



CLIMATE FINANCE

A PRIMER ON CARBON MARKETS
AND CLIMATE TECH

SUPPORTED BY:



GLOBAL
FINTECH
FEST

SEPTEMBER 2022

DIRECTOR'S MESSAGE



With a transformational shift in sustainable finance in the last few years owing to the seriousness of climate change, we are seeing a rise in carbon markets and green finance instruments globally. As more sovereigns and companies look to carbon offset mechanisms and carbon credit markets to fulfil their carbon mitigation goals, technology has started playing an important role to enable these mechanisms.

In this whitepaper, we review the carbon credit markets and provide insights on how technology is being deployed by both large and small firms to further develop these markets and enhance carbon mitigation. The report was led by our Carbon Market advisor, Pranam Reddy, and developed by our summer analysts from Hansraj College, and an MBA student team from the University of Hong Kong. I would like to express my gratitude to all those who contributed to this report and look forward to engaging with the readers on the topic.

Syed Musheer Ahmed

Founder
Finstep Asia

EXECUTIVE SUMMARY

2021 was when mother nature came closest to reminding the entire world sequestered by the pandemic that, climate change is an apparent and present danger that confronts every nook and corner of the world. Analogous to the virus that hasn't spared a single country in the world.

Disasters ranging from Forest fires in areas like the frozen hinterlands of Siberia and Canada; seizing technologically advanced countries like Germany & Belgium with some of the worst floodings in recent memory; landslides and forest fires in Turkey to temperatures as high as 18°C in Antarctica. All this and more is evidence that no one and no part of the planet could escape the harmful impacts of climate change. According to the latest report released in the 6th Assessment on 9 August 2021 by the Intergovernmental Panel on Climate Change (IPCC):

"It is unequivocal that human influence has warmed the atmosphere, ocean, and land. As a result, widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.

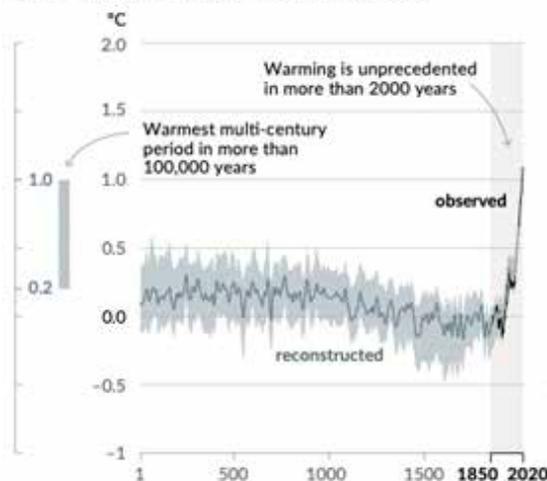
Human-induced climate change is already affecting weather and climate extremes in every region around the globe. There is evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclone. Its influence has strengthened since the Fifth Assessment Report (AR5)."

The human impact mentioned above is due to the emission of Greenhouse Gases (GHG) caused by normal anthropogenic activities like transportation, agriculture, power requirements for commercial and residential entities, deforestation, etc., including burning fossil fuels to meet the energy requirements of the planet. Therefore, it is imperative that countries, companies, and individuals take urgent action to address, combat, and arrest the ever-growing GHG footprint. If 2021 were a precursor of things to come, unless the people act now, the cost on a financial and a psychological level would be catastrophic for the inhabitants.

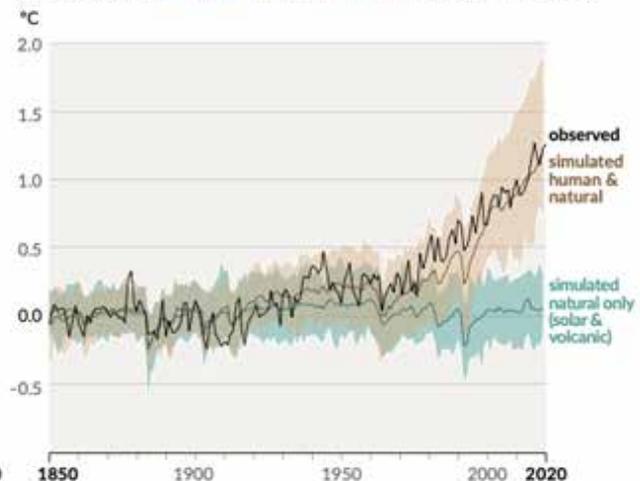
EXECUTIVE SUMMARY

Changes in global surface temperature relative to 1850–1900

(a) Change in global surface temperature (decadal average) as reconstructed (1–2000) and observed (1850–2020)



(b) Change in global surface temperature (annual average) as observed and simulated using human & natural and only natural factors (both 1850–2020)



Source: IPCC, AR6 – Climate Change 2021 – The Physical Science Basis

Countries have met consistently in a Conference of Parties (COPs) following the constitution of the UNFCCC (United Nations Framework Convention on Climate Change) in the early 1990s. In Glasgow, the recently concluded COP-26 was to address the challenges posed by Climate change and develop strategies by consensus to mitigate and adapt to a warming world. It was at COP-26, where countries like India and China pledged for the first time to commit to something they used to baulk at before - go Carbon Neutral by 2070 and 2060, respectively. In comparison many OECD countries have pledged Carbon Neutrality by 2050. Many OECD countries had also earlier

pledged \$100 Billion in annual finance by 2020 for lesser developed countries in support of climate action but could not meet the target even though it was on an upward trajectory until the pandemic hit.



EXECUTIVE SUMMARY

As per the report by a climate think tank Climate Policy Initiative, by 2030, the world needs to spend \$4.13 trillion compared to the \$632 billion currently being spent the world over (including infrastructure, energy efficiency and other measures to adapt climate change). Though the gap seems vast, it will narrow down as more and more countries, organizations, and individuals take sustainability initiatives and green finance more seriously. In addition, low carbon growth and Green finance have caught the imagination of notable brands investing more in renewable energy projects, green hydrogen, energy storage technologies, as well as R&D in building greener alternatives as opposed to BAU.

This report provides an understanding of various developed mechanisms like the Carbon credits market, Clean Development Mechanism (CDM), and Joint Implementation (JI) schemes designed through the Kyoto Protocol. The carbon credit markets have gone on to evolve into two kinds - Regulatory and Voluntary (as explained further on). Subsequently, the report also explores actions currently being undertaken at the governmental and corporate levels.

The report also explores ecopreneurship - entrepreneurship focused on ecological conservation. Some have developed methodologies built on blockchain, attempting to usher in more transparency, accountability, and reliability for individuals to get involved in tackling Climate change.

From climate activism to the pledges of sovereign governments & Corporates alike, it appears that the current wave of Sustainability & Green Finance is picking up pace at an extremely rapid clip. There is no other avenue other than growth trajectories that involve huge investments in non-GHG polluting alternatives. Major polluters realize the window of opportunity to effectively limit global temperature to less than 1.5°C is very narrow & the amount getting pledged for green finance has only one direction i.e an upward trajectory. It is a hope that, with these steps the world can collectively avert the worst impacts of further climate change & planet degradation.

Pranam Reddy
Carbon Markets Advisor
Finstep Asia

Table of Contents

	Page no.
1 Introduction to Carbon Footprint	01
2 Carbon Footprint And Carbon Trading	04
2.1 Carbon Trading And Carbon Credit	06
2.2 ITMO - International Transferable Mitigation Outcomes	07
3 Overview of Carbon Trading	09
3.1 Types of Carbon Markets	10
3.2 Carbon Pricing	13
3.3 Functioning of Carbon Markets	17
3.4 Change In Carbon Market Over Time?	22
3.5 The Future of Carbon Markets	24
4 Policies and Initiatives undertaken	25
4.1 Paris Agreement / COP21	28
4.2 Glassgow Climate Pact / COP26	29
4.3 California Cap and Trade	30
4.4 Korean Emissions Trading System	31
4.5 Voluntary Offset Standards	33
5 International Analysis	37
5.1 India	38
5.2 USA	41
5.3 China	43
5.4 European Union	46

Contents

6	Green Finance	48
6.1	Considerations For Green Finance	49
6.2	Sustainability In The Capital Market: Green Bonds	51
6.3	Green and Sustainable Financing In Hong Kong	53
6.3	Green Regtech: Improving Sustainability Data Transparency and Accessibility In Finance	55
<hr/>		
7	Ecopreneurship	56
7.1	Role of Companies	57
	Case study:	
7.2	<i>IOEN</i>	58
7.3	<i>T-RECs.ai</i>	59
7.4	<i>Electrify</i>	60
7.5	<i>MAS ESG Registry, STACS, Singapore</i>	61
7.6	<i>MioTech</i>	62
7.7	<i>Terrapass</i>	63
7.8	<i>Aspiration</i>	65
7.9	<i>Handprint Tech</i>	67
7.10	<i>Sui Carbon</i>	69
7.11	<i>Carbon Credits</i>	70
7.12	Other Usecases Using Blockchain Technology	71
7.13	Other Usecases Using Carbon Credits	72
7.14	Other Usecases Using Methods Other Than Carbon Trading	74

Footnotes & references

Authors



INTRODUCTION TO CARBON FOOTPRINT

65%

The global average concentration of CO₂ in the atmosphere increased from about 277 parts per million (ppm) in 1750 to 419.5 ppm in 2022, i.e. an increase of around 65%. [1]

40 countries

About 40 countries and more than 20 cities use carbon-pricing methods, many of which they want to do over time. In line with current carbon pricing plans comprise about half of their emissions, which means about 13% of global greenhouse gas emissions worldwide. [2]

Introduction to Carbon Footprint

164%

The number of global commercial markets for carbon dioxide (CO₂) trading grew by 164%, as it reached a record of 760 billion euros (\$851 billion) last year, analysts Refinitiv said on Monday. Most of the increase comes from the European Union's Emissions Trading System (EU ETS), established in 2005 and is the world's most established carbon market. It accounts for 90% of the global total at 683 billion euros, the annual Refinitiv Carbon Market in the review indicated. [3]

The Intergovernmental Panel's 5th assessment report on Climate Change states that severe weather conditions on the planet have increased since the 1950s, including

heavy rainfall, heatwaves, floods, and droughts. According to that report, the intensity and density of heavy rain will increase globally. At the same time, some regions will experience severe and frequent droughts, and the prevalence of tropical storms will also increase in Categories 4 and 5 (IPCC, 2014). Greenhouse gas emissions, mainly carbon dioxide, are the leading cause of climate change.

Therefore, one of the critical aspects of climate change governance is to reduce carbon dioxide emissions. Furthermore, national economic growth mainly depends on fossil-fuel energy, which generates a large amount of carbon dioxide.



Introduction to Carbon Footprint

It is necessary to achieve sustainable economic and social development through energy conservation, building low carbon structures, promoting technological and institutional innovations, and patterns of economic development. These will help turn actions that deal with climate change into new opportunities and sources of growth to encourage economic development.

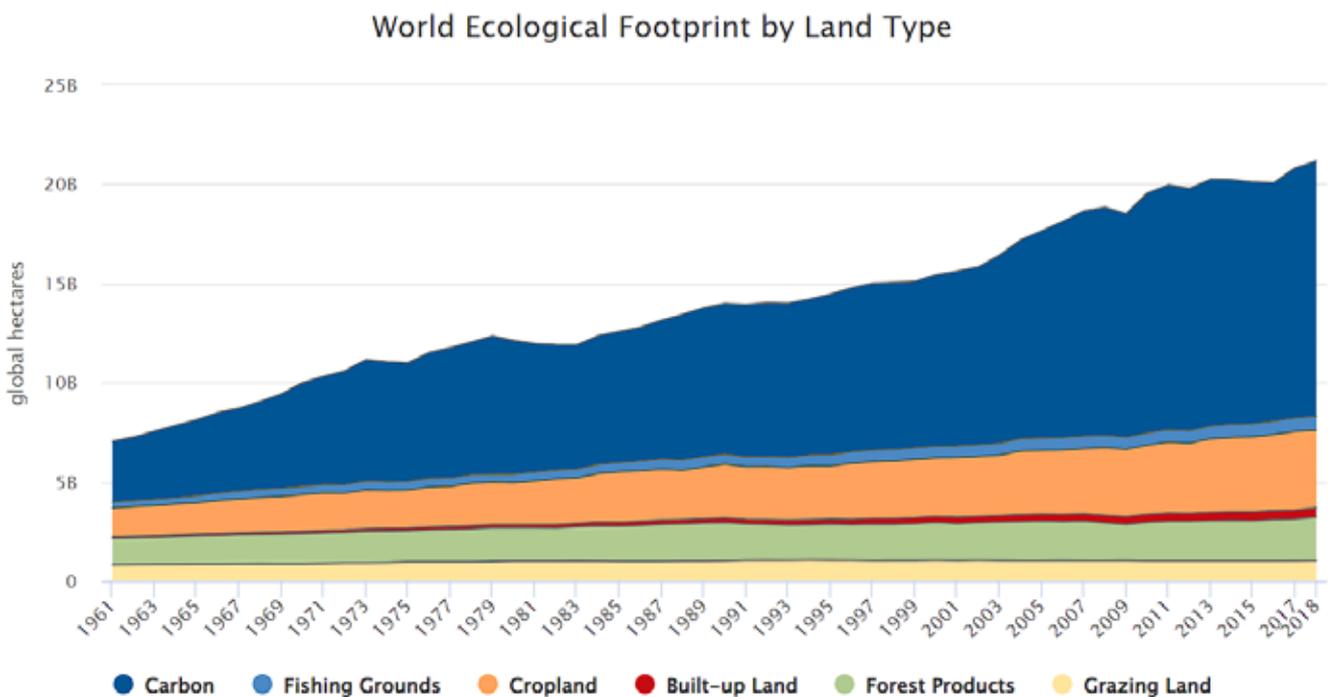
Reducing these emissions means controlling fossil energy consumption, which affects all countries' economic development and production.

Though there are a lot of institutional arrangements available to reduce carbon dioxide emissions, a carbon-pricing mechanism has a crucial market-oriented solution that includes carbon trading and carbon taxes. However, carbon taxes are difficult to implement due to various obstacles. Therefore, carbon-trading mechanisms are more prevalent at present. [4]



2 Carbon Footprint and Carbon Trading

“According to the IEA’s Global Energy Review 2021, CO₂ emissions have increased by almost 5% in 2021 and this number will rise to 33 billion tonnes, based on the latest national data from around the world as well as real-time analysis of economic growth trends and new energy projects that have set to come online.” [5]



Source- data.footprintnetwork.org

The world is witness to the alarming growth trend of Carbon Footprint. Even though more and more companies are working to prevent climate change by reducing their greenhouse-gas emissions, it is still not sufficient.

