessing more than 100 active carbon credit methodologies for adherence to the high-integrity Core Carbon Principles (CCPs).

Voluntary Carbon Markets Integrity Initiative (VCMI)

An important aspect of the VCM is ensuring that buyers are empowered to make credible claims that accurately and transparently describe their voluntary climate action. In 2023, VCMI launched its capstone Claims Code of Practice with the goal of building trust and confidence in how companies engage with carbon markets. The Claims Code of Practice provides companies with a rulebook on the credible use of carbon credits and associated climate claims, all with the goal of accelerating climate action. The initiative is working to publish additional modules for the Claims Code of Practice in order to make it operational for ambitious corporate entities.The Claims Code of Practice is expected to enhance demand for voluntary carbon credits in light of lower-than-expected demand through 2023. VCMI is currently conducting research to explore additional VCMI claims and an “on ramp” option which will provide a pathway towards the Silver, Gold, and Platinum claims. Other work and modules include finalised names of claims and a monitoring, reporting, and assurance framework.

U.S. backing of high-integrity voluntary carbon markets

In May 2024, The United States (U.S.) Government released a Voluntary Carbon Markets Joint Policy Statement and Principles (Principles) which is aligned with VCMI's Claims Code of Practice (Claims Code). This move from the U.S. has helped build confidence among governments and businesses across the world in high-integrity VCMs and is in turn expected to support growth of the market. High-integrity voluntary carbon markets can put extra investment to work that will otherwise remain untapped. This is expected to boost overall participation and unlock investment.

EU Carbon Removal Certification:

The EU carbon removal certification framework aims to scale up carbon removal activities and fight greenwashing by empowering businesses to show their action in this field. This voluntary framework sets rules for the independent verification of carbon removals, as well as rules to recognize verification schemes that can be used to demonstrate compliance with the EU framework. As the framework only recognizes activities that remove carbon, reduction credits are unable to be certified under this framework.

In February 2024, the European Parliament and the Council of the EU reached a provisional agreement on the Carbon removals and carbon farming (CRCF) Regulation, establishing the first EU-wide voluntary framework for certifying carbon removals, carbon farming and carbon storage in products generated in Europe. The regulation establishes EU quality criteria and outlines monitoring and reporting processes to facilitate investment in innovative carbon removal technologies, as well as sustainable carbon farming solutions, while addressing greenwashing.

The following projects can be certified under the CRCF Regulation:

1. Permanent Carbon Removals
2. Carbon Farming and Carbon storage in products
3. Carbon storage in long-lasting products

The high-quality carbon removals should meet the EU quality criteria for: quantification, additionality, long-term storage, and environmental sustainability.

COP28 Presidency, GFANZ and VCMI pledge to collaborate with Businesses, and Other Stakeholders

In September 2023, the COP28 Presidency, the Glasgow Financial Alliance for Net Zero (GFANZ), and the Voluntary Carbon Markets Integrity Initiative (VCMI) hosted a high-level round table to promote high-integrity demand in voluntary carbon markets. The discussion emphasized the vital role of high-integrity VCMs in the net zero transition, the need for a comprehensive integrity framework for VCMs, and the importance of clear demand signals from COP28.

The voluntary carbon market (VCM) is expected to see a surge in activity, driven by increasing corporate commitments to climate action and the growing demand for carbon offsets to achieve net-zero targets. Due diligence is also becoming much more extensive in the wake of increasing scrutiny on the provenance of carbon credits. The rapid growth in the market necessitates robust assurance and 3rd party verification systems to ensure the integrity and effectiveness of carbon offset projects.

New Technologies & Innovation, transforming transparency & trust

One of the most pressing challenges in the voluntary carbon market is the lack of transparency. Carbon credits are often traded in a decentralized and non-standardized manner, making it difficult to trace the origin and history of these credits. This opacity can result in double-counting, where the same carbon credits are sold multiple times, undermining the environmental impact of these transactions.

The continuing growth of the VCM is attracting new technologies and innovation with traceability and quantification platforms. For example, the application of blockchain technology to the VCM is useful in providing auditable, traceable, and reproducible records that document the emissions process and life cycle of carbon credits. Each carbon credit is recorded as a transaction on the blockchain. This transaction includes detailed information about the credit's origin, the methods used for emission reductions, and its transfer history. Because the blockchain is immutable and decentralized, all participants can trust the information on it. This solves the problem of double counting as each credit's unique identifier prevents it from being duplicated or sold multiple times. Blockchain technology has the potential to revolutionize the voluntary carbon market by enhancing transparency and traceability. Key benefits of using blockchain include Enhanced Transparency, Reduced Fraud and Double-Counting, Improved Trust and Efficiency, Lower Transaction Costs, among others.

