International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

CARBON CREDITS, EMISSIONS TRADING AND ENERGY SAVING

Ranveer Ratra

Pathways School Gurgaon, Haryana, India 122009

DOI: 10.46609/IJSSER.2023.v08i07.020 URL: https://doi.org/10.46609/IJSSER.2023.v08i07.020

Received: 17 July 2023 / Accepted: 28 July 2023 / Published: 30 July 2023

ABSTRACT

Emissions trading systems involving carbon credits are a new market-based form of reducing pollution, specifically carbon emissions. It has been growing in popularity, being used in markets across the world after being introduced internationally in the Kyoto Protocol. Now, the country of India is creating its own domestic Carbon Market to begin in 2025.

This research paper focuses on understanding the successes and shortfalls of carbon markets that are dominating across the world. The European and Chinese ETS were examined deeply, looking specifically at the impacts on the Gross Domestic Product and how effective they actually were in reducing pollution. The same principles of their successes were taken into account when assessing the Indian carbon market structures, including the running PAT scheme, which would become the base for the countrywide system in 2025. Observing the results of successful industries in the scheme, such as the aluminium, steel, and cement industries, and how those could be replicated economy-wide Using the analysis of the pre- existing emissions trading measures, a conclusion was reached around features of environmental integrity, cost effectiveness, integration with other policies, and greater verification being most suitable for a future carbon market.

The paper also considered the ethical and social implications of such a system, as there have been cases of green washing, and even the Chinese system is seen to not entirely move production away from non-renewable sources despite the well-promoted and monitored trading system.

Research Question: How can the Modern World prepare itself for the climate crisis in a manner that it does not discount any progress?

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

Foreword

This paper you are about to read is an important contribution to the Climate dialogue for two reasons.

First, the topic of Carbon Markets could not be timelier. The author, Mr. Ranveer Ratra, de-mystifies how Carbon Markets and carbon credit certificates work. He has researched the European system, the Chinese system, and the Indian system. He presents the three distinct approaches and based on those findings he offers a compelling and informative story on the pros and cons of the different approaches used to apply this carbon credits instrument to further the global Energy Transition.

The second reason is even more exciting for me, as a long-term practitioner in the global energy markets and a veteran observer of Energy Transitions in many countries. Ranveer Ratra is a member of the Indian Youth Climate Initiative. He is just starting on his scholarlyjourney.

The success of the global Energy Transition will have a huge bearing on Ranveer's own future and that of his peers over the next 60-70 years. His entire generation and the ones to follow, will be taking over the driver's seat in a decade or so, from those of us veterans holding the policy levers now. Carbon markets and carbon credits are our legacy. It is inspiring to see that concerned youth are taking a long and critical look at what they are inheriting from us, and probing and questioning what they find. This paper is one exampleof that.

It gives me immense joy to see young, engaged citizens like Ranveer joining national movements like the Youth Climate Initiative. He is investing personal time, effort, and intellectual curiosity with a view to then sharing his newly gained knowledge on this topic within his Youth Climate network. This is exactly the sort of youth leadership that we needto see!

Ranveer has made a commendable contribution to the dialogue. This paper should be read by veterans and new recruits alike!

I wish all of us good luck in this climate battle that we have no choice but to win.

--Mohua Mukherjee

--Energy Professional, ex-World Bank, and current Senior Research Fellow at OxfordInstitute of Energy Studies

https://www.linkedin.com/in/mohuamukherjee/

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

Introduction

The modern world has become increasingly socially and environmentally conscious with new metrics such as ESG's[1] measuring the sustainability value of companies and whetherthey should be invested in or not. The manner in which a corporation or even a country decidesto utilise its resources in order to create goods and services does not remain as the only view as to whether it has value. The process, it's impacts on surrounding factors and on the world asa whole has gained extreme importance over the past two decades. This awakening to wider impacts is often linked to climate change acting as one of the main drivers of wild plants and animals going extinct along with deteriorating human health and quality of life. International organisations and authorities such as the United Nations have put forward a large array of regulations and systems, and have sought collective agreement of over 190 countries, in order to combat these problems while human development and innovation is not limited.