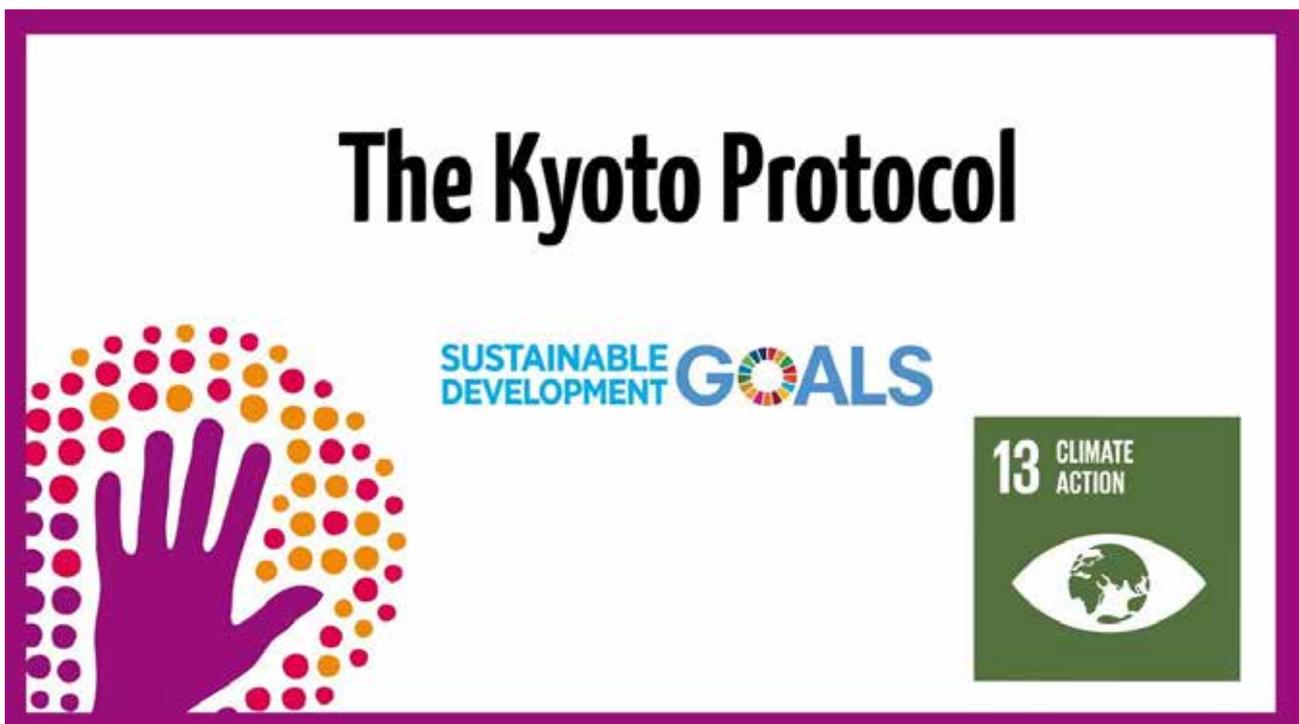
The Carbon Footprint defines the total greenhouse gas emissions caused by a person or a company. The recourse to reduce the carbon footprint of humans includes efforts to Reduce, Reuse, Recycle and Refuse. However, at the industrial level, the aim of carbon emissions reduction cannot be decreased.

2 Carbon Footprint and Carbon Trading

Under the Kyoto Protocol, Carbon trading and Clean Development Mechanism (CDM) were the two robust processes to mitigate these GHG emissions for any country.

We can see the crucial role of the Carbon market and emissions trading in various programs employed to reach the goals defined in the Kyoto Protocol with the most negligible costs. Emissions trading programs like the European Union Emissions Trading System (EU ETS) allow private trading of allowances. The Kyoto Protocol, within its framework, provides the national emissions targets under these programs. This national or international authority allocates permits to individual companies based on established criteria.

Countries that could not cope with the Kyoto emissions reduction obligations can enter Emissions trading to purchase the allowances to cover their required carbon emission.



Carbon Footprint and Carbon Trading

In addition to the regulated carbon market where the companies purchase these carbon credits, there also exists the voluntary carbon market where individuals can buy these carbon offsets to compensate for the emissions caused by them. For example, if a person travels by plane, they can offset the carbon produced from air travel. Measuring the size of the voluntary carbon market is not as simple, given the big differences in reporting and measurement standards. The market size of the voluntary carbon offsets market in 2021 was about \$1 billion; it's expected to be worth \$50 billion by 2030. [6]

2.1 Carbon Trading and Carbon Credit

Carbon Trading is an approach to controlling the rising Carbon Dioxide (CO₂) in the environment. It is buying and selling permits that allow the permit holder to emit carbon dioxide. These permits are known as carbon credits, enabling companies to emit a certain amount of carbon dioxide or other greenhouse gases. For example, one credit allows releasing a weight equal to one ton of carbon dioxide.

[co₂e = Carbon Dioxide equivalent].

These carbon trading and carbon credits have originated with the Kyoto Protocol, a United Nations treaty. The Kyoto Protocol has aimed to reduce global carbon emissions and mitigate climate change starting in 2005. Since then, many countries have created their Cap and Trade Programs to reduce carbon dioxide emissions.

For example, in 2005, the European Union (EU) created the world's first international cap-and-trade program to reduce emissions. In this, the trade is authorized and regulated by the government.



Carbon Trading and Carbon Credit

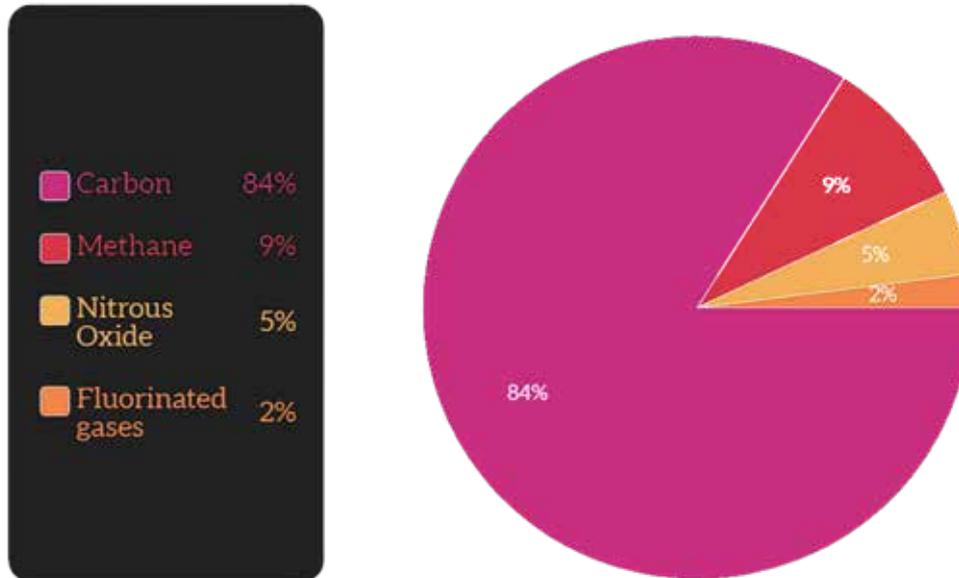
Then, companies can participate in carbon credit trading, with each having a maximum carbon pollution allowance. Unused allowances can work in favour of that company, and they can sell their credits to other companies that cannot reduce their carbon dioxide emissions. However, if a company produces higher emissions than its permitted limit, they are taxed. Hence they have to purchase the carbon credits from the companies that are polluting less to save them from heavy taxes. A baseline of maximum carbon emission is set every year for carbon dioxide emission. That baseline is also reduced annually by a certain percentage so that companies are encouraged to develop new techniques through which they can pollute less.

2.2 ITMO - International Transferable Mitigation Outcomes

Internationally transferred mitigation outcomes (ITMOs) use a carbon dioxide equivalent (CO₂e) metric for a new set of market provisions or other greenhouse gas mitigation outcomes defined under Article 6 of the Paris Agreement, set to come into effect as of 2020. They were to replace other forms of international carbon credits, such as those issued during the Kyoto era, the Clean Development Mechanism, and Joint Implementation.



ITMO - International Transferable Mitigation Outcomes



After six years of strenuous negotiations, pending items that prevented the full implementation of the Paris Agreement on carbon markets and transparency have been approved at the Glasgow COP26 climate change conference in November 2021.

Under this agreement, those who will create carbon credits will need to deposit into a fund 5% of proceeds generated to support developing countries to tackle climate change, while on the otherhand, 2% of credits will be cancelled to maintain an overall reduction in emissions. These new rules also allow participants to use their previous credits created between 2013 and 2020.

But at the same time, critics of carbon trading, such as Carbon Trade Watch, insist that it places disproportionate weight on individual lifestyles and carbon footprints.



OVERVIEW **OF CARBON TRADING**

3

Overview of Carbon Trading

3.1 Types of Carbon Markets

Carbon Market

The term carbon market refers to the market in which carbon credits are bought and sold within defined standards as made by the government for the prevention or reduction of Greenhouse Gas (GHGs) emissions.

Carbon markets have two major categories:

- 1. Compliance Markets
- 2. Voluntary Markets

Both these markets, Compliance Markets and the Voluntary Market can play a significant role in diminishing carbon emissions all across the globe as they both play complementary roles.



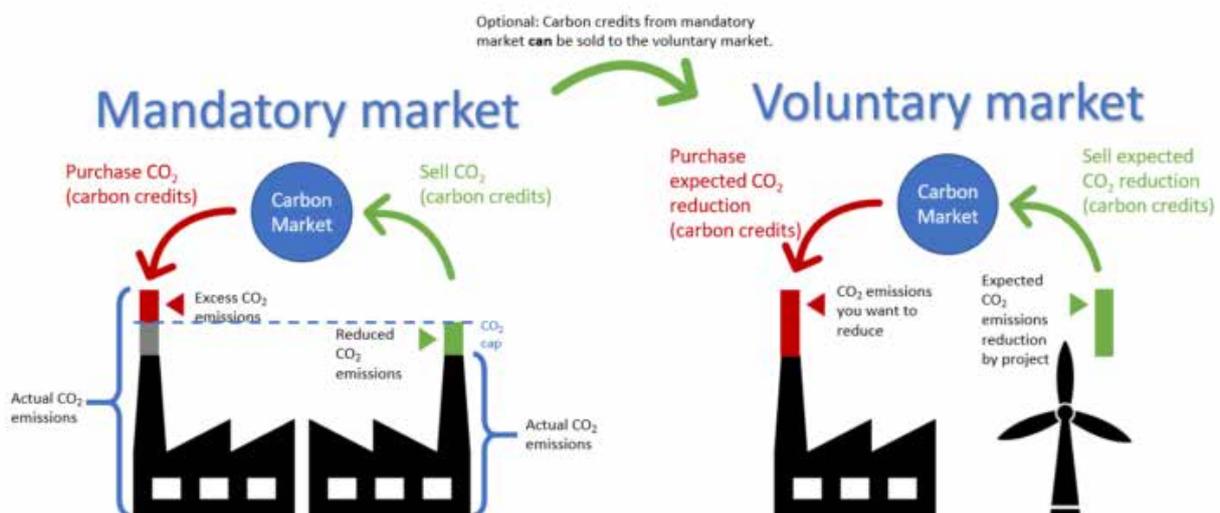
3

Overview of Carbon Trading

3.1 Types of Carbon Markets

Compliance Markets

The compliance market is driven by companies and governments legally responsible for Greenhouse Gas (GHG) releases. It is a regulated mechanism to curb international carbon emissions. The compliance market is where companies can obtain and surrender the emission permits (carbon credits) or offsets to meet their targets. The Cap-and-Trade Programs initiated by various countries allot the companies a restricted number of carbon credits. The companies are then allowed to trade these credits to profit from unused credits by selling them to other companies or else to meet the regulatory requirements. The most active compliance carbon offset program was the United Nations Clean Development Mechanism under the Kyoto Protocol and European Union Emissions Trading Scheme.



SOURCE- www.sustainalize.com

3 Overview of Carbon Trading

3.1 Types of Carbon Markets

Voluntary Markets

The Voluntary Market operate separate to works outside of the compliance market and allows the companies or individuals to trade the carbon credits voluntarily. This market fall outside of government regulatory schemes by firms and individuals who can freely buy carbon offsets to reduce greenhouse gas (GHG) emissions.

The rising demand for voluntary carbon credits in recent years has doubled over the last three to four years, reaching the amount of 95 Metric (tCO₂e) in 2020. According to the research conducted by McKinsey, they are estimating that the annual global demand for carbon credits could rise to 1.5 to 2 billion metric tons of carbon dioxide by 2030 and 7 to 13 billion metric tons by the mid-century.

These carbon credits are also called Verified Emission Reductions (VER) in the voluntary markets. Individuals and private sector companies mainly purchase these. The two common motivators for buying these carbon credits are Corporate Social Responsibility (CSR) and Public Relations (PR). The prices for voluntary carbon credits can vary considerably depending on the project, the size of the transaction, and the registered standards like the American Carbon Registry, Gold Standard Registry, Climate Action Reserve, Verra, etc.

3 Overview of Carbon Trading

3.2 Carbon Pricing

Carbon Pricing

The carbon price is the cost of carbon emissions that encourages pollutants to reduce greenhouse gas emissions. The price of carbon transfers the burden of costs associated with climate change to those responsible for it. By setting the amount of carbon, the public can hold pollution companies accountable for the cost of increasing greenhouse gas emissions; these costs can include air pollution, temperatures, and various threats to public health through food and water). Also, pricing carbon can create financial benefits for those companies that reduce carbon emissions.

It's an approach to reducing carbon emissions that deploy market structures to pass on the cost of emitting to the emitters.

Its primary goal is to decrease the carbon emissions in the environment, address the causes of climate change and meet the national and international climate agreements.

But according to the World Bank Carbon Pricing Dashboard, as of April 2021, close to 80% of GHG emissions, i.e., over 40 gigatons (Gt) of carbon dioxide equivalent (CO₂e) annually, are not covered under the regulated carbon pricing schemes today.