Challenges to Adoption

Despite the inherent promise and potential opportunities, associated with the VCM, fundamental challenges impede further development and adoption of the VCM which occur over the lifecycle of the carbon credit.

Asymmetry remains significant hurdle

Increased Scrutiny in recent years has spurred positive developments in the carbon credit market. Improved methodologies, redesigned processes, and stricter governance protocols are raising the bar for credit quality. However, despite these advances, asymmetry among the frameworks creates hurdles. The VCM relies on a complex interplay of standards developed by various organizations, including Verra, Gold Standard, and the American Carbon Registry (ACR). These standards are constantly evolving, with increased emphasis on comprehensive reporting requirements, data transparency, accuracy, and traceability. The voluntary carbon market currently lacks a single, universally accepted standard for verification methodologies. This can create confusion and inconsistencies in verification practices.

Independent organizations that set standards for projects that produce carbon offsets and certify carbon credits play a significant role in today's market. At COP28, six of the largest independent crediting programs, including Verra, Gold Standard, and the Global Carbon Council, agreed to collaborate and better coordinate their approaches to certification. Initiatives like the development of core carbon principles (CCP) by Integrity Council for Voluntary Carbon Market (ICVCM) and Voluntary Carbon Market Integrity Initiative (VCMII) are working to address this by providing standardized frameworks.

The integrity of carbon credits remains a critical area of concern, buyer-side risks

Studies show that market participants identified negative public perception and the quality of carbon credits as the primary obstacles confronting the voluntary carbon market. The VCM faces challenges in building trust and maintaining market confidence. Possibility of Greenwashing has raised concerns about the market's integrity and reliability, creating a negative perception that could hinder its growth. Corporations are under great public scrutiny and sometimes legal pressure. Civil society and the media are increasingly aware of misleading climate claims and are calling out corporate greenwashing that remains widespread. Buyers are exposed to reputational risks, where any shortcomings in project integrity can result in fines, penalties, and reputational damage. For example, funded projects fail to deliver on environmental promises or where a project causes social or ecological harm. The risk of double counting prevails alongside.

Financing and Verification Delay is a Barrier on the Supply Side

The participants of the market, majorly the project developers, identify verification delays, limited access to early-stage financing, and inefficiencies in the value chain caused by intermediaries as the key bottlenecks in the growth of the market. Inadequate funding for many small to mid-size developers presents a significant challenge on the supply side of the carbon credits. Studies cite that Forestry and Land Use and Renewable Energy credits had the largest gross declines in volume due to delays in issuing new Forestry and Land Use credits which is further attributed to two major reasons:

1. Waiting for Verra to release their updated consolidated methodology for Reduced Emissions from Deforestation and Degradation in Developing Countries (REDD+) projects, and
2. Increased buyer due diligence in the face of recent media scrutiny of these projects.

Verra, the organization responsible for maintaining the VCS standard that hosts the majority of REDD+ projects, released a new version of their consolidated REDD+ methodology in November 2023 that includes updated baseline calculations and uncertainty estimation procedures. Though the updated methodology arrived too late in the year to make a discernable impact on the volume of transactions in 2023, this development is expected to influence sales of REDD+ credits in years to come.

Establishing an effective policy

Carbon credit markets, established through Cap-and-Trade policies, hold immense potential for driving cost-effective emission reductions and mitigating climate change. However, these markets face several challenges that require careful consideration and innovative solutions.

One of the most critical hurdles lies in setting the right "cap" on emissions. A cap that is too high essentially renders the program ineffective as companies can meet compliance requirements without significant emission reductions. This can lead to a surplus of carbon credits, driving down prices and hindering investment in emission reduction projects. Conversely, a cap that is too low creates a situation of scarcity, where demand for credits outstrips supply. This scenario drives carbon prices up very quickly, potentially leading to economic disruption as industries struggle with high compliance costs. Ultimately, these costs might be passed on to consumers through higher prices for goods and services. Finding the optimal cap level requires a data-driven and collaborative approach. Governments can leverage scientific analysis to determine the level of emission reduction needed to achieve established climate goals. Economic modeling can further inform policy decisions by predicting the impact of different cap levels on industries and consumers, ensuring a balance between environmental ambition and economic feasibility.