One such solution offered to regulate the amount of harmful emissions, was the system of Carbon Credits or Carbon offsets. A carbon credit is essentially a permit that gives one entity the permission to emit a certain amount of carbon dioxide other greenhouse gasses or essentially a permit that allows them to cause a certain amount of pollution. This permit or a carbon credit is gained when pollution or emissions are either reduced elsewhere or prevented from occurring leading to no net addition from the emission created by the holder of the permit.In most Carbon Credit systems around the world, one carbon credit allows the emission of oneton or a thousand kilograms of carbon dioxide or the an equivalent of the same.

This system of monitoring and regulating carbon emissions was initially introduced within the Kyoto Protocol created in the United Nations framework convention on climate change (UNFCCC)[2] in Kyoto Japan, December of 1997. The Kyoto protocol was an essential mandatethat was specifically aimed at industrial or developed countries reducing their greenhouse emissions as the threat of climate change grew. Specifically, the protocol intended to reduce carbon dioxide emission by 5% from 1990 by the year 2012. On February 16th, 2005 the protocol became a part of international law. The countries under the protocol were given maximum carbon emission levels for specific time periods, partaking in carbon credit trading.

If one nation was emitting more than it's limit it would be punished with an even lower emission limit in the next time frame.

[1] https://www.sustainalytics.com/esg-ratings

[2] United Nations Framework Convention on Climate Change. "The United Nations Framework Convention on Climate Change." United Nations, 1992. Web. <https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf>

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

So, how does carbon credit trading work? It is based on the same Cap and trade model of regulations that were used to combat sulphur pollution in the 1990s. Introducing market based incentives to reduce pollution rather than simply placing a mandate, rather companies that cut their emission would end up being rewarded while companies that did not would be penalised. As each nation is given a number of carbon credits under its limit, they are incentivised to reduce emissions and thereby have credits left over in surplus which can be sold to other countries that produce more emissions. When the surplus offsets are purchased by another country they can be used to "offset" or neutralise the extra emissions they cause, leading to carbon credits also being called "carbon offsets". Hence larger countries that are wealthier and more industrialised, produce more emissions and must purchase a greater number of credits in order to maintain their economy while off setting their emissions, yet these expenses continue to rise as each time their limit is lower and they must purchase more credits. Essentially putting a price on the carbon they emit. While countries with lower emissions are able to sell what remains of theirs and gain funds. The price on carbon is determined by the market supply and demand. The more a country pollutes the more it will demand offsets and hence the price will rise.

Eventually leading to any practice that is polluting or that produces high amount of carbon dioxide is unattractive and overpriced for countries and corporations. To incentivise countries and corporations to reduce their carbon emissions at a faster rate, the prices of carbon must rise faster. As this will cause polluting countries and corporations to find it cheaper to resort to renewable and non-polluting methods as emissions based method become more expensive. In other words, it is cheaper for them to figure out how to pollute less and therefore pay less,, rather than needing to continue to buy credits. The main objective of the carbon prices is hence to rise as fast as possible, creating a genuine penalty for polluters leading to true change. This carbon price must in plan rise quickly to the point where polluters believe it is more cost effective for them to invest in new renewable technology that reduce their pollution levels.

Methodology

This essay will be focussed on the Indian carbon credit market, its effectiveness, it's shortcomings and how the same can be optimised to allow the country to reach it's internationally agreed environmental security targets, including complete carbon neutrality by or net zero, the year 2070.

In order to do the same the essay will first look at international carbon credit structures already in place internationally and in specific countries. Observing data and targets their progress and effectiveness will be measured, understanding successes and shortcomings. Then the Indian carbon market will be looked into, firstly the structures that the government has placed, including the limits along with the rate of adoption and progress. Further the legislation and policy of the

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

Indian carbon market will be looked into to observe where international components and elements can be applied. The data internationally will be compared to India's. The same will be applied in terms of practicality comparing business growth and development while carbon credit markets arise.

Then the essay will finally reach the analytical conclusion of whether the model and method of carbon credits is ethical and valid? How can it be optimised in a manner to be internationally and future sustainable? Suggestions and conclusions will be drawn from the previous analysis throughout the essay.