According to the High-Level Commission on Carbon Prices, meeting the world's climate goals cost-effectively can be accomplished using either a cap-and-trade system or a carbon tax charge.

3 Overview of Carbon Trading

3.2 Carbon Pricing

The first strategy limits the absolute emissions that industries can discharge and permits those with low emissions to sell their additional carbon credits to more prominent producers, accordingly making a commercial centre for ozone-harming substance discharges. The European Union's Emissions Trading System (ETS) is the most commonly known example of a cap-and-exchange framework. In the subsequent strategy, a tax rate was charged on carbon emissions.

The highest carbon price is charged by Sweden, around US\$ 137 as of April 2021. Sweden's economy grew substantially, i.e., 60% since the Swedish carbon tax (1991), while its carbon emissions decreased by 25%, but it is not the case for all countries.

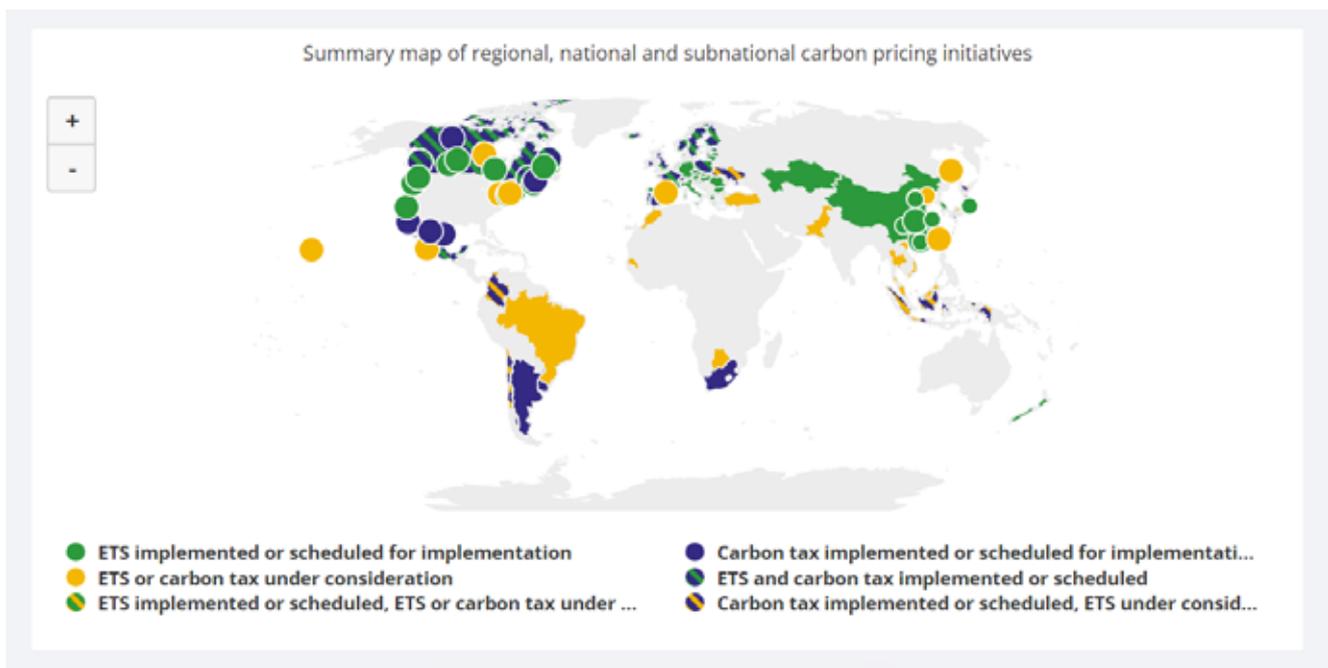
Several carbon pricing programs have been launched around the world. There are 64 carbon programs in place or planned for implementation - 34 of which are direct carbon taxes, ETS covers 31 in all 46 parts of the country, and the remaining 35 are in sub-regions.

Overall, less than 1% of the global emissions currently fall within the amount of carbon equivalent to the minimum carbon offset cost. The average international price is only \$ 3 a ton, which is a long distance away from the target of \$ 75 per ton needed to reduce sufficient gas emissions to keep global temperatures below 2°C. [7]

3 Overview of Carbon Trading

3.2 Carbon Pricing

Carbon Prices around the world in 2019



KEY STATISTICS ON REGIONAL, NATIONAL AND SUBNATIONAL CARBON PRICING INITIATIVE(S)

68 Carbon Pricing initiatives implemented

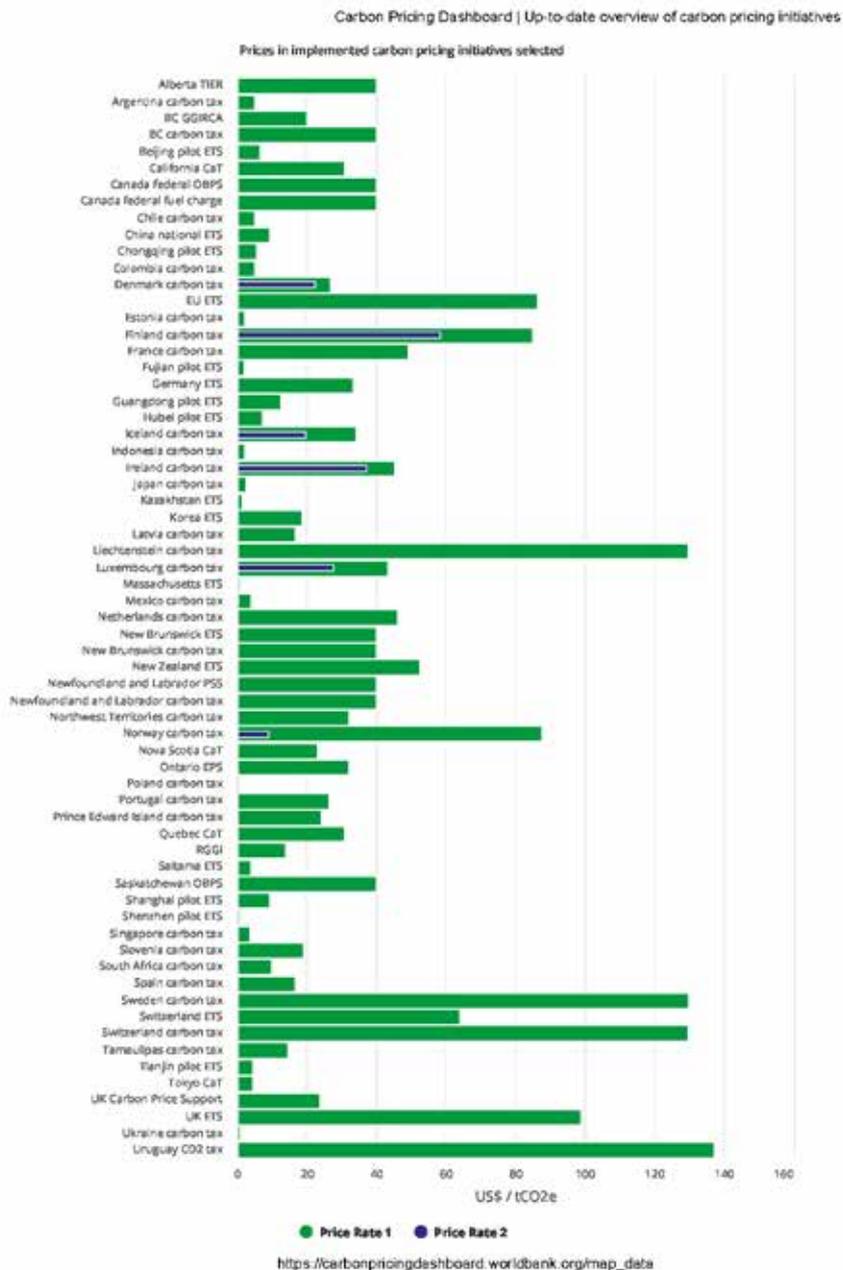
46 National Jurisdictions are covered by the initiatives selected

36 Subnational Jurisdictions are covered by the initiatives selected

In 2022, these initiatives would cover **11.83 GtCO₂e**, representing **23.11%** of global GHG emissions.

3 Overview of Carbon Trading

3.2 Carbon Pricing



3 Overview of Carbon Trading

3.3 Functioning of Carbon Market

Supply

(a) Cap Reduction

The Cap is the absolute maximum quantity of GHG emissions to be emitted by companies covered by the EU ETS to meet the ETS emissions reduction target, corresponding to the number of allowances allocated in a particular year. Thus, allowances are reduced every year to meet the goal of reducing carbon emissions.

(b) Free Allocation

Allocation is distributing emission allowances to companies in an emissions trading system. There are two ways of allocation. First, allowances can either be given away freely or sold through auctions. Generally, there are two methods for free distribution of allowances:

1. Grandfathering
2. Benchmarking

With Grandfathering, companies received the allowances according to their historical emissions in a base year or base period. However, the grandfathering method tends to reward historically high emitters and requires further provisions for new entrants (i.e., the new companies that join the system after its initial establishment).

The second method is Benchmarking. In this method, allowances are allocated according to performance indicators. Nowadays, benchmarking is used as the primary allocation method as it's based on performance benchmarks. It strengthens and incentivizes companies to reduce GHG emissions and increase innovation. This method rewards companies with efficient installations, and it can more easily assimilate the new entrants.

3 Overview of Carbon Trading

3.3 Functioning of Carbon Market

At present, allocation will be made primarily by free will, but National Measures specify that the auctioning may also be introduced.

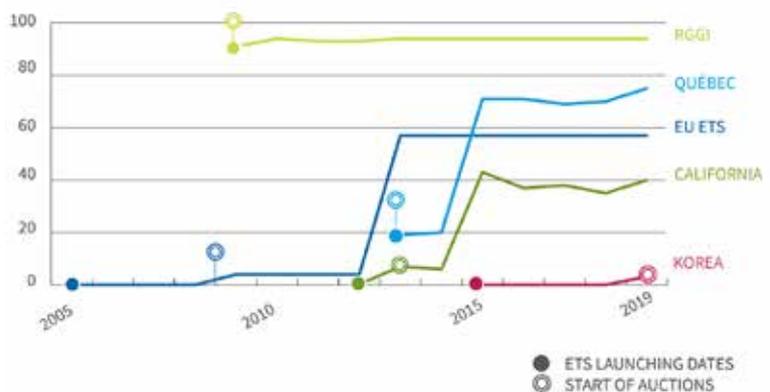
(c) Auctioning of Allowances

The method of Auctioning is also used for allocating emission allowances and puts into practice the principle that the polluter should pay. It is the most transparent method. Companies under the EU Emissions Trading System (EU ETS) are required to purchase a growing portion of the auctions, and this is the default procedure to allocate grants from phase 3 of the EU ETS (2013–2020).

Participation in these auctions is voluntary, and the purpose of auctions is mainly to provide compliance entities with additional supplies to meet their compliance demand. Selling allowances, usually by auction, can reflect the actual need for installations and give the companies an equal opportunity to buy.

Entities with additional supplies to meet their compliance demand. At the same time, it raises the revenue to spend on other measures for addressing climate change.

PERCENTAGE OF TOTAL AUCTIONED PERMITS



Source: ICAP Brief #5 Emissions Trading Revenue

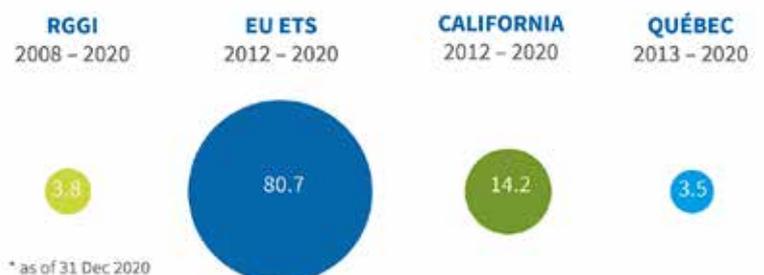
3 Overview of Carbon Trading

3.3 Functioning of Carbon Market

Nowadays auctions are generally conducted by the “sealed bid” method. A sealed-bid auction is a type of auction process where all the bidders simultaneously submit their sealed bids to the auctioneer, and hence no bidder knows how much the other auction participants have bid. So basically, these sealed bids are written submissions placed in a sealed envelope, not disclosed until the stated date. Then, on this day, they are opened together. Then, the highest bidder is declared the winner of the bidding process.

Auction designing and participation rules are set to avoid manipulation, which might have happened due to collusive behaviour through groups of bidders. Thus, it limits the market power of single large buyers.

TOTAL AUCTION REVENUES, USD BILLION*



Korea (2016–2020) raised USD 509 million, Switzerland (2013–2020) USD 45 million, Massachusetts (2018–2020) USD 27 million, Nova Scotia (2020) USD 21 million and Chinese Pilots (2013–2020) USD 215 million in auction revenues.

Source: ICAP Brief #5 Emissions Trading Revenue

Demand

The Taskforce on Scaling Voluntary Carbon Markets (TSVCM) is sponsored by the Institute of International Finance (IIF). It estimates that the demand for carbon credits could increase by a factor of 15 by 2030 and up to 100 by the end of 2050.

3 Overview of Carbon Trading

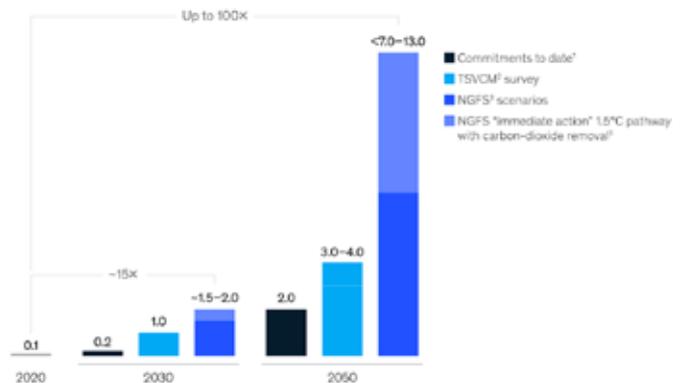
3.3 Functioning of Carbon Market

(a) Emission Reduction

Verified emissions from stationary installations amounted to 1.355 million tones of CO₂eq in 2020, a decrease of 11.4% compared to 2019, based on the information recorded in the EU Registry. This decrease in the emissions was driven by electricity and heat production, where emissions fell by over 15% compared to 2019, reflecting reduced electricity consumption due to the COVID-19 pandemic and the previously observed decarbonization trends. Emissions from industrial installations decreased by 7%, the most significant single decrease since the beginning of phase 3. In 27 countries of the European Union, also called EU27, GDP decreased by 6% due to the pandemic. [8]

Global demand for voluntary carbon credits could increase by a factor of 15 by 2030 and a factor of 100 by 2050.