Ensuring market stability and addressing concerns surrounding price volatility is also crucial for attracting long-term investments in emission reduction projects. Complexities in market design and administrative procedures can create barriers to entry for new participants, hindering market efficiency. Streamlining Monitoring, Reporting, and Verification (MRV) processes through standardized methodologies and innovative technologies can reduce costs and improve data transparency.

By recognizing and addressing these challenges, while simultaneously capitalizing on the existing growth drivers, carbon offset and credit markets can become a powerful tool in combating climate change and fostering a transition towards a more sustainable future.

Competitive scenario in the assurance and third-party verification and validation market

The carbon offset market is experiencing a period of dynamic growth, leading to a more dynamic environment for third party validation and verification bodies like Earthood. The market landscape consists of both established firms expanding their services and new entrants specializing in certifications and accreditations from various standard-setting bodies.

The role of third-party validation and verification body is likely to remain central to established carbon offset standards for the foreseeable future. These VVBs assess carbon offset projects, ensuring alignment with the standards and regulations. Validated and Verified projects fosters transparency and enhances buyers' confidence in the market. Established bodies verify VVB competence and allow them to validate and verify projects and therefore accreditation remains a cornerstone to the VVBs. Players (VVBs) need to compulsorily obtain accreditations from recognized bodies to be able to operate in the industry.

Several bodies provide accreditations for the validation and verification bodies in the carbon offset markets. Earthood holds accreditation from a diverse range of organizations including Global Accreditation Bureau (GAB), Verified Carbon Standards (VCS), Golds Standards, Climate Action Reserve (CAR), Global Carbon Council (GCC), International Carbon Registry (ICR), Social Carbon, CCBA, among others. All other major players, considered for peer benchmarking, are registered with these major standards.

Players in the market gains credibility in the market by aligning their operating practices with the highest standards in the industry. They position themselves within the evolving market by emphasizing their diverse accreditation portfolio, project-specific expertise, and commitment to implementing efficient processes. Earthood has outlined plans to actively invest in and developing technologies like Digital Monitoring, Reporting, and Verification (DMRV) system, which holds the potential to enhance operational efficiency and productivity in the future.

Growing public awareness against the greenwashing and integrity of the quality of the credits generated presents opportunities for growth for validation and verification services. While limited brand awareness can hinder penetration in new markets, developing a strong reputation for expertise in specific project types or geographic regions could be a key advantage. New entrants may emerge, however, established client relationships built on trust and history of delivering high quality services can help Earthood maintain a strong position.

Currently, the validation and verification of carbon projects in India is primarily served by privately held entities. As the country transition towards a more structured carbon trading framework, including the development of the national emission trading system and initiatives like the Carbon Credit Trading Scheme (CCTS), there is expected to be an increasing demand for accredited VVBs.

CRISIL has considered the following players for the purpose of benchmarking operational and financial parameters. Among the range of other services, these players offer third-party verification and validation services to project developers across various industries, helping to ensure accuracy and compliance with standards and regulations. These players either operate in the same line of business or have a service portfolio like that of Earthood Services Private Limited. Please note the peers set considered below is an indicative list and not an exhaustive list of players present in the Validation and Verification industry. Also, kindly note that the revenue numbers for all entities considered

except Earthood also account for other non-carbon market related services. Revenue Numbers for Earthood correspond to FY24 (April to March cycle).

Kindly note that the following competitors are considered for this section:

1. TÜV SÜD AG
2. TÜV NORD Group
3. TÜV Rheinland AG
4. Applus Services, S.A.
5. Bureau Veritas
6. DNV GL
7. 4K Earth Science Private Limited
8. Carbon Check India
9. Epic Sustainability Services

Note: Data in this section is obtained from publicly available sources, including annual reports of players, regulatory filings, and/or company websites. The financials used in the competitive section are re-classified by CRISIL based on the annual report and financial filings by the players.

