

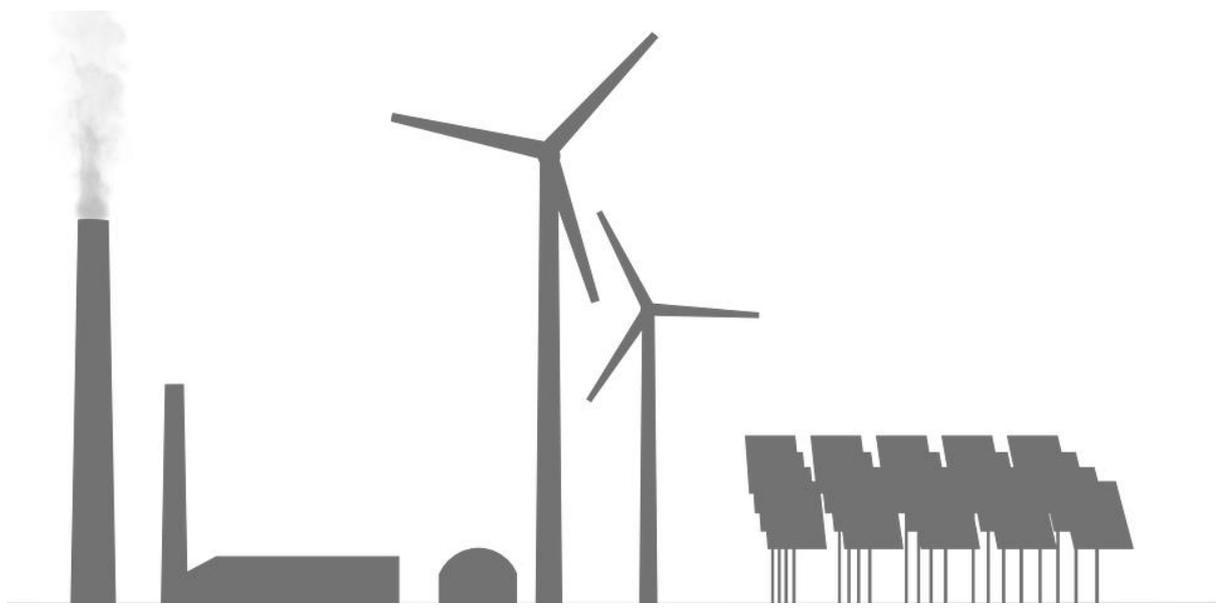


Carbon Credits

Balancing carbon and climate

By

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EXECUTIVE SUMMARY

Capping carbon emissions is essential to mitigate global climate change. This has been discussed since decades under the Kyoto Protocol and countries are using different ways and means to achieve their reductions target. This is easier said than done in a fossil fuel based economy.

Trading carbon credits is one of the many ways to meet the Kyoto targets. Carbon credits can be in the form of a Removal Unit (RMU), Emission Reduction Unit (ERU) or a Certified Emission Reduction (CER) credit. Trading carbon credits might not necessarily work as a deterrent to reduce carbon emissions; it is only balancing the global carbon levels. Someone is emitting more than they should while another is emitting way less than they could. So they trade credits and balance out the carbon.

This article discusses two market-based mechanisms such as Clean Development Mechanism and Joint Implementation to earn carbon credits supported with examples. Further the process of carbon trading through the International Emissions Trading is also discussed.

THE CONTEXT

Ever since the advent of industries and modern production, the earth and its environment are undergoing a series of unprecedented changes. It is estimated that the period between 1983 and 2012 has been the hottest 30-year period over the past eight centuries¹. Industries depend heavily on the use of fossil fuels as a source of energy, whether it's in the form of coal or oil. Extracting energy from fossil fuels requires burning it which is accompanied by release of several gases into the air; including carbon dioxide (CO₂). High levels of CO₂ in the atmosphere causes pollution as well as accelerates the greenhouse effect.

Greenhouse effect in a nutshell

The earth's atmosphere is a protective layer of gases around the earth that keeps the temperature warm enough for life to survive. Solar radiation heats up the earth's surface. The radiation that is emitted (re-radiated) from the earth's surface is trapped by the gases in the atmosphere. This is called the greenhouse effect. This is a naturally occurring phenomenon. The gases which contribute to this process are called greenhouse gases. Thus, greenhouse gases trap heat. Clearly this is an important process for the earth's ecosystem to thrive.