International carbon Markets

EU ETS

Since the Kyoto protocol in the late 1990s multiple carbon markets have developed, majorly in developed countries. Despite there being no overall global marketplace for carbon credit trading, many regional and national markets have been formed. One of the largest and longest existing carbon market is present in the European Union. The carbon market looks over the carbon dioxide from maritime transport, aviation within EU economic boundaries, electricity and heat generation, along with industries that are energy intensive such as oil refineries, production of metals, cements, organic chemicals or steel. Along with nitrous oxide and perfluorocarbons from chemical and aluminium production.

The same cap and trade model was used in the European union as they began the first emission trading system or ETS in the year 2005. With the same model of a cap on emissions, which reduces over time and the usage of credits within this cap can be traded as required. Yet any revenues from the sale of the credits must be placed into the state's budget to further combat the climate crisis. The system works in phases with time frames, currently being in its fourth of 2021-2030. Each phase involves revisions such as opening up to new sectors as proposed in 2021 or a revision in 2018 to fit the European union's 2030 climate and energy frame work. An interesting part of the EU ETS is Free allocation, despite auctioning the allowances (carbon credits) is the primary way of their distribution and circulation, a significant part is allocated free in order to reduce any chances of carbon leakage. Carbon leakage entails that one country has a sharp rise in its carbon emissions as another moves it's polluting practices there due to strict constraints in their country. Although it may seem counterintuitive, averting carbon leakage is integral since increased emissions in one region can have detrimental impacts on neighbouring countries, with the tight geography of Europe the same could create large problems.

The third phase from 2013 till 2020 observed a great amount of progress in the European carbon market and achieving its objectives. The total allowable cap on emissions was reduced by 21%

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

within the 8 years of the phase. Along with that the emissions from stationary installations.[3] have reduced by 29% along with an overall decrease of almost 43% since the beginning of the ETS system in 2005. The decrease from the year 2019 to 2020 was the most significant, supported by impacts of the pandemic as industrial and energy demands dropped as well.

The total emissions reduced by 11.4% from 2019 to 2020, with the average percentage change between 2013 to 2020 being only a reduction of 3.825%. Despite this success in emission reduction, the same year was also the only time the Real GDP growth rate was negative in the entire 8 years of the phase being a reduction of 6%[4]. The real challenges is to achieve these kinds of reductions even without the unwanted GDP growth reduction context. That is referred to as de-coupling GDP emissions, meaning the technological innovations and clean energy generation investments are adopted which increase output without leading to emissions.

With environmentally positive success visible in the system created by the European union, the same phase was not entirely on the planned path created initially by the union. At the beginning of the third phase there was imbalance between the supply and demand of the Allowances of about 2.1 billion allowances. Addressing the issue in the short term the actions was to post pone the auction to 2019-2020 from 2014-2016. Along with that the Market stability reserve or MSR was created in 2015, this adjusts the volume of allowances that are auctioned in accordance with the pre-defined thresholds of the total number of allowances in circulation or TNAC. The system began operating in 2019, taking out allowances from the market circulation, reducing the volume that is auctioned for member states each year. In preparation for the same, the commission would regularly observe the TNAC for the previous years, using the revisions and TNAC the auction volumes were reduced by nearly 40%.

Observing the graph above[5] we can observe how the prices of carbon permits increased drastically over the course of the third phase of the EU emissions trading system, with the cost per tonne rising to over a 30 euros and up till 100 euros in the fourth phase as well. This made it increasingly costly for corporations to pollute within the European union.