Operational overview of the players under review

Sr. No.	Company Name	Year of Incorporation	No. of Employees	VVB Status	Services Offered
1	Earthood	2012	70 +	Active	Auditing, Validation, Verification, and Certification, Compliance, Sustainability Advisory and Reporting
2	TÜV SÜD AG	1866	20000 +	Active	Auditing and System Certification, Testing Services, Product Certification, Inspection, Technical Advisory, Training, Risk Management,
3	TÜV NORD Group	1869	10000 +	Active	Certification - Management System, Food Safety, Laboratory Services, Product Certification, Third Party Inspection, Quality Assurance, Social Accountability
4	TÜV Rheinland AG		20000 +	Active	Testing and assessment, Certification and Auditing, Training and Qualification, Inspection and Supervision, Consulting and Project Management
5	Applus Services, S.A.	1996	25000 +	Active	Inspection and QA/QC, Engineering and consulting, Supervision and quality management, Non-destructive testing, Testing and analysis, Vendor surveillance, Energy efficiency, Certification service
6	Bureau Veritas	1828	80000 +	Active	Sustainability Assurance, Asset lifecylce solution, Energy Transition Conformity Assessment, Compliance, Testing, Inspection and Certification, Consulting and Training
7	DNV GL	1864	15000 +	Active	Advisory, Certification, Classification, Cyber security, Data and analytics, Inspection, Software, Testing, Training, Verification and assurance
8	4K Earth Science Private Limited	2018		Active	Auditing, Validation, Verification, Compliance, Assurance and Training

Sr. No.	Company Name	Year of Incorporation	No. of Employees	VVB Status	Services Offered
9	Carbon Check (India) Pvt. Ltd.	2012	50 +	Active	Auditing, Validation, Verification, Compliance, Assurance
10	Epic Sustainability Services Pvt. Ltd.	2010	100 +	Active	Auditing, Reporting, Assurance, Certification

Sr. No.	Company Name	Accrediation Scope							
		Agriculture	Chemical Processes/ Industrial Manufacturing	Energy Efficiency/ Fuel Switching	Forestry and Land Use	Household/ Community Devices	Renewable Energy	Transaportation	Waste Disposal
1	Earthood	☑	☑	☑	☑	☑	☑	☑	☑
2	TÜV SÜD AG	☑	☑	☑	☑	☑	☑	☑	☑
3	TÜV NORD Group	☑	☑	☑	☑	☑	☑	☑	☑
4	TÜV Rheinland AG	☑	☑	☑	☑	☑	☑	☑	☑
5	Applus Services, S.A.	☒	☒	☒	☒	☒	☑	☒	☑
6	Bureau Veritas	☑	☑	☑	☑	☑	☑	☑	☑
7	DNV GL	☑	☑	☑	☑	☑	☑	☑	☑
8	4K Earth Science	☑	☑	☑	☑	☑	☑	☒	☑
9	Carbon Check India	☑	☑	☑	☑	☑	☑	☑	☑
10	Epic Sustainability Services	☑	☑	☑	☑	☑	☑	☑	☑

Players in the verification and validation industry cater to projects across all the major sectors. While major players offer similar services, Earthood specializes in the Carbon Offset Market validation and verification area across different programs.

Earthood possesses a diverse range of accreditations, including those from the United Nations Framework Convention on Climate Change (UNFCCC) as a Designated Operational Entity (DOE), the ANSI National Accreditation Board (ANAB), and the Global Accreditation Bureau (GAB). These accreditations enable Earthood to certify carbon offset projects across diverse array of programs and registries—including the Clean Development Mechanism (CDM), Verified Carbon Standards (VCS), Gold Standards (GS), and several others. In total the company can provide validation and verification services under 15 registries and standards, allowing it to operate in multiple regulatory environments.

Earthood also provides services across multiple sectors and is accredited to operate in 11 out of 15 sectors classified by the UNFCCC. Its sectoral coverage includes renewable energy, energy demand, forestry and agriculture, waste, and others.

Earthood has been ranked as the “Best Verification Company” by Environmental Finance, an online news and analysis service, in the Voluntary Carbon Market Rankings 2023 and 2024.

Growth opportunities in the market

As the global carbon market continues to evolve, various strategic pathways for growth have emerged. These pathways are driven by emerging markets, increasing regulatory frameworks, and growing demand for sustainability and carbon-related advisory services.

Geographic expansion for market penetration

Expanding into diverse regions presents an opportunity to tap into diverse project portfolios, such as Latin America, offer opportunities for nature-based projects and presents growth opportunities. Increased geographic presence in diverse regions could enable more effective service delivery and penetration into new carbon markets.