Greenhouse gases cause global warming

When the amount of the greenhouse gases in the atmosphere begins to increase beyond their normal concentration, they trap more and more heat and the temperatures on earth begin to rise to dangerous levels. In recent times, human activities are resulting in excessive emissions of these gases and are the main factor behind rising greenhouse gas levels. It is estimated that the current levels of greenhouse gases are the

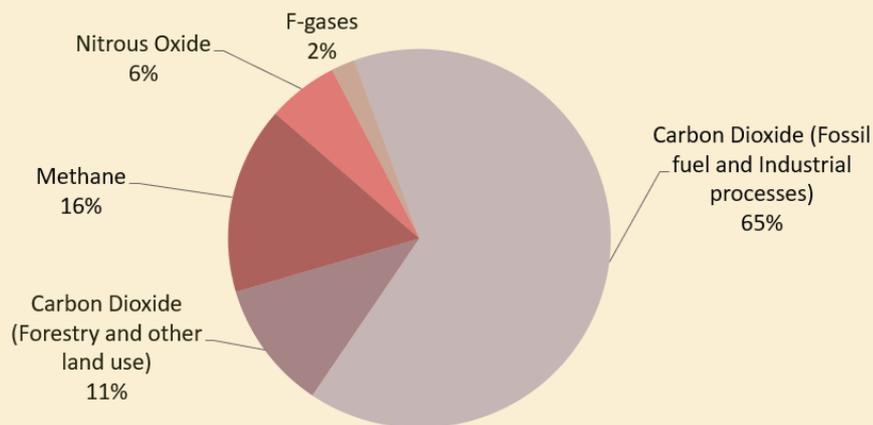
¹ Pachauri, R.K., and L.A. Meyer. 2014. *Climate Change 2014: Synthesis Report*. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC, Geneva: IPCC. http://ar5-syr.ipcc.ch/topic_observedchanges.php

highest in 3 million years². This phenomenon of increasing concentration of GHG in the atmosphere leading to the warming of earth is called global warming. This is being linked with rising sea levels, frequent floods and drought-like events.

Greenhouse gases

The primary greenhouse gases that human activities emit are carbon dioxide, methane, nitrous oxide and fluorinated gases. Of these, Carbon Dioxide contributes approximately 76% of global greenhouse gas emissions. Methane forms 16%, while Nitrous Oxide forms 6%, followed by fluorinated gases at 2% of total greenhouse gas emissions.

GLOBAL GREENHOUSE GAS EMISSION



Source: IPCC 2014

Greenhouse gases vary in their ability to retain heat in the earth's atmosphere. Radiative forcing gives an idea of the change in energy in the atmosphere as a result of greenhouse gas emissions. **Global Warming Potential (GWP)** is defined as the amount of energy the emission of 1 ton of gas will absorb over a period of time, relative to that of 1 ton of Carbon Dioxide. The GWP of CO₂ is 1. A higher GWP results in higher radiative forcing.

Greenhouse gases differ in their persistence in the atmosphere. Over the years, there has been a steady increase in the

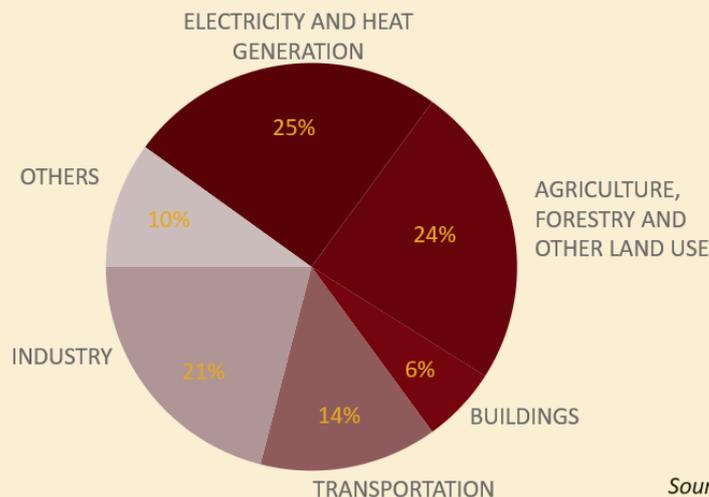
² Paul Fraser, Paul Krummel, Zoe Loh. *The Conversation*. <http://theconversation.com/world-greenhouse-gas-levels-made-unprecedented-leap-in-2016-86545>

amount of Carbon Dioxide produced worldwide. From approximately 11 million metric tons in 1751, Carbon Dioxide levels grew by a staggering 1000 times in the 1960s. By 2015, it stood at 36.2 billion metric tons.