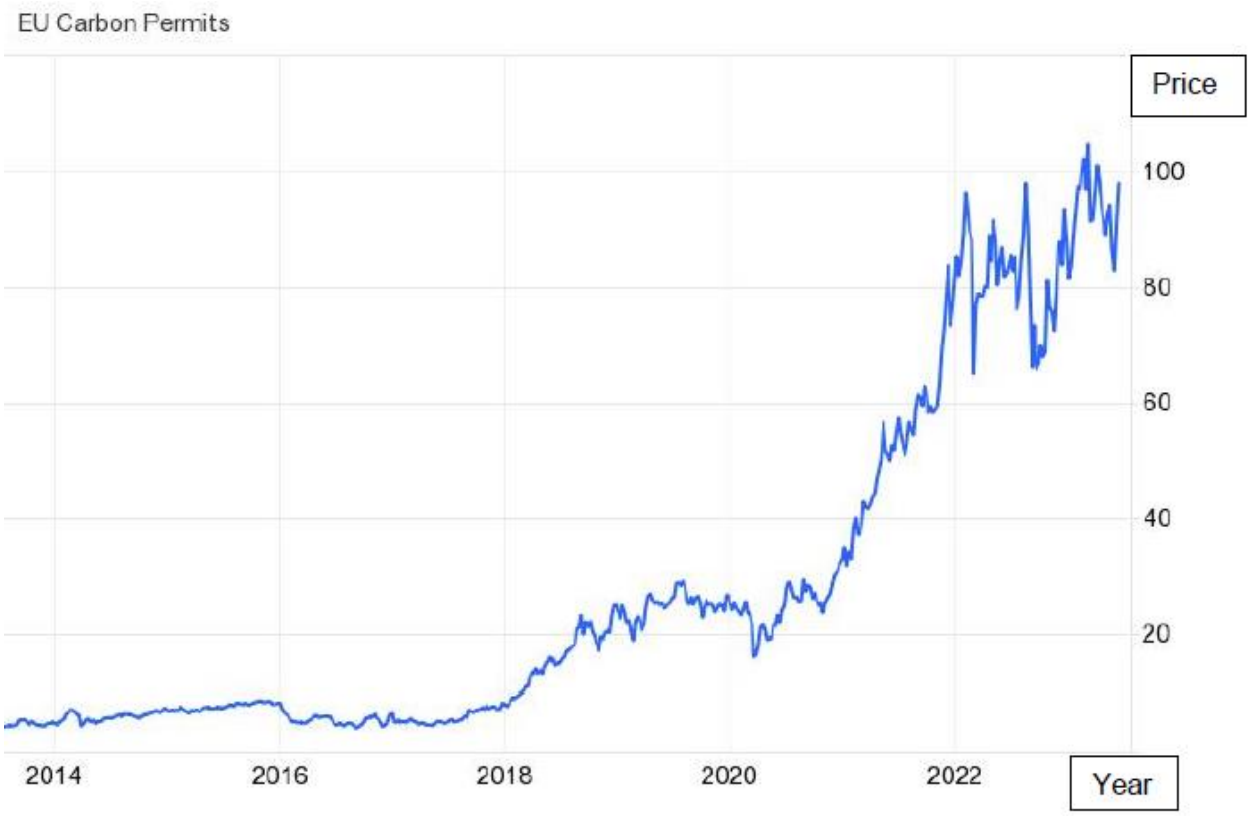
[3] power plants, manufacturing installations essentially any unit where activities related to the ETS take place

[4] which can be attributed to factors such as Brexit and the beginning of the pandemic

[5]Carbon Price." Trading Economics. Trading Economics, n.d.
Web. <https://tradingeconomics.com/commodity/carbon>.

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"



Chinese ETS

Instead of the oldest, the largest market in the world for carbon trading was launched in China in 2021. Rather than being a cap-based system that would focus on the total emissions, it is based on a rate based system that looks at carbon dioxide emissions per unit of output or as a newly coined term describes it as based on carbon intensity. This market has come along with China's goal of reaching carbon neutrality by the year 2060. Being a national scheme, within this ETS enterprises will have to provide output data long with emissions data, while receiving allowances based on historical values of the same. In other words, they will be assessed on how much output they delivered while creating a certain amount of pollution and this is a convenient way to understand which companies in a peer group are producing the same unit of output efficiently, or with a the smallest amount of emissions. Since the ETS in China has been operational in 2021 it has obliged more 2000 large emitters in the country's power sector to account for previous emissions in 2019 and 2020. The current scope of the ETS includes close to 4.5 billion tonnes of carbon dioxide per year, yet this only accounts for 40% of the total emissions in China as it currently only looks over the power generation sector. China's pilot ETS which have been running since 2013, continue to run side by side, yet as the national system came into play the pilot ETS lost their market as the corporations moved under the national system.