Tapping opportunities into ESG advisory sector

With the rising global focus on environmental, social, and governance (ESG) factors and growing emphasis on corporate sustainability commitments, there is a growing market for ESG advisory services to support organizations in aligning with global ESG frameworks and regulatory standards. Companies in this sector are expanding their offerings beyond validation and verification to include a wide range of sustainability advisory services such as energy audits, water audits, environmental due diligence, and compliance with extended producer responsibility (EPR) regulations.

As a part of this, Earthood has undertaken notable projects including certifying the Delhi Metro Rail Corporation's headquarters, Metro Bhawan, as carbon neutral. Furthermore, Earthood has also conducted environmental audits for the Indian Army's Pulgaon military railway station to provide recommendations for CO_2 emissions reductions.

Opportunities from Transitioning Carbon Markets

The transition of carbon projects from existing carbon development mechanism (CDM) to the Article 6.4 mechanism under the Paris Agreement is expected to expand the market for emission reductions (ERs). This transition could notably increase the number of projects generating carbon credits, particularly as the framework broadens to include sectors previously excluded under the Clean Development Mechanism (CDM). The potential for an increase in the volume of emission reductions due to this shift may present new opportunities for project developers, validators, and verifiers.

Financial overview of the companies under review

Across the Third-Party Validation and Verification segment, CRISIL has considered consolidated level numbers for available players as of CY23. Total revenue across all business segments, including non-carbon market services, of the players have been considered for the purpose of analysis in this section.

Key Financials

Table 22 Operating income across all business segments of the players (CY 21-23)

Sr. No.	Company Name	Revenue for CY23 (Rs. Lakhs)	Revenue for CY22 (Rs. Lakhs)	Revenue for CY21 (Rs. Lakhs)	CAGR CY21-23
1	Earthood	4,717.71	3,254.67	1,063.86	110.58%
2	TÜV SÜD AG	2,889,191.97	2,540,090.70	2,260,643.44	13.05%
3	TÜV NORD Group	1,457,158.49	1,287,920.82	1,160,536.52	12.05%
4	TÜV Rheinland AG	2,268,429.38	1,973,132.30	1,777,376.13	12.97%
5	Applus Services, S.A.	1,894,039.14	1,818,596.00	1,505,824.32	12.15%
6	Bureau Veritas	5,400,312.37	5,012,760.27	4,221,681.49	13.10%
7	DNV GL	2,573,552.46	2,114,068.20	1,813,793.86	19.12%
8	4K Earth Science	-	681.33	404.01	68.64%
9	Carbon Check India	-	2,811.80	919.64	205.75%
10	Epic Sustainability Services	-	653.48	425.10	53.72%

Note: 1) The financial numbers for all the entities represented above have been converted to INR considering applicable exchange rates
2) The revenue numbers for all entities except Earthood, 4K Earth Science, Carbon Check India, and Epic Sustainability Services, also account for other non-carbon market related services
3) Numbers for Earthood, 4K Earth Science, Carbon Check India, and Epic Sustainability Services correspond to fiscal year (April to March cycle)
4) These figures have been obtained as is from the latest financial disclosures available of the entities considered.

Source: *Company filings, CRISIL Research*

The revenue numbers of the players, except Earthood, 4K Earth Science, Carbon Check India, and Epic Sustainability Services, correspond to the overall business offerings of the players and not just assurance and 3rd party verification and validation services. Earthood has seen a four-fold increase in its revenue over the last two years driven by diversification in its geographical presence and service offerings.

Table 23 Earnings Before Interest Tax Depreciation and Amortisation (EBITDA) across all business segments of the players

Sr. No.	Company Name	EBITDA for CY-23 (Rs. Lakhs)	EBITDA for CY-22 (Rs. Lakhs)	EBITDA Margin (CY 23)	EBITDA Margin (CY 22)
1	Earthood	2,729.42	1,379.03	57.85%	42.37%
2	TÜV SÜD AG[7]	369,144.36	335,331.36	12.78%	13.20%
3	TÜV NORD Group	145,228.07	128,011.42	9.97%	9.94%
4	TÜV Rheinland AG	229,443.79	288,280.29	10.11%	14.61%
5	Applus Services, S.A.[8]	474,430.12	432,559.71	25.05%	23.79%
6	Bureau Veritas[9]	828,941.23	978,883.69	15.35%	19.53%
7	DNV GL	438,727.40	351,260.82	17.05%	16.62%
8	4K Earth Science	103.92	43.03	15.25%	10.65%
9	Carbon Check India	629.04	155.49	22.37%	16.91%
10	Epic Sustainability Services	34.13	27.91	5.22%	6.57%