Identifying the source

Electricity generation involving coal and fossil fuels alone contribute 25% of greenhouse gas emissions. Overall, factories and industries (beyond metal and chemical industry) contribute 21%. Agriculture and forestry contribute 24%, while the transportation and construction sector stand at 14 and 6%, respectively.

SECTOR-WISE GLOBAL GREENHOUSE GAS EMISSIONS



Source: IPCC 2014

While economic activity is essential for development, using fossil fuels is the issue. Most of the developing economies tend to be highly populated as well. There are tried and tested clean energy solutions available. However, it is not as straightforward as just implementing it in different countries. Switching to cleaner sources of energy while meeting the demand is a challenge for most developed economies. Moreover, climate change is impacting everyone on the planet; not just the developed economies. So it is important for every country to respond to the issue going forward.

HOW DO YOU KEEP A CHECK ON CLIMATE CHANGE?

Kyoto Protocol

The United Nations Framework Convention on climate change adopted the Kyoto Protocol on December 11, 1997 with the objective of addressing concerns posed by global warming. The Protocol aims to stabilize greenhouse gas concentrations and prevent dangerous human interference with the climate system. It came into effect on February 16, 2005.



The Kyoto Protocol refers to two categories of countries (also known as Parties). Annex-1 consists of developed countries, and NonAnnex-1 comprises developing economies. In total, 197 countries are part of the convention and meet under the aegis of Conference of Parties or COP.

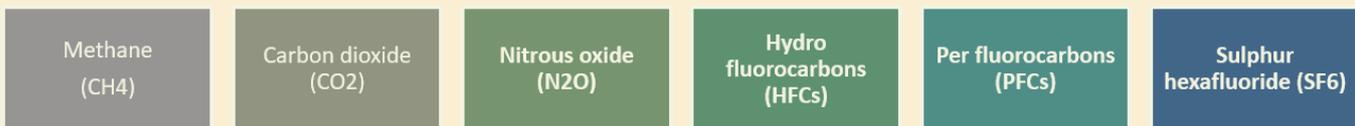
The first commitment period of the Kyoto Protocol was between 2008 and 2012. **The second commitment period is between 2013 and 2020, and members have committed to a reduction in greenhouse gas emissions by at least 18% below the prevalent levels in 1990.** This is also referred to as the Doha amendment. The countries which have agreed to emissions

reduction during the second commitment period of the Kyoto Protocol are called Annex B.

The cap on Greenhouse Gases

As a result of its efforts towards curbing emissions, the Kyoto Protocol identified six main greenhouse gases that needed to be controlled. Each country that complies with the Kyoto Protocol were assigned an emissions target. During the second commitment period, Nitrogen Trifluoride (NF₃) was added to the list of greenhouse gases.

GHGs CONTROLLED UNDER KYOTO PROTOCOL



The initial level of emission is referred to as the Party's assigned amount. Member countries of the Protocol are required to meet their commitments, and not exceed their emission targets. Once these targets are met, nations must submit reports to the governing bodies.

COP 21 Paris Agreement

The Paris Agreement that undertook in 2015 is an understanding between the leaders of over 170 countries to reduce greenhouse gas emissions. Its objective is to limit the global temperature increase to below 2 degrees Celsius (3.6 F) above pre-industrial levels by the year 2100. Ideally, the agreement aims to limit the temperature rise within 1.5 degrees Celsius (2.7 F). This agreement is also referred to as the 21st Conference of the Parties to the UN Framework Convention on Climate Change or COP21.

This is considered as a landmark agreement since it is the first time that countries will set their own targets. The Paris Agreement requires member countries to chart out their own action plan called the Nationally Determined Contributions or NDCs for limiting global temperatures rise within 2 degrees Celsius. There will be global verification every 5 years to assess the collective progress towards achieving the purpose of the agreement in keeping global temperatures below 2 degrees Celsius, and to inform further individual action by Parties.

COP 23 Fiji Agreement

Recently, COP 23 was presided by Fiji in November 2017 at Bonn. The result was advanced implementation guidelines for member countries. These guidelines empowered members to move together in achieving the ambitious Paris goal of restraining the rise in global temperatures within 1.5 degree Celsius.

COP 24 Poland

COP 24 that will take place in Poland in December 2018 will deliberate on the decisions for full implementation of the Paris Agreement.