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

Despite the expansive size of China's carbon market their growth has been slow with only a total of 412.05 million tonnes of allowances in 2021 including all regional and domestic offsets. While the European union being smaller went over 2 billion tonnes of allowances in the same year although, it must be noted that the European union ETS is in its third decade. When the carbon market was launched in 2021 the Chinese ministry of ecology and environment published central ETS documents and formed two central carbon market institutions the Beijing Green exchange and the China Hubei carbon Emissions exchange. In Beijing Voluntary carbon credits or VERs and China-certified emissions reductions or CCERs are traded, while in Hubei, the centre acts as a registry of transactions and holdings till an official national registry is made. What is a CCER? As mentioned initially as well the countries and corporations can prevent emissions from being created to gain credits. When an emissions reduction is verified they can gain a certificate for the same which can be traded, this certificate is the CCER. This certificate has been adapted to Chinese requirements from the earlier principle of the Kyoto protocol's "certified emission reductions" or CERs that used to be internationally verified.

In addition to the structure not being based on cap and trade, there is another stark difference between the European carbon market and the Chinese carbon market. The Chinese market does not entirely force or encourage the change from a coal powered or non-renewable system to new and renewable technologies. Instead, it majorly incentivises the usage of more efficient coal powered plants in the energy sector specifically. Due to the allocation being intensity based, the corporations don't feel the need to entirely abandon carbon emitting systems unless they are inefficient completely. If they can increase their carbon based system's efficiency, they can produce the same amount of power or electricity with less emissions. While a cap based system would straight away penalise for the amount of carbon produced.

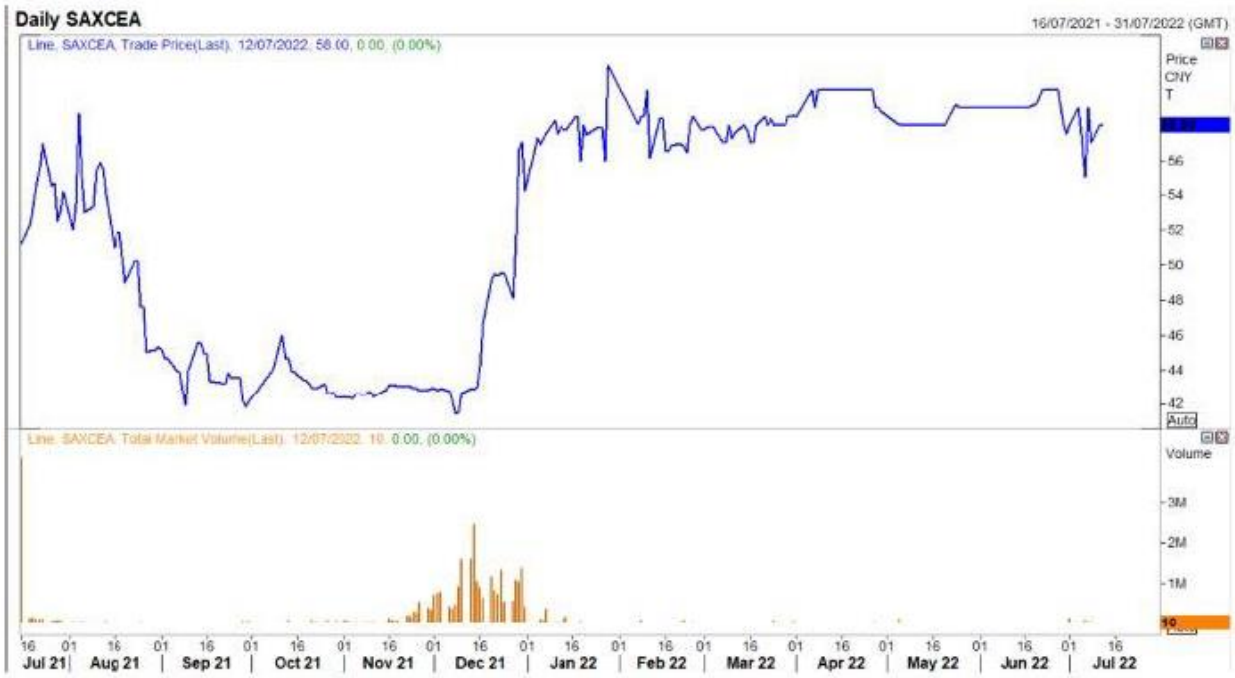
A central goal that China's emission trading system has is to create a system where there is improved GHG emissions reporting and accounting. This is what will lead to the market's expansion as policy makers observe current data to forecast the future. While the European ETS utilises third party auditors to verify and certify emissions in the region, in China the Ministry of Ecology and Environment assigns verification to local government environment and ecology bureaus, which then review the emissions reports provided by companies and those with questionable data are then asked to get 3rd party verification.