Note: 1) The financial numbers for all the entities represented above have been converted to INR considering applicable exchange rates
2) The revenue numbers for all entities except Earthood, 4K Earth Science, Carbon Check India, and Epic Sustainability Services, also account for other non-carbon market related services
3) Numbers for Earthood, 4K Earth Science, Carbon Check India, and Epic Sustainability Services correspond to fiscal year (April to March cycle)
4) These figures have been obtained as is from the latest financial disclosures available of the entities considered.
5) The financial data for 4K Earth Science, Carbon Check India, and Epic Sustainability Services presented corresponds to the latest available figures for the fiscal year (FY23)
6) EBITDA = Total income – Total expenses + Finance costs + Amortization and depreciation
7) In case of TÜV SÜD AG, EBITDA: Earnings before interest, before other financial result, before amortization & depreciation and before income tax, but after income/loss from participations.
8) In case of Applus Services, S.A., EBITDA: Total Revenue – operating expenses (procurements, staff costs) – other operating expenses + Depreciation and amortization charge
9) In case of Bureau Veritas, EBITDA: Total operating income – operating expenses (Supplies, Other purchases and external charges, Taxes other than on income, Wages and salaries, Payroll taxes, Other expenses) + Depreciation, amortization and impairment

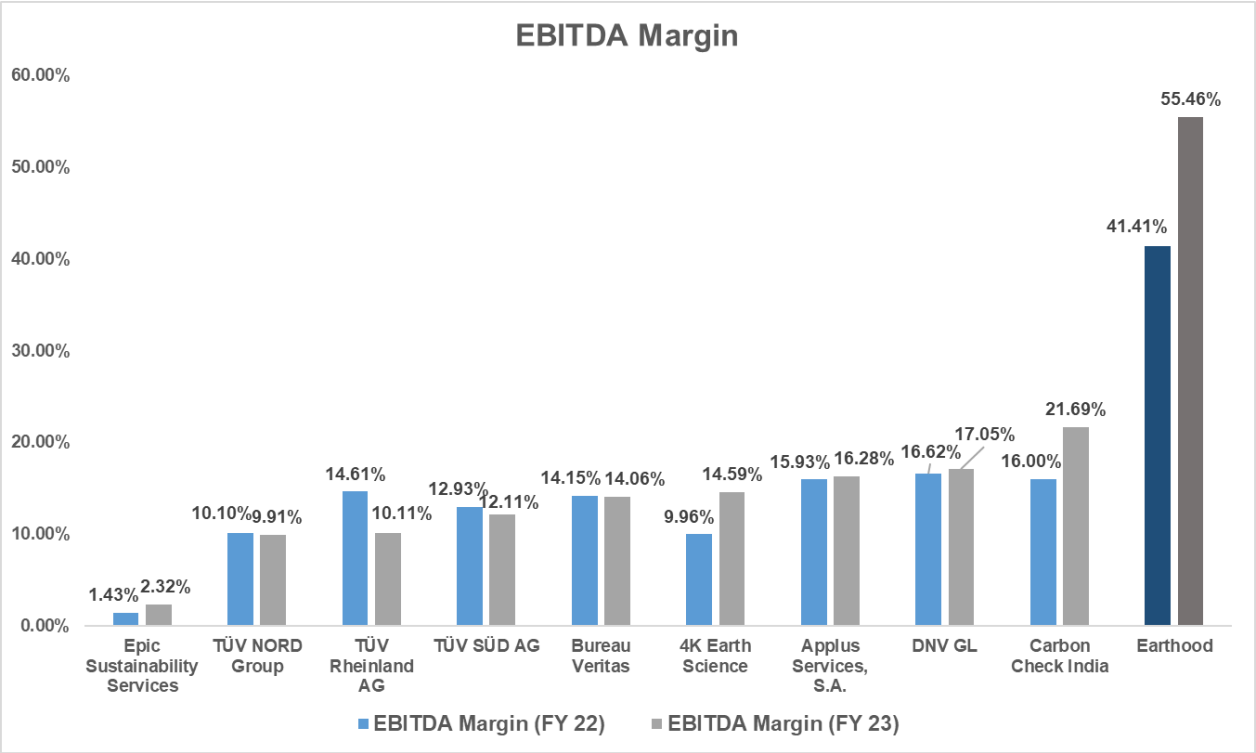
Source: *Company filings, CRISIL Research*

Earthood recorded a robust EBITDA margin of 57.85% during FY24 which indicates strong operational efficiencies.