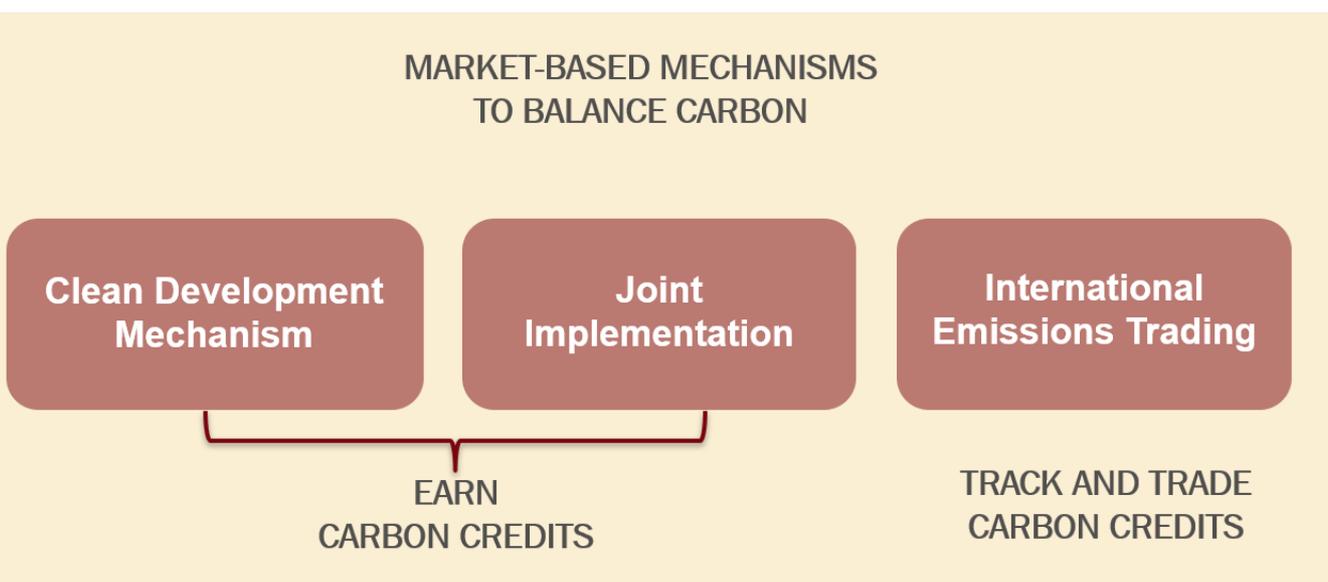
HOW DO YOU MEET THE COMMITMENTS TO EMISSIONS REDUCTION?

Member countries meet their targets primarily through national measures. However, the Kyoto Protocol offers additional means in the form of market-based mechanisms. Such instruments stimulate sustainable development through technology transfer and investment.

Under this, the protocol helps countries meet their targets by reducing emission or removing Carbon from the atmosphere in a cost-effective way. These mechanisms also encourage private sector and developing countries to contribute to emission reduction efforts.

In addition to national commitment by member nations, there are three market-based mechanisms that are recognized by the Kyoto Protocol to meet emission goals

- 1) Clean Development (CDM)
- 2) Joint Implementation (JI)
- 3) International Emission Trading (IET)



Having a clarity of these mechanisms is essential to understand how carbon balance takes place globally.

Clean Development and Joint Implementation are project-based mechanisms that feed the Carbon market. While Clean Development involves investment in emission reduction or removal enhancement projects in developing countries; Joint Implementation allows developed countries to carry out emission reduction or removal-enhancement projects in other developed countries. The credits earned are then tracked and traded as per the International Emissions Trading.

Overall, these are flexible instruments, reduce the cost of meeting emissions targets, and are effective in the reduction of greenhouse gases.

CLEAN DEVELOPMENT MECHANISM (CDM)

The Clean Development Mechanism (CDM) is mentioned in article 12 of the Kyoto Protocol. This allows a (Kyoto Protocol ratified) developed country to implement clean energy project in developing countries.

Certified Emission Reduction (CERs)

CDM projects can earn certified emission reduction (CER) credits that are calculated on the basis of emissions reduced after implementation of the Protocol measures. Each credit is equal to one ton of Carbon Dioxide emission and is counted towards meeting targets of the Protocol. These saleable credits can be used by developed countries to meet part of their emission reduction targets under the Protocol.