With this emissions trading system in China the progress seen has been positive. The price of carbon at the end of 2021 reached a high 54.22 yuan per tonne which is 13% greater than the price at which it began with in July, with high demand and an unresponsive market. Over this course of a hundred and fourteen trading days of 2021, 179 million tonnes of carbon allowances were traded. Majority of these, 83% to be exact were conducted over the counter. These are either listed trades or bulk over the counter trades which occur with a minimum of a hundred

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

thousand(1 lakh) allowances. All of these trades are spot trades and occur digitally. Currently, financial institutions and other risk-taking entities are not permitted to participate in the market yet. However the Chinese government has stated that the same may change in the future.



6

These two systems presented in this power, European and Chinese are currently the most relevant and best suited for inspiration as other countries try to develop their own carbon markets. Yet what are their strengths and weaknesses? Which method is better?

The cap and trade system currently in place in the European union has multiple strengths and weaknesses. Firstly, the definitive cap that it assigns and reduces over time helps quantify the goals of each country and corporation in its region. The market players are fully aware that the carbon credits will continue to get scarce (and more expensive)and hence any emission based activity becomes counterproductive in itself. This allows corporations to take decisions that cause carbon emissions to reduce as a direct result of the system aiding environmentally positive progress. This is clearly seen in the progress of the European union mentioned above. Secondly, the presence of free allowances has allowed carbon leakages to be avoided to a great extent. With a definitive cap and scarcity there is a very high chance that countries and corporations will

[6] "China's ETS." Refinitiv Perspectives. Refinitiv, 2022. Web. <http://perspectives.refinitiv.com/wp-content/uploads/2022/07/3-China-ETS-19-07-2022.jpg>.

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

try to shift their carbon intensive activities elsewhere, yet that would lead to the same pollution still occurring in another location. This is likely to happen even though the method is supposedly market based. Also it does not directly take into account how much monetary value in terms of Gross domestic product or innovation and development is added or removed due to the cap. Although 2020 was the only year where the Real GDP growth rate ended up being negative, it has been steadily dropping since 2017 as emissions began taking larger reductions. According to the EUTL data verified total emissions in million tonnes CO2eq have been reducing steadily since 2013, yet the reductions each year from 2014 to 2017 were only about 20 million tonnes per year, while from 2017 to 120 were over 133 million tonnes each year. This steep rise in reduced emission was environmentally positive yet in this time frame the growth rate of real GDP went from 2.6% to -6% across Europe and the UK. Due to the cap and trade system such being based on simply limiting carbon emissions, it does not provide incentive for economic development. The negative impact on the GDP is a combination of business becoming discourage, start-up costs rising and the market encountering barriers to entry in almost every industry.

On the other hand the carbon intensity system used in China maintains some strengths as well. Solving the problem created earlier with the emission reduction impacting the economic progress of the country. The carbon intensity system is based on carbon emissions allowed per unit of output. This incentivises environmental efficiency while still maintaining a level of economic progress. As those that produce greater levels of output, electricity which is highly carbon intensive in the case of China will hence have a greater allowance of carbon emissions. While those firms that are inefficient and do not produce as much will lose their position in the market. This is seen with the Chinese GDP growth rate remaining positive throughout 2021 and 2022 while European growth fell, as mentioned above. Even though the same is a smaller time frame the positives of the Chinese method can be considered. Yet this same feature of the market can also prove to make the system ineffective. As discussed earlier due to the Chinese system being based on carbon intensity, there is less incentive for the electricity production firms to switch their current technology for renewable and sustainable alternatives. As they get allowances per output they are more likely to increase their energy-efficient producers based on coal or gas rather than get new sources of electricity. Yet this point can only be inferred and not proven due to the small time duration that the Chinese Emissions trading system has been in place, along with the fact that it has only been implemented in a singular sector, limiting the extent to which we can draw overall market conclusions. Therefore the Chinese emission trading market should continue to be observed to understand its effectiveness.