Managing employee costs a critical factor

Underscoring the service-driven nature of the industry, employee costs constitute a substantial share of total revenue. It is generally understood that in service sectors, employee-related expenses—including salaries, benefits, and training—can account for anywhere from 15% to 30% of total revenue. This range varies depending on factors such as company size, operational efficiency, and specific business models. In the Validation and Verification industry, the demand for highly skilled employees is even more pronounced. These services require specialists with advanced expertise in areas such as environmental science, carbon accounting, and regulatory compliance. The need for ongoing training, certifications, and deep technical knowledge adds to the cost, making employee-related expenses a crucial factor in maintaining service quality and meeting industry standards.

EBIDTA across all business segments of the players (FY23)



Source: *Company filings, CRISIL Research*

Table 24 Net Profit across all business segments of the players

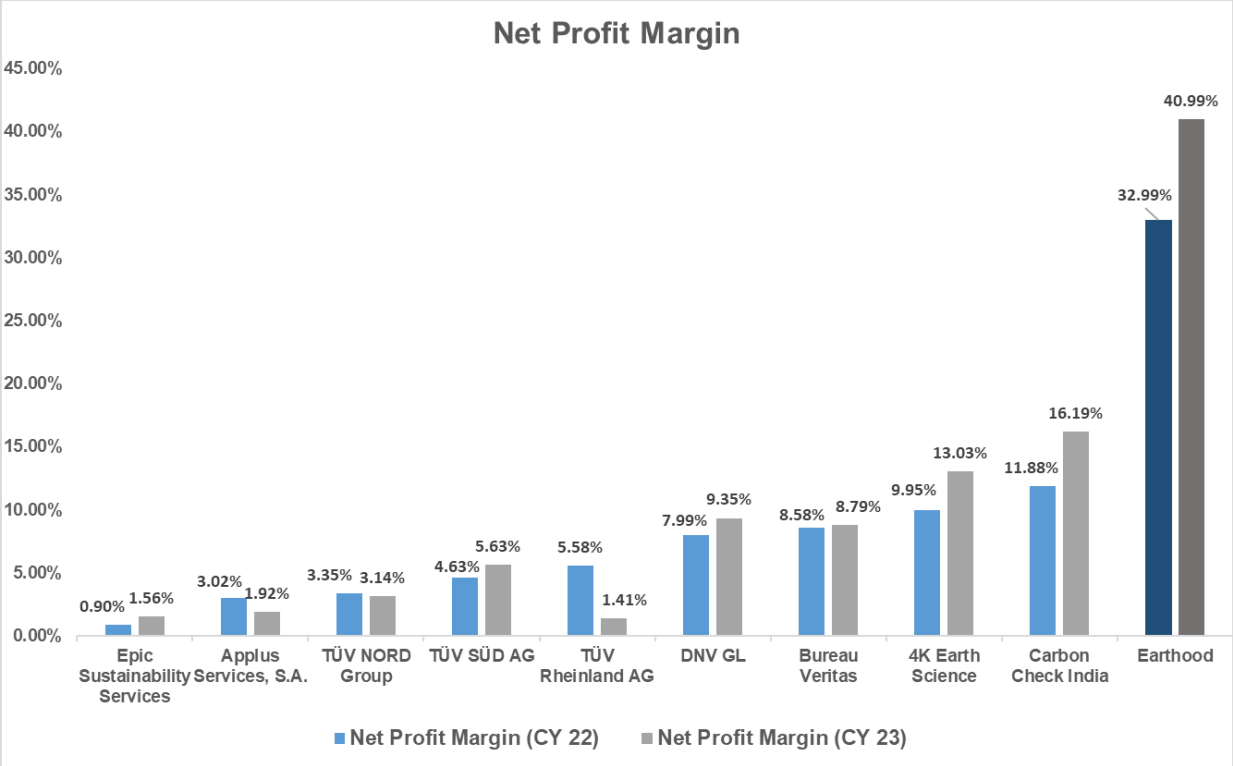
Sr. No.	Company Name	Net Profit for CY-23 (Rs. Lakhs)	Net Profit for CY-22 (Rs. Lakhs)	Net Profit Margin (CY23)	Net Profit Margin (CY22)
1	Earthood	1,933.60	1,073.58	40.99%	32.99%
2	TÜV SÜD AG	162,714.34	117,632.11	5.63%	4.63%
3	TÜV NORD Group	45,794.70	43,114.92	3.14%	3.35%
4	TÜV Rheinland AG	31,940.05	110,117.32	1.41%	5.58%
5	Applus Services, S.A.	36,353.04	54,912.73	1.92%	3.02%
6	Bureau Veritas	474,798.25	429,898.35	8.79%	8.58%
7	DNV GL	240,542.52	168,831.54	9.35%	7.99%
8	4K Earth Science	88.79	40.19	13.03%	9.95%
9	Carbon Check India	455.09	109.23	16.19%	11.88%
10	Epic Sustainability Services	10.21	3.83	1.56%	0.90%