Voluntary demand scenarios for carbon credits, gigatons per year



Source: www.mckinsey.com

(b) Balancing the Supply and Demand

At the start of phase 3, the EU ETS had a high structural imbalance between the supply and demand of allowances, equalling 2.1 billion allowances. To address this imbalance for a short term in 2014, the commission postponed the auctioning of 900 million allowances from 2014-16 and 2019-2020. Moreover, in 2015 it created the MSR as a long term solution.

3 Overview of Carbon Trading

3.3 Functioning of Carbon Market

The MSR adjusts auction volumes according to predefined thresholds of the total number of allowances in circulation (TNAC) to maintain the carbon market in balance.

While the increase in demand for carbon credits is notable, McKinsey's analysis shows that the demand by 2030 can be compared with the potential availability of carbon credits: 8 to 12 Gt CO₂ per year. These carbon credits arise from 4 categories: avoided nature loss (including deforestation), nature-based sequestration, like reforestation; preventing or reducing emissions such as methane from landfills; and technology-based removal of carbon dioxide from the atmosphere.

However, several factors could make it challenging to mobilize the entire potential supply and bring it to market.

The development of projects would have to ramp up at an unprecedented rate. Most of the potential supply of avoided nature loss and nature-based sequestration is in a small number of countries. All projects come with risks, and many of those projects could struggle to attract financing because of the long lag between the initial investment and the eventual sale of credits. Once these challenges are accounted for, the estimated carbon credits supply drops from 8–10 GtCO₂ to 1–5 GtCO₂ per year by 2030.

3 Overview of Carbon Trading

3.4 Change In Carbon Market Over Time?

In the 1980s and 1990s, awareness grew about the dangers of climate change and the necessity to decrease greenhouse gas emissions. The first World Climate Conference (1979) led to the signing of the UN Framework Convention on Climate Change (UNFCCC) at the 1992 World Summit in Rio de Janeiro. Here, 166 countries (now 194) recognized the need to reduce greenhouse gas emissions (GHGs) to the extent that "will prevent dangerous anthropogenic disruptions in the climate system."

At the same time, trade-in emissions began to emerge as an effective and ever-growing policy tool for tackling pollution control, primarily through the successful depletion of lead in gasoline and the creation of an acid rain trading system in the United States.

On the international front, the Montreal Protocol on Substances that Deplete the Ozone Layer, signed in 1987, laid the clear

groundwork for targets and timetables for emissions levels in different countries. Moreover, it included a finite amount of emissions trading. There was considerable enthusiasm for using such a tool to address climate change as countries grappled with how to design the 1992 UNFCCC and meet its objectives in the 1990s. Indeed, advocacy for international GHG emissions trading began in the late 1980s and early 1990s: the United States initially promoted it in the UNFCCC treaty negotiations. The idea of "joint implementation" as an informal version of emissions trading ultimately appeared in the UNFCCC (Wiener 2001).

3 Overview of Carbon Trading

3.4 Change In Carbon Market Over Time?

This enthusiasm for emissions trading eventually overcame various objections and led to the signing of the Kyoto Protocol in 1997. The Kyoto Protocol was the first vehicle of its kind for emissions trading in greenhouse gases or carbon markets. Kyoto put up a system of emissions limits for a basket of six GHGs for developed countries, a mechanism for those developed countries to trade their emissions limits, and another set of mechanisms for developed countries to counteract their emissions by financing emissions reductions in developing countries. While the Kyoto Protocol has led to a minimal number of trades directly among nations, the European Union and various other jurisdictions have pursued emissions trading to reduce their regional GHG emissions. As a result, carbon markets are now the largest class of environmental or emissions trading markets globally in terms of both volume and market value by a vast margin.



Source: www.carbonmarketwatch.org

3 Overview of Carbon Trading

3.5 The Future of Carbon Markets

We are now in a very different place than we were fifteen years ago. Then, in the late 1990s, most intellectual and stakeholder debates focused on a single global trading program being designed as the vehicle to address global climate change. The key issues were the design of that program.

Today, that kind of top-down global program seems far-fetched or impossible. Instead, we see dozens of national and sub-national trading systems emerging. In addition, we now have a fundamental knowledge of these carbon markets. At the same time, the future of national climate change policy in the United States - the world's largest producer of manufactured goods and a significant emitter trading partner is uncertain.

If a comprehensive U.S. policy emerges, it is unclear whether it will be an emissions trading program, tax, a tradable performance standard, or traditional regulation.

It raises several new issues that have received little attention in the previous literature. In addition, some cases were not fully anticipated or understood during the design stages of existing carbon market systems.





POLICIES AND INITIATIVES UNDERTAKEN

In this section, we have covered various compliance or certified and voluntary standards for carbon credits.

4 Policies and Initiatives Undertaken

The Kyoto Protocol was an international agreement signed with several countries to reduce emissions. Adopted in Kyoto, Japan, in 1997, when greenhouse gases proliferated and became international law on 16 February 2005. The Protocol was affiliated with the UNFCCC. Countries that signed the Kyoto Protocol were allocated a large amount of carbon offset for a while and then participated in carbon offset trading. If a country extends beyond its assigned limit, it should suffer from lower carbon emissions in the future. The units they trade in are called Certified Emission Reductions or CERs. Each country has different goals to meet at the end of the year.

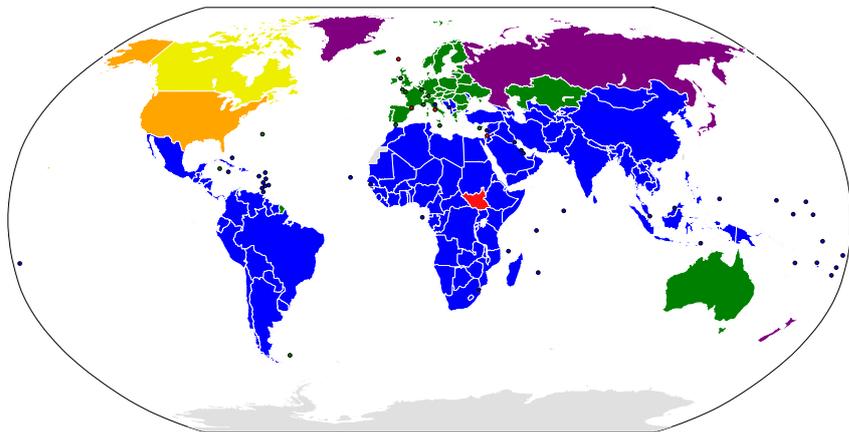
The agreement placed additional burdens on developed countries, and developing countries, including India and China, were initially exempt from the Kyoto Protocol. The protocol divided countries into two groups, namely Annex 1 and Non-Annex 1. Annex 1 contained developed countries, while Non-Annex 1 contained developing countries.

Kyoto Commitment Season 1 (2008–12)

In the first phase of the Protocol (2008–12), participating countries committed to reducing their emissions by an average of 5% below 1990 levels. [18]



Policies and Initiatives Undertaken



- Annex B parties with binding targets in the second period
- Annex B parties with binding targets in the first period but not the second
- non-Annex B parties without binding targets
- Annex B parties with binding targets in the first period but which withdrew from the Protocol
- Signatories to the Protocol that have not ratified
- Other UN member states and observers that are not party to the Protocol

Source- www.wikipedia.com

The Kyoto Protocol provides for three mechanisms that enable countries or operators to acquire carbon reduction credits discussed below:

1. Under Joint Implementation (JI), any Annex I country can host a greenhouse gas reduction project in another Annex I country to meet its Kyoto Targets. Thus, granting Emission Reduction Units (ERUs) to countries. Russia and Ukraine have hosted the largest number of JI projects.
2. Under Clean Development Mechanism (CDM), a developed country is a committed member of the Kyoto Protocol, funds or implements carbon reduction projects in other developing countries, and earns CER credits for meeting its targets.
3. Under International Emissions Trading (IET), countries can trade in the certified emissions reduction units in the international market to complete their targets. Countries with excess units can sell them to countries that have exceeded their set emission targets.

The Kyoto Protocol ended around 2012.

4.1 Paris Agreement / COP21



The Paris Climate Agreement came into effect in 2015, signed by all UNFCCC stakeholders, that replaced the Kyoto Protocol.

It was an environmental agreement ratified by almost all nations in 2015 to address the problems of climate change. The agreement includes obligations from all major GHG emissions nations to reduce emissions and strengthen those obligations over time.

The principal clause of the treaty was to reduce global warming in this century to 2° (preferably 1.5°) Celsius above pre-industrial levels.

The Paris Agreement also imparts a framework for developing countries to assist developing countries in improving climate change and establishing a framework for monitoring and reporting on international climate objectives.

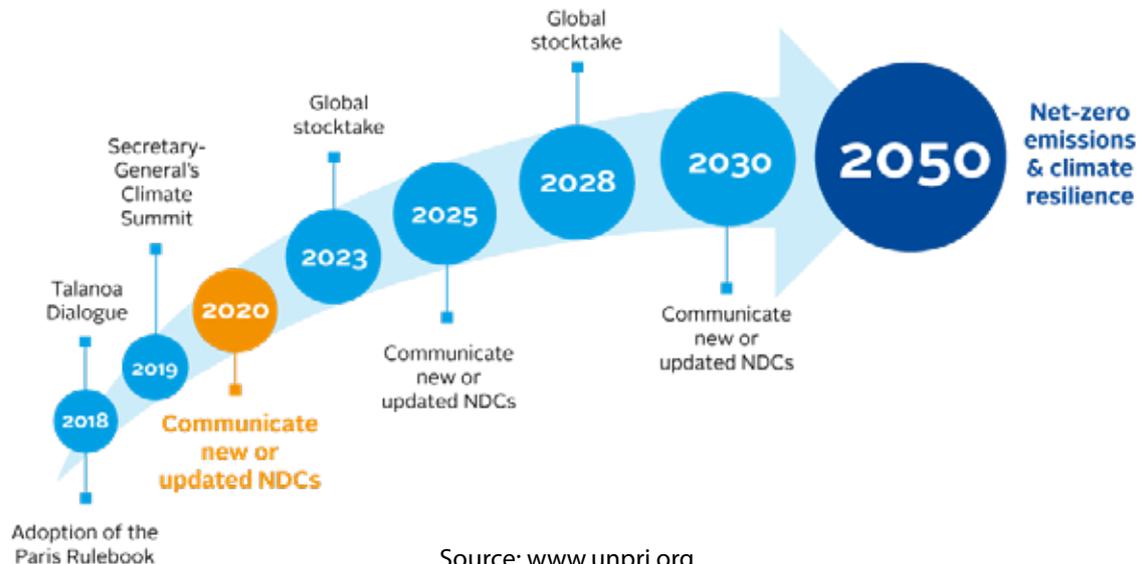
PARIS CLIMATE AGREEMENT



Source- www.energytracker.asia

Paris Agreement / COP21

AMBITION MECHANISM IN THE PARIS AGREEMENT



4.2 Glasgow Climate Pact / COP26

The Glasgow Climate Pact is an agreement signed in 2021 by the United Nations Climate Change Conference (COP26).

This agreement is the first climate agreement that plans to reduce uninterrupted coal consumption, an agreement to revisit plans to reduce by 2022 and try to keep the Paris Agreement of 1.5 ° c achievable.

The number of countries committed to reaching the net-zero target base was more than 140. More than 100 countries promised to postpone deforestation by 2030. More than 40 countries are promising to get rid of coal. India has vowed to pull part of its energy demand from renewable sources by 2030.

Glasgow Climate Pact / COP26

The governments of various developed countries and major car manufacturers, including GM, Ford, Volvo, BYD Auto, Jaguar Land Rover, and Mercedes-Benz, have decided to work on new automobiles to reduce gas emissions. [10]



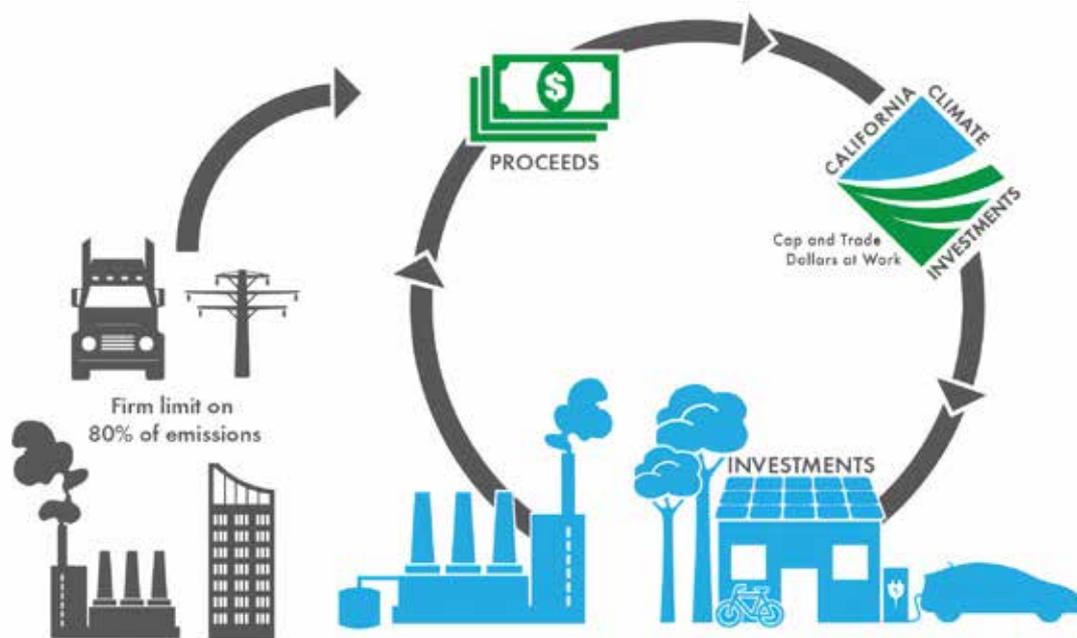
Source: www.manifestclimate.com

4.3 California Cap and Trade

In 2013 California's cap-and-trade program was set in motion to reduce greenhouse gas emissions in the province. California's emission trading system is the fourth largest globally, following the cap-and-trade plans of China, the European Union, and the Republic of Korea. In addition to reducing carbon emissions from one of the world's largest economies, California information has provided important information on creating and regulating a comprehensive cap-and-trade economic system.