Observing the two methods it is not entirely clear whether one is better than the other. The European union’s system will help reduce carbon emissions at a better and faster rate as the cap

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

is controlled and reduced. While the Chinese system will allow continuous economic prosperity and efficiency to continue as the intensity based programs incentivises output optimisation. Possibly the most effective system would include elements of both, an intensity based system with greater control across industries can prove to be the most efficient solution, as appears from the data and progress observed in the two regions.

Carbon credit system in India

Since the beginning of the carbon credit system as it became international law in 2005, India has been a large contributor along with China and Brazil in creating instruments that reduced carbon emissions through registration with the United Nations framework convention on climate change, UNFCC. This was under their presence in the Clean development Mechanism, CDM of the Kyoto Protocol.[7] CDM is a United Nations run Scheme focussed on offsetting carbon. This scheme allowed companies and business in developed countries to fund emission reducing projects in other countries, claiming those saved emissions as part of their own. This was majorly active during the first commitment period that ended on December 31, 2012. India has been a prominent part of the international carbon market, by the end of the second commitment in 2020 India was able to channelise $10 billion in foreign direct investment under the CDM as per the Trade promotion council of India. The chairman of EKI energy services that is involved with work on climate change stated that between 2010 and 2022, India issued 278 million credits, which represents almost 17% of the global supply. This is relatively large considering India is a developing country with no formal domestic market created at the time.

What pre-existing progress and policy is already in place in India?

The PAT scheme along with Energy saving certificates running in India for more than a decade along with even the system of renewable energy certificates. The perform Achieve trade scheme which began with its first cycle in 2012-2015 is an administrative instrument which was aimed at reducing specific energy consumption in more intensive industries. The pat scheme is again a market based approach as the certification of energy-savings can be traded as are other forms of carbon credits. The PAT scheme is “top down” in the sense that the government decides which companies are required to comply with the scheme, and those companies, (usually the largest industries which use the most energy) are called “designated consumers”. In the same first cycle the scheme was able to reduce energy consumption in almost 400 designated consumers[8] by

[7] "The Clean Development Mechanism." UNFCCC. United Nations Framework Convention on Climate Change, n.d. Web. 7 July 2023. <https://unfccc.int/process-and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism>

[8] energy intensive enterprises

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

5.3% which was greater than the initial target of 4.1%. These targets were created on the basis of the annual specific energy consumption for each of enterprises in 2010, taking the same as a base year adjusting for import/export of power, product mix, change in fuel quality, capacity utilisation and etcetera. All industries except forthermal power generation performed as per or better than the targets.

The central functioning part of the PAT scheme is the trade of energy saving certificates, similar to the allowances described in the above systems. One energy saving certificate is equivalent to 1 tonne of oil equivalent of energy savings. In the same way when one enterprise surpasses their goal of savings they receive certificates corresponding to the amount which they have over achieved. They can sell and trade these in the market, further they can store them to be used in the next cycle to reach future targets. Since April of 2017, the Energy saving certificates have been managed by the energy exchange and power exchange of India, while the BEE acts as an administrator and has developed a platform to manage the Certificate trading process. If at any point the enterprise is unable to reach the savings target or purchase credits they must pay a fine of 1 lakh Indian rupees along with the value of the energy savings that have not occurred measuring by 1 tonne of oil equivalent savings.

If the price of the certificates is very low, it implies that the targets for designated companies were set too low. Therefore, it was very easy for all companies to overachieve the specified energy savings amounts and everyone earned certificates, so there is a glut in the market. No one wants to buy, only sell, and the price falls based on the laws of supply and demand. Furthermore, it is seen that when prices are on the lower side, some non-compliant companies prefer to pick up the cheap certificates rather than to invest in any energy saving improvements of their own. Therefore, it is very important to understand the energy consumption and the technology being used by the designated consumers and correctly set the levels of ambition for them to reduce their energy consumption. Having said this, the PAT Scheme has worked well for the most part and it is only occasionally that the market has been flooded with too many Energy Savings certificates.