Note: 1) The financial numbers for all the entities represented above have been converted to INR considering applicable exchange rates
2) The revenue numbers for all entities except Earthood, 4K Earth Science, Carbon Check India, and Epic Sustainability Services, also account for other non-carbon market related services.
3) Numbers for Earthood, 4K Earth Science, Carbon Check India, and Epic Sustainability Services correspond to fiscal year (April to March cycle)
4) These figures have been obtained as is from the latest financial disclosures available of the entities considered
5) The financial data for 4K Earth Science, Carbon Check India, and Epic Sustainability Services presented corresponds to the latest available figures for the fiscal year (FY23)

Source: *Company filings, CRISIL Research*

Earthood recorded a strong net margin of 41% during FY24 which indicates company's prudent financial management.

Net Profit across all business segments of the players (FY23)



Source: Company filing, CRISIL Research

Table 25 Financial snapshot of key players considered (FY23)

Sr. No.	Company Name	Revenue for CY 23 (Rs. Lakhs)	Revenue CAGR (FY21-23)	EBIDTA for CY 23 (Rs. Lakhs)	EBITDA Margin (FY 23)	Net Profit for CY 23 (Rs. Lakhs)	Net Profit Margin (CY 23)
1	Earthood*	4,717.71	110.58%	2,616.64	55.46%	1,933.60	40.99%
2	TÜV SÜD AG	2,889,191.97	13.05%	349,817.43	12.11%	162,714.34	5.63%
3	TÜV NORD Group	1,457,158.49	12.05%	144,397.02	9.91%	45,794.70	3.14%
4	TÜV Rheinland AG	2,268,429.38	12.97%	229,443.79	10.11%	31,940.05	1.41%
5	Applus Services, S.A.	1,894,039.14	12.15%	308,310.55	16.28%	36,353.04	1.92%
6	Bureau Veritas	5,400,312.37	13.10%	759,364.28	14.06%	474,798.25	8.79%
7	DNV GL	2,573,552.46	19.12%	438,727.40	17.05%	240,542.52	9.35%
8	4K Earth Science**	-	68.64%	99.38	14.59%	88.79	13.03%
9	Carbon Check India**	-	205.75%	609.90	21.69%	455.09	16.19%
10	Epic Sustainability Services**	-	53.72%	15.15	2.32%	10.21	1.56%

Note: 1) The financial numbers for all the entities represented above have been converted to INR considering applicable exchange rates
2) The revenue numbers for all entities except Earthood, 4K Earth Science, Carbon Check India, and Epic Sustainability Services, also account for other non-carbon market related services
3) Numbers for Earthood, 4K Earth Science, Carbon Check India, and Epic Sustainability Services correspond to fiscal year (April to March cycle)
4) These figures have been obtained as is from the latest financial disclosures available of the entities considered
5) The financial data for 4K Earth Science, Carbon Check India, and Epic Sustainability Services presented corresponds to the latest available figures for the fiscal year (FY23)

Source: *Company filings, CRISIL Research*

About CRISIL Market Intelligence & Analytics

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Our strong benchmarking capabilities, granular grasp of sectors, proprietary analytical frameworks and risk management solutions backed by deep understanding of technology integration, make us the partner of choice for public & private organisations, multi-lateral agencies, investors and governments for over three decades.

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It is India's foremost provider of ratings, data, research, analytics and solutions with a strong track record of growth, culture of innovation, and global footprint.

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