The California plan is part of a comprehensive national strategy to reduce greenhouse gas emissions to 1990 levels by 20%, 40% below 1990 levels by 2030, and 80% below 1990 levels by 2050. [11]

California Cap and Trade



Source: www.manifestclimate.com

4.4 Korean Emissions Trading System

The Korean emissions trading system (KETS), launched in 2015, accounts for about 66% of total emissions in Korea. It is the first mandatory trading system for non-Annex I countries under the UNFCCC. [12]

KETS may initiate increased emissions trade between emerging economies and developing countries.

The European Commission supports Korea through a technical assistance project focused on building the capacity needed to implement KETS.

Policies and Initiatives undertaken

In the table below, we have compared some major compliance offset programs based on their launching year, areas under which they function, number of projects, and amount of carbon offsets issued.

Compliance Carbon Offset Programs	Founded in (Year)	Geographic Coverage	Carbon offset Label	Projects and amount of offsets
Clean Development Mechanism (CDM)	2007	Developing countries	Certified Emission Reduction (CER)	7848 registered projects. 2,217 million CER issued as of 2020 [14]
Joint Implementation (JI)	2008	Developing countries	Emission Reduction Unit (ERU)	872 million ERU's issued under JI as of 2015 [15]
California compliance Offset Program	2013	United States	Air Resources Board Offset Credit (ARBOC)	Around 160 million credits issued as of 2019 [16]
Regional Greenhouse Gas Initiative(RGGI)	2009	Northeast United States	RGGI Offset Allowance	\$1.9 billion in lifetime energy bill savings and 6.6 million short tons of CO2 emissions avoided [17]

Market-based mechanisms under the Kyoto Protocol, i.e., The Clean Development Mechanism (CDM) and Joint Implementation, are responsible for most of the offset credits issued in the market, with project implementation mainly in developing countries.

Voluntary Offset Standards



Climate Action Reserve (CAR)

The Climate Action Reserve was launched in 2008. It is a US-based voluntary program whose projects are implemented in North America. The Climate Action Reserve (CAR) establishes standards for measuring and securing projects to reduce GHG emissions, provides oversight of independent third-party verification agencies, and issues and tracking carbon credits, called Climate Reserve Tonnes.



Verified Carbon Standard (VCS) Registry by VERRA

Climate Group and the International Emissions Trading Association (IETA) developed this standard. It provides accurate, measurable, scalable, and permanent reduction based on projects. Credits are managed through registration to register, transfer and withdraw Voluntary Carbon Units (vcus).



Gold Standard Registry

It was launched in 2006 by WWF-UK (nonprofit foundation). A simplified version of the CDM Gold Standard, using the same basic methods. They focus on renewable energy and energy-saving projects with substantial benefits for sustainable development.

Voluntary Offset Standards

Voluntary Offset Standard

Launched on 28 June 2007, it is the latest voluntary rate to be released. It is based on the existing standards recommended by the UNFCCC, bringing the voluntary market to the level of regulated processes in the (Kyoto) compliance market. Moreover, VOS supports the current operating systems.



American Carbon Registry (ACR)

The American Carbon Registry (ACR) was established in 1996 as the GHG Registry, the first private GHG registry in the USA. The American Carbon Registry Standard sets out the eligibility requirements for registering project-based carbon offsets and includes methodology requirements, project validation, and other process requirements and information regarding the regular use of the American Carbon Registry. ACR also records project-based carbon offsets from around the world.

Plan Vivo

Plan Vivo Registry is an Offset Project Standard for forestry, agricultural, and other land-use projects focused on encouraging sustainable development and enhancing rural livelihoods and ecosystem services. In addition, the Plan Vivo Foundation verifies and issues forwarding ('ex-ante') and post-sequestration ('pre-posted') credits called 'Plan Vivo Certificates'.

Voluntary Offset Standards



Climate, Community, and Biodiversity Standards (CCBS)

The Climate Community and Biodiversity Alliance develop this standard. For land-based projects that can simultaneously bring diverse climate change and social benefits. It uses government agencies' panel approaches to climate change management guidelines (IPCC GPG) but can also use COM-approved methods to calculate climate reduction/savings. See an example of an approved CCB project [here](#).



The Green-e logo

The green-e logo is a US standard, recognized nationally. It is an independent national certification and certification system for renewable energy and renewable energy companies.

Voluntary Offset Standards

In the table below, we have compared some major voluntary offset programs based on their launching year, areas under which they function, amount of carbon offsets issued. Most voluntary programs are based in the United States but issue credits worldwide. In addition, these voluntary operators are affiliated with one or more compliance standards.

Voluntary Programs	Founded in (Year)	Geographic Coverage	Amount of offsets/ projects
Climate Action Reserve	2008	United States, Mexico	Over 150 million offset credits issued [19]
The Gold Standard	2003	International	2300 projects in 93 countries; 191 million of Co2 reduced; \$28 Billion dollars of shared value created [20]
Plan VIVO	1997	International ()	Plan VIVO® Issuance of Plan Vivo Certificates (PVCs) have increased by 40% in the last year alone (from 5 million issued PVCs to 7 million PVCs) [21]
VERRA- VCS program	2007	International	98.8 million VCUs in 2019, 1941 total projects. [22]
Green E	1997	International	Green-e® certified approximately 90 million megawatt-hours in retail transactions in 2020, an increase of over 30% from the previous year. Nearly half of the generation was from facilities less than five years old [23]



INTERNATIONAL ANALYSIS

Under this analysis, we have studied four major economies: India, China, US and the European Union

5 International Analysis

5.1 India

India

According to the EU JRC, India is responsible for 2421.73 Mt CO₂ emissions, making it the third-highest.

However, carbon emissions per person are relatively low at about 1.9 tons per year. [24] India has cut down its GHG emissions over the past decade. From 2005 to 2014, global GHG pressure dropped by 21%. According to Climate Transparency, of the G20 countries, India is the only country on track to achieve its goals under the Paris Agreement. India has also ratified the COP26 agreement and is now committed to reducing its carbon emissions and supporting renewable projects.

Various developed countries used to see India as a cheap place to achieve their carbon emissions goals through mitigation projects, making India one of the global beneficiaries of carbon trading through the Clean development approach. But now, developed countries are shifting their focus to poorer African countries to launch offset projects.

Multi Commodity Exchange started trading future in January 2008 after the Government of India recognized carbon offsets as assets on 4 January. The National Commodity and Derivative Exchange, with notice and proper approval from the Forward Market Commission (FMC), presented Carbon Credit's future contract objective to provide transparency in the markets and help producers earn income from environmental projects. Carbon debt in India is sold through NCDEX only as a future contract. [25]

5 International Analysis

5.1 India

Indian government PAT program

The Perform Achievement and Trade (PAT) program is a market-based compliance mechanism to accelerate progress in energy efficiency in energy-intensive industries. Under this program, energy-intensive units from the wind turbine industries are allocated specific targets for energy reduction. Units are required to meet these objectives through the use of energy-saving technologies. Those who exceed the target are awarded Energy Conservation Certificates (ESCerts), equivalent to one ton of oil metric (MTO). Those unable to meet their assigned goals must purchase ESCerts (units that have exceeded their targets) through a medium-sized trading system operated by the Indian Energy Exchange (IEX). These Energy Efficiency Certificates are issued by the Bureau of Energy Efficiency (BEE). Achievements from the first two rounds of the PAT program are shown below. [26]

	Implementation Period	Energy Savings Target (Mn Tonne of Oil equivalent)	Actual Energy Savings (Mn Tonne of Oil equivalent)	Actual Emission Reduction (MN Tonnes of CO ₂)
PAT Cycle-I	2012–15	6.6	8.67	31
PAT Cycle-II	2016–17 to 2018–19	8.869	13.28	61

5 International Analysis

5.1 India

As of 2017, the PAT system was implemented annually in a continuous cycle. The PAT Scheme's first-round (2012-2015) reduced the power consumption of more than 400 energy-intensive businesses by 5.3%, above the initial target of 4.1%. [13] The consistent consistency of the target in the first two rounds of the PAT has raised whether the target was a desire for prominence. Research into the effectiveness of PAT systems shows that high energy prices would encourage energy savings even in as usual scenarios the business environment - as usual (non-PAT), which emphasizes the need for a more realistic, targeted investment that increases energy costs. [27]



5 International Analysis

5.2 The United States of America

By 2020, the United States produced 4535.30 Mt of Co2 according to the EU JRC. [28], making it the second-largest in the world. The annual carbon emissions are over 15.52 tons per person [29] making it the world's highest emitters per capita.

Reporting of greenhouse gases came into effect voluntarily by compiling a register of the greenhouse gas emission organization authorized under Section of the Energy Policy Act 1992. This program provides resources for resources, industries, and other organizations. establishing a public record of emissions and the results of voluntary measures to reduce, prevent, or exploit GHG emissions.

In 2009, the United States Environmental Protection Agency established a similar reporting system for facilities producing

25,000 tons or more of carbon dioxide per year. This has resulted in thousands of U.S. companies monitoring and reporting their greenhouse gas emissions, which account for nearly half of all GHG emissions in the United States. US President Biden has vowed to reduce US emissions by 50 to 52 percent by 2030 [30], more than double the country's previous commitment under the 2015 Paris climate agreement.

The United States government has adopted a flexible approach to dealing with greenhouse gas emissions. George W. Bush's administration has chosen not to sign the Kyoto Protocol, but Obama's administration has entered into a Paris agreement. However, the Trum administration withdrew from the the paris agreement, while promoting crude oil and gas exports. Thereby increasing Carbon emmissions, making USA the largest producer.

5 International Analysis

5.2 The United States of America

When Joe Biden got elected, his administration reverted back to carbon mitigation and his administration committed to reducing carbon emissions to half of 2005 by 2030.

California is the only region with an established cap and trade market. By 2030, the government aims to reduce gas emissions by 40% below 1990 levels. Approximately 450 market-oriented businesses should bring about a 15 percent reduction in greenhouse gas emissions compared to the "normal business" by 2020. Companies under state law can buy a certain percentage of carbon credits to stay below the cap release.

According to the International Emissions Trading Association, California's carbon credits are expected to increase by about 66% to \$41 by 2030.^[31] Furthermore,

According to Refinitiv, "The two regional markets for carbon in North America - the Western Climate Initiative and the Regional Greenhouse Gas Initiative - has grown by 6% last year combined with about 49 billion euros." ^[23]



5 International Analysis

5.3 China

China is committed to eliminating high pollution by 2030 and net-zero by 2060. To reduce the temperature to 1.5 degrees, C-coal plants in China without carbon dioxide must be eliminated by 2045. Based on current emissions, China is the world's largest producer of greenhouse gas emissions. However, despite having the largest carbon footprint in the world, as with India, China's per capita emissions remain relatively low at 7.3 tons vs much higher per capita emissions in developed countries. China's coal-fired power plants are a big contributor, which includes coal-fired power stations, coal mines, and a steam locomotive. [33]

The Chinese government has implemented several policies to control the use of coal and promote the use of natural gas. One of the policies was the launch of a national

emissions trading carbon trading infrastructure and capabilities scheme in mid-July of 2021. The plan involves more than 2200 companies in the energy sector and is designed to help the country achieve its goal of achieving carbon neutrality by 2060. The national ETS is estimated to cover more than \$ 4 billion in tCO₂, accounting for ~ 40% of emissions of national carbon. Unlike other systems, the Chinese cap is based on the output cap.

China's national carbon market was expected to enter the phase of expansion and capacity building in 2022, which will expand the carbon dioxide trade system to cover a wide range of sectors, as well as develop carbon trading infrastructure and capabilities across provinces, companies, and trade. The development approach is important in setting the price of carbon in many Chinese energy-intensive industries

5 International Analysis

5.3 China

as well as strengthening the measurement and utilization of the emerging carbon market. Furthermore, China is expected to soon restart its China Certified Emission Reductions market, which is home-certified carbon credits that can be sold to potential buyers and companies that have registered a compliance market to complete their withdrawals of up to 5% of the proceeds.

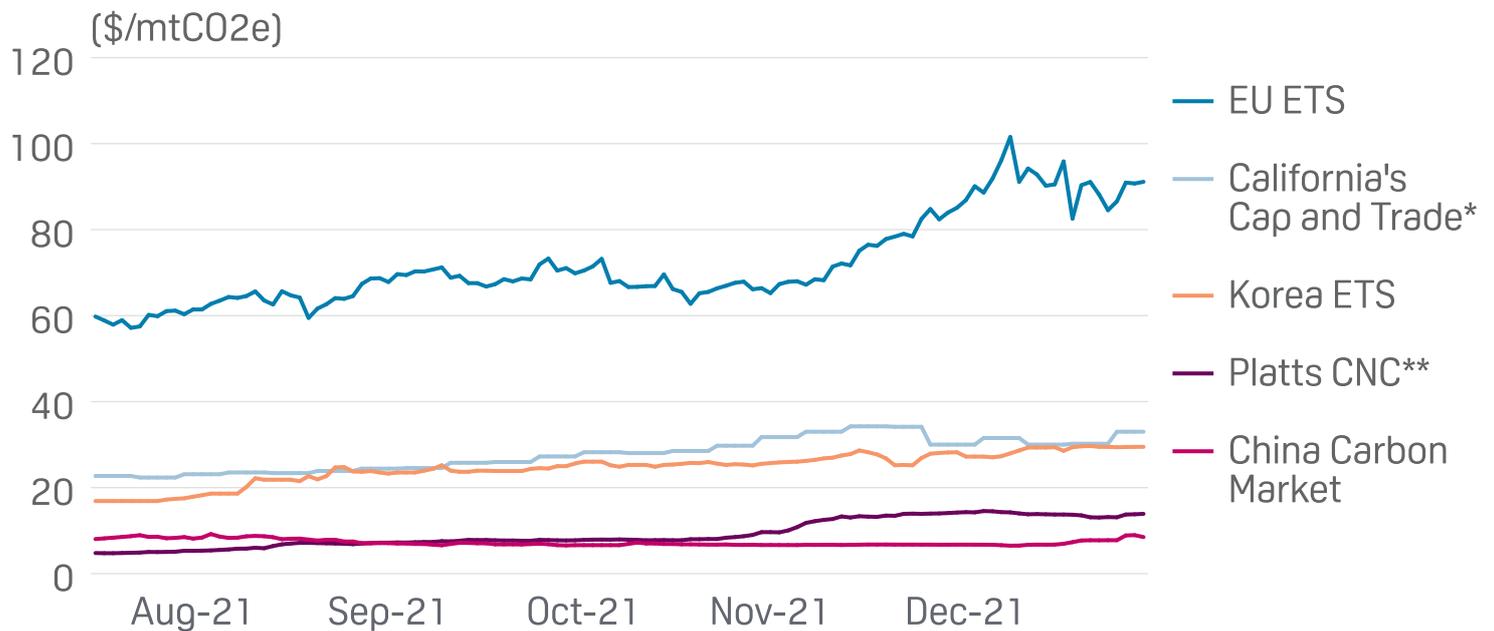
In pursuit of the carbon peaking and carbon neutrality goals, the People's Bank of China (PBOC) launched the carbon emission reduction facility (CERF) in November of 2021. This is a structural monetary policy instrument that aims to mobilize more social capital to promote carbon reduction, and support the development of clean energy, energy conservation, environmental protection, carbon reduction technology and other relevant key areas in a steady and direct manner.