Clean Development Projects earn

CER

CERTIFIED EMISSION REDUCTION CREDITS

1 CER = REDUCTION OF 1 TONNE OF CO₂ EMISSION

An example of a CDM could be rural electrification project using solar panels or installation of energy efficient boilers. CDM projects largely include installation of renewable sources of energy. Thus, as the cost of clean technology continues to fall, CDM projects continue to be more viable solution towards emissions reduction. The details of projects registered for CDM, credit earned and other data is reported to UNFCCC and can be seen in this link

(<https://cdm.unfccc.int/Projects/projsearch.html>)

Some examples of CDM projects are discussed below.

Wind Project in China³

The Fujian Nanridao Wind Project of China consists of nineteen, 850kW turbines with a generation capacity of approximately 16.15 MW. In addition to reducing about 38,000 metric tons of Carbon Dioxide equivalent, the project promotes sustainable development by expanding local employment opportunities and boosting local tourism. The project has funding from the United Kingdom of Great Britain and Northern Ireland.

Himachal Pradesh Reforestation⁴

This is the world's largest CDM project with investment from India, Spain, Sweden, Japan and Canada through the World Bank's Bio Carbon Fund. The project entrusts people with the task of growing and protecting plantations. The project is expected to sequester 5 million tons of CO₂ equivalent over the first crediting period of 20-years.

Kenya Agricultural Carbon Project (KACP)⁵

The objective of this project is to remediate land using a wide range of methods to increase the soil organic content. This should improve the soil's water absorption, nutrient supply and bio diversity, and help prevent erosion.

Better soil raises farm yields, improves food security and makes agriculture more resilient to climate change. This project issued carbon credits for sequestering carbon in soil leading to a reduction of 24,788 metric tons of Carbon Dioxide, which is equivalent to emissions from 5,164 vehicles in a year. The project has formed the basis for developing one of the first methodologies for accounting emissions reductions from the application of sustainable agricultural land management (SALM) practices.

³ <https://carbonfund.org/projects/fujian-nanridao-wind-project-of-china/>

⁴ <http://www.forestcarbonportal.com/project/himachal-pradesh-reforestation-project--improving-livelihoods-and-watersheds>

⁵ <https://wbcarbonfinance.org/Router.cfm?Page=BioCF&FID=9708&ItemID=9708&ft=Projects&ProjID=58099>

JOINT IMPLEMENTATION (JI)

According to article 6 of the Kyoto Protocol, developed countries can carry out emission reductions or removal enhancement projects in other developed countries. In exchange, country implementing these measures can earn **Emission Reduction Units (ERUs)** each equivalent to one ton of Carbon Dioxide, which can be counted towards meeting its Kyoto targets.

Joint implementation offers parties a flexible and cost-efficient means of fulfilling a part of their Kyoto commitments, while the host party benefits from foreign investment and technology transfer.

The following are examples of projects under Joint Implementation.

Lovochemie Project in the Czech Republic⁶

A project in the Czech Republic by Denmark reduced the level of Nitrous Oxide (N₂O) emissions in the country's largest fertilizer manufacturer. The greenhouse gas N₂O is a by-product of the production of Nitric Acid, an essential component in fertilizers. It comprises of installation of a new catalyst technology in the existing installation for reduction of N₂O emissions. The company chose Hereaus of Germany as the supplier of the new catalyst technology and also contracted them to install and monitor the process.

ERUs between 2008 and 2012 were expected to be more than a million tons of Carbon Dioxide. Based on the JI project agreement, the project will use the additional funds from selling ERUs for green investment. In turn, this leads to positive environmental impacts of operations in towns, including

⁶ https://ji.unfccc.int/about/multimedia/ji_highlights.pdf

rehabilitation of brown fields and optimization of waste water treatment plants

Use of Waste Sawdust as Fuel in Romania⁷

This project by Denmark seeks to improve the environmental conditions in five towns in central Romania through fuel-switching in the district heating system. The project reduces the environmental impact of dumping waste sawdust and wooden chips in the local forest area.

The project puts this waste biomass to use, turning it into the fuel that powers five new boiler plants. Hot water is then distributed to residents of the towns via a network of pipes installed as part of the project. The sawdust substitutes for the natural gas, oil and coal that were previously used in the district heating systems. ERUs between 2008-2012 were expected to be 0.5 million ton of Carbon Dioxide.