Under this facility, the PBOC provides low-cost funds to financial institutions and guide the financial institutions to extend carbon reduction loans at rates close to the loan prime rate (LPR) of the same maturity. For the time being, the facility is available to financial institutions licensed to operate nationwide. For qualified carbon emission reduction loans, the PBOC provides the commercial lenders with funds worth 60 percent of the principal at the rate of 1.75 percent.

5 International Analysis

5.3 China 🇨🇳

CHINA CARBON PRICES RELATIVE TO GLOBAL CARBON MARKETS



Note: China carbon market launched July 16.

*California carbon price assessed weekly

**Nature-based voluntary carbon credit prices

Source: S&P Global Platts, Shanghai Environment and Energy Exchange, Korea Exchange

Source: www.spglobal.com

5 International Analysis

5.4 European Union



The European Union has produced about 2.54 billion tons of carbon dioxide emissions by 2020, a 13% decrease compared to 2019 levels. The highest CO2 emissions produced in the EU were in 1979, at 3.99 billion metric tons.

The most significant contributor to CO2 emissions in the EU is Germany. Despite levels here declining by about 20% since 2005, Germany still emits more polluted air than other emissions, France, Italy, and Poland. [35]

With the EU ETS established in 2005, the European Union has created a market path that provides CO2 value and incentives to reduce carbon emissions economically. As a result, it has effectively reduced pollution from the power generation industry by 42.8% over the past 16 years.

(The program covers more than 11,000 energy industries, industries in 27 EU member states and Iceland, Liechtenstein, and Norway. It covers about 41% of emissions from the EU. And 2019).

In June 2021, EU member states adopted a new climate law that set the Union's obligation to reduce greenhouse gas emissions by at least 55 percent by 2030 compared to 1990. To achieve this new, ambitious goal, the European Commission unveiled its "Fit for 55" package of new rules and legislative proposals in July 2021 - including the renewal of the EU ETS. The EU 2030 target for ETS emissions is 61% (previously -43%) compared to 2005. [36]

5 International Analysis

International carbon markets can play a crucial role in reducing greenhouse gas emissions more affordably. Hence, the number of trading systems issued worldwide is growing. In addition to the EU emissions (EU ETS) trading system, national or international programs are already operating or developing in Canada, China, Japan, New Zealand, South Korea, Switzerland, and the United States.

China now accounts for more than 27% of total global exports. The US, which is second globally, accounts for 11% of the worldwide total. India is responsible for 6.6% of global exports, splitting 27 EU countries, accounting for 6.4%. [37]

At COP 26 summit, the Indian prime minister said India would aim to roll out net-zero by 2070 [38], while the US government aims to achieve net-zero by 2050 [39]. China has promised to achieve net zero before 2060. [40] The EU has set a long-term strategy for climate neutrality by 2050.

Sweden and Germany have official net-zero targets for 2045. France, Denmark, Spain, Hungary, and Luxembourg have set their sights on 2050. Japan, Korea, Canada, and New Zealand have passed a law committing to achieving net-zero by 2050, while Ireland, Chile, and Fiji have proposed legislation. The UK has a legally binding net-zero policy by 2050 and new short-term targets to reduce carbon emissions by 78% by 2035. [41]

The data shows that all major carbon markets saw significant volume and price growth over the past year, focusing on gas production. However, the potential for these markets is very high. President Biden's commitment is expected to accelerate US growth, with China - one of the world's largest exporters - also seen as a critical player in the carbon capture market.



GREEN FINANCE

**A VITAL WAY TO CONTRIBUTE TO A SUSTAINABLE
FUTURE**

6.1 Considerations for Green Finance

Green Finance is no doubt becoming popular due to several reasons, including but not limited to:

Risk and Regulations

Over the past years, governments across the globe have rolled out a series of disclosure requirements on how corporations should disclose the risks exposed to environment and sustainability issues. Furthermore, multiple countries have drafted their own either based on or imaging Task Force on Climate-Related Financial Disclosures (TCFD) issued by the Financial Stability Board. Additionally, developed economies in the Asia Pacific have taken the green issues seriously through real regulatory actions. For example, in 2020, the Monetary Authority of Singapore (MAS) issued Guidelines on Environmental Risk for Banks, Insurers, and Assets Managers. On the other hand, Hong Kong Monetary Authority and Securities and Futures Commission (SFC) is the active facilitator in advancing Hong Kong's green finance strategies and launched the new Centre for Green and Sustainable Finance in July 2021 [42].

Investment Strategies (ESG integration)

Changes in investors' risk appetite and regulatory requirements have prompted investors to look through their portfolios for sustainability and social impact factors. For example, according to Fidelity, funds with an ESG focus have outperformed over both shorter and longer periods [44]. Many investors include nonfinancial factors when formulating their investment policies and principles, which reflects environmental, social, and governance (ESG) considerations. This investment approach will eventually affect the portfolio's financial risk-return profile and the investor's convictions to the broader society.



Considerations for Green Finance

Demand of funding in green and sustainability projects

Climate changes have uneven impacts on regions across the world. Developing countries are essentially in need of support. The OECD estimates that \$79.6 billion of climate finance was mobilized in 2019. The UK is doubling our International Climate Finance commitment to help developing nations with £11.6 billion over the next five years to 2025/2026. According to the Glasgow Climate Pact of COP26, Prime coal financing countries have committed to ending international coal finance by 2021. Besides, over US\$ 20 billion of new public and philanthropic finance (In the form of Climate Investment Funds and the Global Energy Alliance for People and Planet energy funds) have been committed to supporting developing countries such as Indonesia and the Philippines to scale up clean power and transition away from coal [45].



6.2 Sustainability in the Capital Market: Green Bonds

One of the most prominent fields where sustainability is increasingly considered is the capital market. The sustainability element of Environmental, Social, and Governance (ESG) is instilled in the concept of responsible investment as investors and financiers are considering progressively additional factors in structuring their financial portfolios. As a result, their capital is allocated in the best sustainable and ethical way. Amongst the numerous products, Green Bonds and ethical funds stand out in this play. According to Climate Bonds Initiative, as of 27 November 2021, US\$ 427 billion of Green Bonds have been issued year-to-date [46]. In the Asia Pacific, for the first half of 2021, US\$ 51.9 billion of climate bonds were issued, versus US\$ 53.2 billion for the entire 2020. China is the largest green bond issuer in the region, accounting for US\$ 22 billion during this period of 1H2021; globally, second only to the United States [47].



Source: www.ifec.org.hk

Sustainability in the Capital Market: Green Bonds

Hong Kong has an established mature capital market. The city's stock market, as of December 2020, according to HKDTC, stood in rank as the 3rd in Asia and 5th in the world by market capitalization. Over 2,500 countries were listed on the Hong Kong Stock Exchange with a total capitalization of about US\$ 6 trillion.

On the other hand, Hong Kong is a popular place for governments, banks, and corporates to issue and trade debt securities. Moreover, as China's most scalable offshore RMB hub, Hong Kong is also the most popular destination for issuing debts denominated in the growing influential Chinese currency (also known as dim sum bond).

According to the design consultancy firm Arcadis*, Hong Kong is one of the most sustainable cities in the world. However, the growth of air pollution and housing affordability has persistently been the city's most imminent challenges to address. In October 2021, in response to the Paris Agreement, the Hong Kong SAR government announced the Hong Kong's Climate Action Plan 2050A to set out the guidance and vision for reducing carbon emissions, combating climate change challenges, and carbon neutrality.

The new plan outlines the four major decarbonization strategies, namely,

1. Net-zero electricity generation
2. Energy saving
3. Green buildings
4. Green transport and waste reduction

The city aims to commit US\$ 240 billion to bring forward these visions over 15 to 20 years.

* Arcadis, 2018

^ HKSAR Government, Hong Kong's Climate Action Plan 2050, October 2021

6.3 Green and Sustainable Financing In Hong Kong

Green and sustainable finance in Hong Kong is expanding area of financial activities. With the introduction of the Guangdong–Hong Kong–Macao Greater Bay Area (GBA) and the Belt and Road Initiative, the ultimate goal is to achieve carbon neutrality before 2050, as announced by the Chief Executive's 2020 Policy Address. The Hong Kong government and private institutions have been working together to address the growing importance on three different initiatives to achieve such goals:

- 1) **Government Green Bonds** – The Government Green Bond Programme (GGBP) was launched in 2018 with an introductory borrowing ceiling of HK\$100 billion. The borrowing ceiling of the GGBP has been doubled to HK\$200 billion to permit more issuance of green bonds totalling HK\$175.5 billion within the coming five years, from 2018 to 2022. Also, retail green bonds will also be issued for the involvement of the general public. A total of over US\$7 billion equivalent of green bonds, targeting global institutional investors and covering us dollar, Euro, and Renminbi tranches in multiple tenors, has been successfully issued under the GGBP.
- 2) **Grant schemes** – A new Green and Sustainable Finance Grant Scheme launched in May 2021 to provide subsidies for eligible bond issuers and loan borrowers to cover their expenses on bond issuance and provide external review services. The scheme will support green and sustainable bond issuance and lending to enrich further the green and sustainable finance ecosystem in Hong Kong. The scheme is expected to last for three years.
- 3) **Cross-agency collaboration** – A new agency group called The Green and Sustainable Finance Cross-Agency Steering Group was established in May 2020, and a tactical plan was initiated in December 2020. With six key focus areas and five near-term action points for strengthening Hong Kong's financial ecosystem. The agency was created to support a greener and more sustainable future. [48]

Green and Sustainable Financing In Hong Kong

To make sure progress is in place, HKMA has been working with Authorized Institutions (AI) to adopt a three-phase approach in promoting green and sustainable financing: [49]

Phase 1: Developing a common assessment framework for institutions

Phase 2: Develop supervisor expectations for AI

Phase 3: After targets are set, the implementation, monitoring, and evaluation of AI's are created.



Source: www.mpfa.org.hk

6.4 Green Regtech: Improving Sustainability Data Transparency and Accessibility In Finance

Improving the quality of governance in banking and finance is a constantly discussed topic amongst the financial market participants. For example, improving the transparency of ESG disclosure and the reliability of ESG data has been the concern of financial regulators across the globe. The adoption of Regulatory Technologies (or RegTech), a branch of FinTech, provides solutions to the issues of ESG data collection, data reliability, and data accessibility.

On the other hand, the governance element of ESG is of growing concern to different stakeholders in the capital markets, including regulators, investors, corporates, and financial service providers. As a result, RegTech is playing an increasingly important role in directing the economy towards a more sustainable path by providing measurable, predictable, and standardized guidance for businesses to follow.

While some RegTech companies focus on areas such as prevention and detection of financial crimes, know-your-customer (KYC) during the onboarding process, and new applications in the context of green finance, others emphasize data accessibility and transparency, enabling business stakeholders to make more informed decisions and strategies in an ESG context.



ECOPRENEURSHIP

THE ROLE OF PRIVATE COMPANIES

7

ECOPRENEURSHIP

7.1 Role of Companies

Climate change is an apparent threat to communities worldwide, with short-term, medium, and long-term effects on their livelihoods. The Private Sector has a central role in reducing these Greenhouse Gases (GHGs) as they are the ones who contribute a significant amount of GHGs emissions.

In a vacuum created by government inefficiency in climate change, urgent corporate leadership measures are needed to retain global temperatures below 2 °C and to pursue efforts to limit them to 1.5 °C, as stated in the Paris Agreement.

The private sector should play a pivotal role in accelerating global decarbonization by setting targets to reduce global carbon emissions and compensating for their residual emissions through buying carbon credits. This compensation is critical in catalyzing faster climate action: it puts a price on carbon, attracts funding to suitable and worthy projects, it allows companies to

do something (rather than do nothing) in their way of getting zero and is currently developing and supporting solutions that will significantly reduce gas emissions today.

Governments solely will not be able to accomplish the goals of the SDGs by 2030. Instead, the responsibility of working for sustainable development has also been assigned to companies, community organizations, and many other players involved in economic and development activities worldwide.

There are many ways businesses and the private sector can promote sustainable development. The private sector should see and implement all of these changes as an investment in the future. It is an investment because it is estimated that applying sustainable business models to achieve the SDGs will generate opportunities for businesses worth approximately \$12 trillion US. [50]

7.2 Case study: ***IOEN - The Internet of Energy Network***

The Internet of Energy Network (IOEN – pronounced “ion”). A community-driven network that aims to build a new energy economy, powered by blockchain and Holochain. IOEN rewrites the crypto-energy story and reshapes the future of energy

IOEN’s mission is to create a digital infrastructure for clean energy powered by virtual microgrids and to help reach global net-zero carbon emissions by 2030.

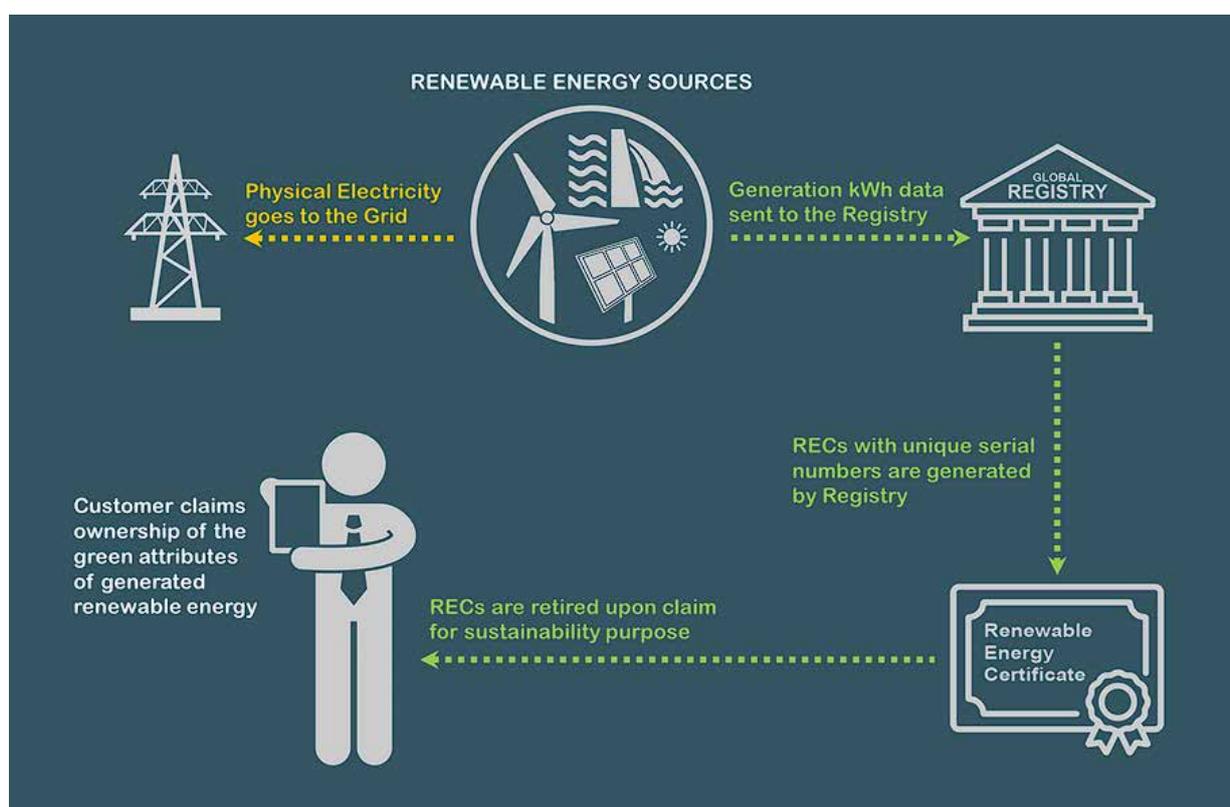
IOEN brings a unique approach to using token utility to bootstrap multiple virtual microgrids worldwide, building device by device. IOEN’s Proof of Balance model rewards users for taking energy actions and connecting their devices to others, while it works like bees in a hive to accomplish grid stability and clean energy integration.



7.3 Case study: *T-RECs.ai - Renewable Energy Certificate trading*

Founded in 2018, T-RECs.ai Pte Ltd is a pioneer in the Renewable Energy Certificate {RECs} in Singapore and is compliant with RECs 673:2021 code of practice. The compliance standard is increasingly important to facilitate the renewable energy deployment in Singapore. The company's REHash™ platform tracks and certifies the transfer of ownership and retirement of RECs on a blockchain platform built on the proof of stake {PoS} consensus protocol. Sustainability can be achieved through the RECs trades on this REHash™ platform.

RECs are used to trace and verify the production of 1 megawatt-hour (MWh) generated from a renewable source (including solar, hydro, and wind). Buying RECs is the most effective path to achieving carbon neutrality. T- RECs {trusted RECs} by TRECs.ai enable a more effective and efficient way to verify, audit, and track the RECs on a platform built on blockchain technology.



Source: www.trecs.ai/trusted-recs

7.4

Case study: *Electrify - P2P Green Electricity Platform Built on Blockchain Technology*

Founded in 2017, Electrify is a Singaporean start-up that focuses on facilitating green electricity purchases on a blockchain-based infrastructure. The company's utility-grid-wide electricity trading marketplace allows green-aware retail customers to identify electricity generated from genuinely green and renewable sources. In 2020, Electrify collaborated with Engie and Senoko Energy, one of Singapore's largest electric utility companies, to launch the city-state's first peer-to-peer (P2P) energy trading platform, SolarShare. SolarShare significantly increases energy transparency by providing real-time energy generation and usage data. Moreover, consumers can also compare prices and determine their preferred green energy source. The concept of P2P is innovative as the community of green-minded individuals will be able to participate in facilitating the adoption of renewable electricity, in contrast to the past practice where consumers were in a relatively passive position.

Carbon trading (ETS) is a market-based approach to limiting overall carbon dioxide production to limit climate change. Notably, the role of carbon trading will gain traction and promote more investment in clean energy projects as Mainland China, Japan, South Korea, and Hong Kong have made the carbon neutrality pledges by either 2050 or 2060.



Reference:
<https://www.senokoenergy.com/solarshare>

7.5

Case study: MAS ESG Registry, STACS, Singapore

In October 2021, the Singapore-based Hashstacs Pte Ltd ("STACS") partnered with the Monetary Authority of Singapore (MAS) in Project Greenprint to develop an industry-wide blockchain-based ESG Data and Certification Registry. This registry aims to provide reliable ESG data from various sectors in an all-in-one platform. Such an ESG Registry is built upon STACS's blockchain technology that ensures immutability (tamperproof) and data recording and transmission quality. On the other hand, the API (application programming interface) provided by STACS allows financial institutions to enhance their monitoring of trade finance transactions and portfolio management.



Monetary Authority of Singapore

The ESG Registry also enables data availability on different sustainability projects such that data on ESG is therefore available regardless of source. Moreover, the Registry is connected to several ESG certification bodies, allowing end-to-end ESG value traceability that financial institutions mostly need for their investment decision-making

Combining DLT with Various Partners for a Greener Future



Reference: stacs.io/greenstacs-integrated-esg-nexus/

7.6 Case study: *MioTech*

Data is one of the major pain points to tackle in ESG compliance. MioTech provides a solution to track, store and manage carbon emission reliably and energy consumption data leveraging Intelligent Data Acquisition, Data Mining, and AI advanced algorithms. By establishing a credible third-party carbon footprint disclosure platform, MioTech enables companies to improve their environmental performance, enhance transparency with stakeholders, adhere to sustainability-related business strategies, and comply with the regulation.

Now we have the tools and mechanism to bring in data transparency such that sustainability is visible and measurable. But how do we create a platform that provides opportunities to a more significant number of investors to participate in facilitating greener finance? With the adoption of blockchain technology, we can now make green investment accessible to the greater extent of the investment community. In such a way, we create a positive feedback loop to a sustainable economy by incentivizing the investment in green financing.



7.7 Case study: *TERRAPASS*



About:

Terrapass deals in offering carbon offsetting products to business organizations and individuals. As mentioned on their website, Terrapass registered over 2,400 members, reducing 36 million pounds of CO₂ within their first year. It also helps users calculate their carbon footprint. It functions worldwide, but its customers are mainly in the United States.

Founded in: 2004

Headquarters: San Francisco, California

Areas Served: United States

Funding: \$5.8M

Industry: Environmental Services (B2B)

Total offsets: 25000 metric tonne of CO₂

Price

1 Terrapass Coin (TPSC) = 1 metric Ton of carbon offsets

Personal Carbon Offsets (One-Time Purchase) is \$4.99 per 1,000 lbs.

Personal Carbon Offsets (Monthly Subscription) is \$4.49 per 1,000 lbs/month.

Website: <http://www.tera-pass.com/>

Terrapass uses the Gold Standard, Verified Carbon Standard, the Climate Action Reserve, and the American Carbon Registry as their standards when choosing projects to support. Additionally, Terrapass ensures that they have fully verified and monitored all the emission reduction projects undertaken.

Terrapass supports four main projects: farm power, landfill gas capture projects, clean energy, wind power, and an abandoned coal mine methane capture.



Purchasing carbon offsets

The process is straightforward; you balance your carbon footprint by supporting or paying for the carbon reduction projects funded by the company. Terrapass has a lot of products to offer to individuals. The individual who wishes to offset can choose any product according to his requirement. But all products are sort of similar and contribute to carbon offsetting. Some products include Carbon Balanced Living Plan: Cost Starting at \$4.86 (monthly) Personal Carbon Offsets: Cost Starting at \$4.99 (one-time or monthly)

Flight Carbon Offset: Cost is \$4.99 -to \$49.90

EcoTourist Bundle: Cost \$49.89

Terrapass offers carbon offsets for businesses. The packages are similar, which lets companies buy carbon offsets through a monthly subscription or on a one-time basis. Business carbon offsets start at \$11 for a one-time or recurring purchase.

Terrapass offers a carbon footprint calculator which can calculate the carbon footprint of their family, a business, or a particular event. This service is entirely free and is available on their website. The system asks several questions like vehicles you own and their details, how far and how often you travel by public transport, your flight information, and your ZIP CODE. First, it shows how many lbs of Co2 is emitted by you annually. Then, according to your carbon footprint, the algorithm suggests how much you should be contributing to carbon offsets monthly. For example, If one calculates their carbon footprint, which comes out to be 9700 lbs of Co2. And therefore, it will suggest a monthly offset of \$4.04.

There is another tab under businesses called 'Green E Certified Products.' Terrapass wants to let their business clients know that they offer Green E Certified RECs and offsets. Green-e is the nation's leading carbon credit program for selling renewable energy and greenhouse gas reduction certificates in the market. Finally, another tab called 'Aviation.' Terrapass offers its aircrafts clients to help them balance their carbon emissions. It helps them to align with the CORSIA compliance. Carbon Offsetting and the Reduction Scheme for International Aviation (CORSIA) is an international program that works to offset carbon emissions resulting from international air travel. Terrapass also works to help aviation companies to comply with this plan.

7.8 Case study: *ASPIRATION*



About:

Aspiration is one of those digital companies providing services to help customers offset their carbon impact. Aspiration is a new type of Personal Finance Company. It offers retail banking and investing services and helps its customers make sustainable choices with their money for the environment. It is a financial firm, not a chartered bank. It offers a variety of accounts, with a focus on rewarding customers with cashback for purchases made from ethical companies. It is the best institution for those who want to support the environment through their banking choices.

Founded in: 2013

Headquarters: Marina del Rey, California

Areas Served: United States

Funding: \$250 million

Industry: Finance

Website: <https://www.aspiration.com/>

Aspiration offers all banking services to its customers on an online-only platform. But its banking services support the environment and provide various benefits to its climate-conscious customers. It is not like the traditional bank account. Instead, customers use a Spend & Save cash management account (CMA) for their day-to-day financial needs and transactions. The money customers deposit through Aspiration is held at one of its partner banks.

Though Aspiration is not a legal bank, customer deposits are insured by the Federal Deposit Insurance Corporation (FDIC) for up to \$250,000.

ASPIRATION

Aspiration commits that its customer's deposits will never be used to fund fossil fuel exploration or production, which is a significant cause of substantial carbon emissions in the world. Not only this, it gives various cashback and rewards to its customers for making ethical payment choices. For example, it has formed a Conscience Coalition of different retail companies that are environmentally conscious, including TOMS, Warby Parker, Blue Apron, etc. If the customers purchase from one of these retailers using Aspiration's Debit Card, they earn cashback of around 3% to 5%. In addition to this, the customer can also earn cashback by spending money with companies that have high Aspiration Impact Measurement (AIM) scores. This score rates companies based on their ethical treatment of people and the planet, and the companies with the highest scores get the benefit to their customers to earn Aspiration debit card purchasers 0.5% cashback.

Anyone can open a simple Spend and Save account with Aspiration or link a current bank account with Aspiration. This Cash management account (CMA) allows the customer to manage cash, make payments, and earn interest. Though, it is different from the traditional savings account.

After opening the account, the person can make day-to-day transactions using the mobile app. The depositor can withdraw money or check the balance at any Allpoint ATM for free. According to the Pay what is Fair Scheme, there are no minimum balance requirements, and the customer has to pay a monthly fee of whatever he feels is fair.

It also pays a reasonable interest rate for balances but not on the basic Aspiration Spend & Save Account. To take advantage of the high-yield savings feature of the Aspiration CMA, the customer will need to enrol in the Aspiration Plus Account.

Aspiration Plus has a monthly fee of \$5.99 a month billed annually. With Aspiration Plus, cashback rewards for spending with Conscience Coalition members are raised to 10% across the board, although the amounts earned by shopping with companies with high AIM scores remain the same. Aspiration Plus account holders also receive one out-of-network ATM fee reimbursement per month.

7.9

Case study: *HANDPRINT TECH*



Handprint

About:

Handprint calls itself 'Impact as a Service.' It helps firms to create a positive impact on the planet.

By installing and launching Handprint Plugin, companies contribute to sustainable projects with every product they sell. Handprint is a double-sided market. It helps both companies and customers who care about these issues.

Founded in: 2019

Headquarters: Singapore

Areas Served: Mathias Boissonot, Ryan Merrill, Simon Schillebeeckx

Funding: \$750 K

Industry: Climate Tech

Website: <https://handprint.tech/>

The Handprint was started to integrate blockchain technology into the carbon credit market. It was aimed to build something that had much more scalability than a non-profit.

They wanted to create a convincing, credible, and highly efficient; that was the beginning of Handprint back in early 2020.



HANDPRINT TECH

Handprint is two things in one. On one side, they are a multi-sided market, where they connect and curate NGO partners active in the regeneration of our planet. They partner with NGOs involved with reforestation, coral reef reconstruction, ocean plastic clean-up, and social projects like women empowerment, education, etc., digitizing them and functioning as their commercial agents.

On the other side of the multi-sided market are the companies that want to do something positive for the world, like buying 100 trees or paying for the removal of plastic. For this, the company installs and launches the Handprint plugin. Then the company can choose how they want to contribute with every product they sell. Then the company can track its impact and share results with its customers.

The cost of Handprint to customers is zero, and for the merchant, there is an impact monitoring fee. They charge \$0.11 for every unit of the impact created to generate a single unit; there can be multiple numbers of transactions.

7.10

Case study: 穗碳 *Sui Carbon*

The "Sui Carbon" mini-program is developed by the Guangzhou Municipal Bureau of industry and information technology in conjunction with the Guangzhou Power Supply Bureau of Guangdong Power Grid Corporation. It innovates the management mode of energy and carbon emission measurement, unifies the scientific algorithm model, and applies blockchain technology to track the source of enterprise energy consumption data.