Sunflower and Rapeseed Bio-Diesel Fuel Production and Use for Transportation in Bulgaria⁸

In this project, bio-diesel derived from sunflower and rapeseed crops are used as a substitute for petroleum diesel. The bio-diesel will be distributed on the basis of contracts with independent buyers who are contractually bound to use it only in Bulgaria. The bio-diesel plant will have the capacity to produce 60,000 tons per year. This project aims to create new jobs and employ farmers to grow the oil seed crops. ERUs between 2008-2012 were expected to be 677,216 tons of Carbon Dioxide.

⁷ https://ji.unfccc.int/about/multimedia/ji_highlights.pdf

⁸ <http://ji.unfccc.int/JIITLProject/DB/7RG4MHQTV9W72E5VGT66YW3JA4W10K/details>

INTERNATIONAL EMISSIONS TRADING

It's imperative to track carbon credits in order to manage the climate change conundrum. Carbon credits represent a ton of Carbon Dioxide or its equivalent in other greenhouse gases that have been removed or reduced from the atmosphere through an emission-reduction project.

The process of transaction of carbon credits between two parties under the Kyoto Protocol is referred to as Carbon Trading. As per provisions laid out under the Protocol, a buyer pays a seller in cash to buy carbon credits. In return, the buyer gets clearance to emit more Carbon Dioxide into the atmosphere. The standards for this are outlined by International Emissions Trading Association.

Article 17 of the Protocol defines International Emissions Trading as a system that allows countries with spare emission units to sell this excess capacity to countries that are over their targets. The main objective of this system is to make certain that the member states comply with their Protocol commitments.

To do this, energy intensive industries are allocated Carbon permits by other member countries, which allow them to emit a certain amount of Carbon Dioxide. It also helps to cut emissions without impacting economic growth.

Carbon Dioxide is the principal greenhouse gas and is traded and tracked like a commodity. This is known as Carbon Market. The units which may be transferred under the scheme, each equal to one ton of Carbon Dioxide, as follows:

Removal Unit (RMU): Is decided on the basis of land use, land use change and forestry activities such as reforestation.

Emission Reduction Unit (ERU): Generated from Joint Implementation product.

Certified Emission Reduction (CER): Generated from Clean development mechanism project activity.

Thus the RMU, ERU and CER are all a form of carbon credits.

An international transaction log is used to track units and record them through registry systems under the Protocol. This ensures secure transfer of emission reduction units between countries. In order to prevent overselling of units, each party is required to maintain a reserve of ERUs, CERs or RMUs in its national registry.

One of the advantages of carbon trading is that it allows emission reduction to take place wherever abatement costs are the lowest, regardless of international borders. Carbon trading appeals to the private industry, since firms look at profit that can be obtained by selling excess greenhouse gas allowances.

On the other hand, many emission credits are given away as businesses have a number of ways that they can gain extra emission credits. This leads to credits being sold to highest bidder similar to an auction. Similarly, credits are priced unusually high because of hoarding of emission credits by not just governments, but also other environmental agencies. For industries that use fossil fuels, the cost of converting to more renewable resources can be very high. The emissions credits, offsets, and even penalties and fines for exceeding the emissions limit are all cheaper than going through a conversion to a new source of energy.

Carbon tax

There is another method used in the carbon market to limit the emissions - Carbon tax which is imposed on each unit of greenhouse gas emissions and gives firms (and households, depending on the scope) an incentive to reduce pollution. The tax is set by assessing the cost or damage associated with each unit of pollution and the costs associated with controlling that pollution. If the tax is priced correctly, it can be an effective way to actually curb emissions.

While carbon trading is uncertain when it comes to the cost of emissions, carbon tax overcomes this in its structure by ensuring everyone knows the price being paid for each unit of Carbon Dioxide emitted. **It's a form of carbon pricing, and a method**

to limit emissions. However, there continues to be uncertainty about actual emission levels. Conversely, carbon trading provides certainty about the quantity of emissions but uncertainty about the cost of achieving these reductions.

Final thoughts..

Global climate change caused by greenhouse gases is the single greatest environmental challenge of our times. While carbon emissions account for a large percentage of greenhouse gases, they aren't the sole cause of climate change. On one hand, there are ongoing deliberations over the level of emission reductions by various countries, while on the other there are several policies and regulations across different sectors that keep a check on the environmental impact.

Top-down approach like policies have large impact but usually take time to be implemented. However, bottom-up approach such as the market-based mechanisms discussed here allow businesses to promptly start acting on emissions reductions through different avenues.

The carbon credit and trading mechanisms allow collaboration and technology-sharing between different countries creating a mutually benefitting situation. This does not necessarily control emissions from a country but only balance the global carbon emissions.