The program can review the enterprise's historical data. It can also display the enterprise's energy consumption in a graphical form by year, month and day to form energy consumption and carbon emission data. As a result, users can view the historical emission curve and industry emission to show the actual energy consumption and carbon emission level. To analyse the energy consumption and emission trend scientifically, achieve the carbon emission quota target and comprehensively evaluate the production efficiency of the enterprise.

In addition, the program can also provide accurate and reliable data support for the government to formulate policies. By summarizing the industry situation, drawing a map of regional hot spots, and comparing and analysing the dual control of energy consumption and carbon emission intensity, it can quantify the industry's energy use efficiency and technology sustainability degree.



7.11 Case study: 碳积分 *Carbon Credits*

The Xining Eco-environmental bureau uses the WeChat mini-program, official account, and background data management to quantify the behaviour of energy saving, carbon reduction, and environmental protection, which citizens or groups voluntarily practice. It also provides valuable carbon credits to the public through the "carbon integration" function to establish a positive guidance mechanism for green, low-carbon life.

This platform has been online for over six months, realizing the construction, demonstration, and promotion of application scenarios such as low-carbon public welfare, low-carbon travel, and low-carbon education. The accumulated number of users is more than 3000, and the average daily active users are about 300, of which 80% are citizens of Xining, realizing a total carbon emission reduction of about 20 tons. Through the low-carbon public welfare scene, more than 160 individuals and four groups donated money to adopt 377 trees in the Jinshanling green area of our city, obtained nearly 12 tons of carbon sequestration, and realized more than 5000 yuan of afforestation carbon sequestration income. At the same time, through the low-carbon public welfare scenarios, the program can effectively guide and encourage the public to offset and neutralize their carbon emissions and explore a feasible innovation path to realize the ecological value of afforestation.



7.12

Other Usecases Using Blockchain Technology



Air Carbon: Air Carbon: AirCarbon Exchange ("ACX") is a global exchange revolutionizing the voluntary carbon market. Based in Singapore, the Exchange's client base constitutes corporate entities, financial traders, carbon project developers, and industry stakeholders. ACX provides its clients with an efficient and unambiguous trading platform that is simple, frictionless and with the lowest commission fees available on the tokenised carbon offsets into three fungible carbon asset classes. The first is the AirCarbon CORSIA Token (CET) which includes only carbon offsets compliant with CORSIA guidelines. The second is the AirCarbon Global Nature Token (GNT), which includes high-quality carbon offsets only from projects in the forest management industry. The third asset class is the AirCarbon Premium Token (PMT) which only carbon offsets the highest quality and supports the Millennium Development Goals of the UN(CRTs).



Climate Trade: ClimateTrade is a Spanish company whose main objective is to help companies achieve their sustainability goals by offsetting carbon emissions and financing climate change projects. ClimateTrade presently works with more than 20 international companies with more than 150 projects. In 2018 they launched the first Carbon API in the world. It uses blockchain technology to guarantee that carbon credits are cancelled in the corresponding registry and ensure that the money committed from the sale goes directly to the project's source.

Other Usecases Using Blockchain Technology



Carbonex: Founded in 2017 in the UK, Carbonex is a global exchange platform incorporating blockchain technology. Carbon Credits are being converted into a CBN coin which can be traded as effortlessly as a traditional currency. They create ECO tokens encoded in smart contracts, which are available through a crowd sale to allow participants to support the global response to the threat of climate change.



CARBONBLOCK

Carbon Block: Founded in 2018 and based in Canada, carbon Block is tackling the world's climate problem head-on by unveiling the enormous potential of the carbon offset economy. They verify the GHG emission reductions, and then these reductions are quantified and turned into a blockchain token. With the help of brokers, Carbon Block will then sell these ISO-certified carbon offsets to a corporate buyer for a fee

7.13 Other usecases using Carbon Credits



Climate Care: Founded in 1997 and based in the UK, Climate Care has helped create the voluntary carbon market and pioneered carbon finance for community development projects. Today, they continue to develop award-winning carbon reduction projects and have delivered some of the world's most significant carbon offsetting programs.

Other Usecases Using Carbon Credits



Pathzero: The Pathzero forum provides a clear overview of how greenhouse gas emissions are measured and the supporting research conducted to support the statistics. Pathzero Forum provides a simple calculator to show your residual output at any given time and provides access to certified carbon projects for easy removal.



Atmosfair: Founded in 2005 and based in Germany, Atmosfair actively contributes to CO2 mitigation by promoting, developing, and financing renewable energies in over 15 countries worldwide. The company's carbon offset projects reduce CO2 emissions and support sustainable development by transferring technology and combatting poverty. Moreover, 90% of this initiative's projects adhere to the high-quality CDM Gold Standard, which stands among the strictest standards for climate protection projects.



Native Energy: The company was founded in 2000 and operates in the US. Native is pioneering regenerative agriculture community-scale projects that strengthen ranching communities, reduce scope three emissions, preserve biodiversity, and enhance beef and leather supply chains. In addition, they deliver investment solutions that create sustainable value for their clients and communities.

7.14

Other Usecases Using Methods Other Than Carbon Trading



CarbonBuilt

Carbon Built: Founded in 2020 and based in the US, the company cost-effectively uses CO₂ emissions from industrial sources and emerging direct air capture solutions to produce concrete, reducing emissions by at least 60% and potentially more than 100%, when compared to traditional concrete. With widespread adoption, Reverse can enable gigaton-scale CO₂ reductions and removals, storing this carbon in concrete for good.



climeworks

Climeworks: Climeworks develops, builds, and operates direct air capture machines using a technology holding carbon dioxide directly into the air; to remove the inevitable CO₂ emissions. Climeworks is the leader in carbon capture technology; they remove CO₂ from the air to achieve negative emissions, not simply avoid emissions. The captured CO₂ can either be reused for business purposes or stored in rock underground permanently.



Carbon Engineering

Carbon Engineering: The company started in 2009 in Canada and uses a Direct Air Capture technology that captures carbon dioxide straight out of the atmosphere taking up one million tons of CO₂ a year - which is equivalent to the work of approximately 40 million trees.



Footnotes

- [1] <https://www.co2.earth/global-co2-emissions#:~:text=The%20global%20average%20concentra>
- [2] <https://www.worldbank.org/en/programs/pricing-carbon>
- [3] <https://www.reuters.com/business/energy/global-carbon-markets-value-surged-record-851-billion-last-year-refinitiv-2022-01-31/>
- [4] <https://www.ipcc.ch/assessment-report/ar5/>
- [5] <https://www.iea.org/news/global-carbon-dioxide-emissions-are-set-for-their-second-biggest-increase-in-history>
- [6] <https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge>
- [7] <https://www.orfonline.org/expert-speak/pricing-carbon-trade-offs-opportunities-india/>
- [8] https://ec.europa.eu/clima/system/files/2021-10/com_2021_962_en.pdf
- [10] https://en.wikipedia.org/wiki/Glasgow_Climate_Pact
- [11] <https://www.c2es.org/content/california-cap-and-trade/>
- [12] https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/international-carbon-market_en
- [14] https://cdm.unfccc.int/Issuance/cers_iss.html#:~:text=Total%2010708%20Issuances%20for%20PA,Total%20448%20Issuances%20for%20PoA.
- [15] https://www.jstor.org/stable/resrep02794?seq=1#metadata_info_tab_contents
- [16] https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/off-sets/issuance/arb_offset_credit_issuance_table.pdf
- [17] <https://www.rggi.org/investments/proceeds-investments>
- [18] https://ec.europa.eu/clima/eu-action/climate-strategies-targets/progress-made-cutting-emissions/kyoto-1st-commitment-period-2008-12_en#:~:text=In%20the%20first%20period%20of,of%205%25%20below%201990%20levels.
- [19] <https://www.climateactionreserve.org/>
- [20] <https://www.goldstandard.org/resources/impact-registry>

Footnotes

- [21] <https://www.planvivo.org/news/plan-vivo-releases-icroa-endorsed-standard>
- [22] <https://verra.org/project/vcs-program/>
- [23] <https://www.green-e.org/>
- [24] <https://www.worldometers.info/co2-emissions/co2-emissions-per-capita/>
- [25] <http://www.legalservicesindia.com/article/264/Carbon-Trading-In-India.html>
- [26] <https://www.orfonline.org/expert-speak/pricing-carbon-trade-offs-opportunities-india/>
- [27] <https://www.orfonline.org/expert-speak/pricing-carbon-trade-offs-opportunities-india/>
- [28] <https://worldpopulationreview.com/country-rankings/carbon-footprint-by-country>
- [29] <https://www.worldometers.info/co2-emissions/co2-emissions-per-capita/>
- [30] <https://www.cnn.com/2021/04/22/biden-pledges-to-slash-greenhouse-gas-emissions-in-half-by-2030.html>
- [31] <https://www.nbcnews.com/business/business-news/are-carbon-credits-fighting-climate-change-became-billion-dollar-indus-rcna3228>
- [33] <https://www.nbcnews.com/business/business-news/are-carbon-credits-fighting-climate-change-became-billion-dollar-indus-rcna3228>
- [35] <https://www.statista.com/statistics/450017/co2-emissions-europe-eurasia/#:~:text=The%20European%20Union%20produced%20approximately,at%203.99%20billion%20metric%20tons.>
- [36] <https://www.cleanenergywire.org/factsheets/understanding-european-unions-emissions-trading-system#:~:text=The%20EU%20ETS%20follows%20a,and%20they%20can%20trade%20them.>
- [37] <https://www.cnn.com/2021/05/06/chinas-greenhouse-gas-emissions-exceed-us-developed-world-report.html#:~:text=China's%20greenhouse%20gas%20emissions%20in,11%25%20of%20the%20global%20total.>
- [38] <https://timesofindia.indiatimes.com/blogs/toi-ed-it-page/on-track-for-2070-net-zero-target-india-s-clean-energy-transition-is-rapidly-underway-benefiting-the-entire-world/>
- [39] <https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/>
- [40] <https://www.nature.com/articles/d41586-020-02927-9>



Footnotes

- [41] <https://commonslibrary.parliament.uk/global-net-zero-commitments/#:~:text=Sweden%20and%20Germany%20have%20legally,and%20Fiji%20have%20proposed%20legislation>
- [42] <https://www.hkma.gov.hk/eng/news-and-media/press-releases/2021/07/20210715-4/>
- [44] <https://www.fidelityinternational.com/editorial/article/outrunning-a-crisis-sustainability-and-market-outperformance-2ce135-en5/>
- [45] <https://ukcop26.org/cop26-presidency-outcomes-the-climate-pact>
- [47] Climate Bonds Initiative, <https://www.climatebonds.net>
- [48] HKSAR Government, Green Bond Report 2021.
https://www.hkgb.gov.hk/en/others/documents/Green_Bond_Report_2021.pdf
- [49] Hong Kong Monetary Authority, HKSAR Government's Green Bonds Offering,
<https://www.hkma.gov.hk/eng/news-and-media/press-releases/2021/11/20211124-3>
- [50] <https://www.mnovum.com/post/does-the-private-sector-play-a-role-in-sustainable-development>
- [54] <https://www.crunchbase.com/organization/handprint-0998>



References

<https://sustainfi.com/reviews/terrapass/>

<https://www.crunchbase.com>

<https://terrapass.com/>

<https://www.co2.earth/global-co2-emissions>

<https://www.investopedia.com/aspiration-review-4846426>

https://unfccc.int/kyoto_protocol

<https://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-programs/registries-enforcement/>

<https://www.carbonfootprint.com/offsetstandards.html>

https://en.wikipedia.org/wiki/Carbon_emission_trading

<https://ukcop26.org/the-conference/sustainability/>

<https://unfccc.int/news/cop26-reaches-consensus-on-key-actions-to-address-climate-change>

https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/auctioning_en

www.wikipedia.org

<https://icapcarbonaction.com/en/allocation#:~:text=Free%20Allocation%3A%20Free%20allocation%20was,duced%20to%2030%25%20in%202020.>

<https://beeindia.gov.in/sites/default/files/NCM%20Final.pdf>

<https://www.ipcc.ch/assessment-report/ar5/>

<https://carbonpricingdashboard.worldbank.org/what-carbon-pricing>

<https://www.worldbank.org/en/programs/pricing-carbon>

<http://www.legalservicesindia.com/article/264/Carbon-Trading-In-India.html>

<https://www.spglobal.com/platts/en/market-insights/latest-news/energy-transition/010622-commodities-2022-chinas-carbon-market-to-expand-build-capabilities>

https://data.footprintnetwork.org/?_ga=2.139606395.955866857.1643203586-231083304.1642444626#/

<https://agfundernews.com/carbon-markets-evolving-the-way-forward-for-the-us-agrifood-sector#:~:text=Two%20types%20of%20carbon%20markets,based%20markets%20are%20more%20common>

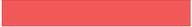
<https://www.statista.com/statistics/239093/co2-emissions-in-china/>

<https://www.worldometers.info/co2-emissions/co2-emissions-per-capita/>

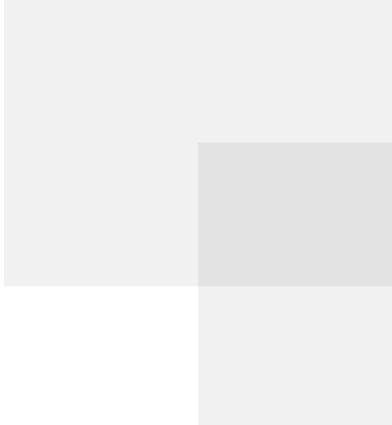
https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems%5B%5D=55

“Stock images courtesy Unsplash”

Images on Cover page and Page-24 by: @theeyeofthepanda_hk



Authors



Report Lead

Pranam Reddy – *Finstep Carbon Market advisor*

Musheer Ahmed – *Founder & MD, Finstep Asia*

Authors

Dhruvi Sachdeva – *Research Analyst, Finstep Asia – Hansraj College*

Lakshay Saini – *Research Analyst, Finstep Asia – Hansraj College*

Contributors

Alexander Haylonde Lam, Jiayi Xiao, Lewis Chen Yingwei and Wang Muyi

Graduate students, University of Hong Kong MBA

Proof Editor

Akshaya Meyya – *External Content Editor*

Report Designer

Akshat Jain – *Digital Marketing Associate, Finstep Asia*