Renewable energy certificates are another part of pre-existing trading policies in the country aimed at reducing carbon emissions. Renewable energy certificates are awarded to organisations that choose to utilise renewable energy sources instead of non-renewable ones. The certificate verifies that the receiver owns ne megawatt hour of electricity generated from renewable energy source. The main reason to have market demand for RECs is the regulation called “Renewable Purchase Obligation” or RPO. It means that if you are a large consumer or electricity distribution company, buying bulk electricity, a certain percentage of it has to be renewable. That can be either in the form of a direct purchase of renewable energy or it can be in the form of purchasing RECs. Then in the same way it can be traded in the form of a carbon credit to other enterprises

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

that are polluting over their limits and not utilising renewable energy certificates allowing them to offset their emissions. A renewable energy certificate (REC) is produced by REC registration India each time a renewable energy source generates one megawatt-hour (MWh) of power and transfers it to the grid. Then, you have the option of selling it or keeping it. A REC that has already been sold by the Indian REC registration cannot be acquired once more.

Despite the impressive progress that the country has made so far, India has made certain very ambitious commitments within their NDC or nationally determined contribution as a part of the Paris agreement and further commitments in Glasgow COP26. The international carbon trade will not allow for the Indian market's own development, aware of the same, the Indian government is working towards creating a domestic independent carbon market Registry outside of the UNFCC, which is targeted to be ready by 2025. However, India has not completely ruled out the possibility of trading carbon credits under the international system, provided that they are approved on a case by case basis.

The Indian carbon market gained its approval in the Energy conservation Amendment bill, 2022 where the central government was given the ability to design and create the carbon credit trading scheme, CCTS. It is planned to be built on the foundations of the previously existing PAT scheme, perform, achieve, trade. The scheme is currently in its seventh cycle improving significantly from the year 2022-23 to 2024-25. Within this scheme the specific consumers[9] are under obligation to reduce their specific energy consumptions in accordance to the targets provided by the bureau of energy efficiency. Along with this the renewable energy certificate market operates side by side. This is similar to a credit, the more emission saved or renewable energy used leads to more certificates available to the large energy users who are subjected to the renewable purchase obligations regulations. The problem that arises is the lack of information and understanding of carbon credits currently with local businessmen and national organisations, making it difficult to implement any changes and carbon reduction actions. Along with that obtaining carbon credits involves verification and validation processes to keep them in line with international requirements although these end up being rigorous and data intensive making difficult for businesses.

So how is the Indian carbon market going to work?

Similar to what was observed in China and Europe, the government of India has released that the Indian carbon market will be developing locally appropriate methodologies and techniques for estimating the reductions and removals of carbon emissions from multiple registered projects and businesses stipulating them to get the required validation, verification, registration and issuance

[9] in this case the enterprises emitting carbon

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

so that the themes becoming operational. Parallel to this Monitoring, reporting and verification, MRV guidelines will be created with consultation. Allowing for the mobilisation of new mitigation opportunities through tapping into demand for emission credits by both private and public entities. The central blueprint that is currently being disclosed to the public states that the bureau of energy efficiency will be the administrator for the Carbon market also working as the secretariat for Indian carbon market governing board, ICMGB. The bureau will also be in charge of distributing Carbon Credit certificates , CCC along with developing stability mechanisms for the market. The blueprint currently includes a voluntary trading and compliance market. Both of whose standards and trajectories are again controlled by the bureau. A compliance market, if not self-explanatory with its name is a Market where the participation is entirely compulsory and are mandated to make sure they contribute the target set in emission reductions. An example of this is the EU market or in India's case it is the PAT Scheme where the designated consumers have no choice but to achieve energy savings every year, or they have to pay a fine or buy a certificate. On the other hand, a voluntary market is where a corporation must participate by their own will to reach their own sustainability goals, without any government obligation. An example of this is the Gold standard. Gold standard also serves as one of the best accreditation verifier for carbon credits that are generated in sustainable development projects. The currently in use Renewable energy certificates and Energy saving certificates under the PAT scheme will be transformed into carbon credits after a transition period. Under the compliance scheme 11 sectors have been defined to have emissions caps with them being the highest emitting sectors. This includes aluminium, petroleum refineries, petrochemicals, chlor alkali, thermal power plants and cement.

As discussed previously before the local domestic structure is mainly being pushed in order for the country to reach their COP26 goals and maintain Compliance with their NDC. This NDC is submitted to entail the goals and plans to reduce emissions in the next 5 years. In the same way after each 5 year time frame passes, the country updates the same to stricter levels of emissions reduction. In the first plan beginning from 2020, India made a commitment to reducing its emissions intensity of its GDP by 45% by the year 2030. Further the Indian government made the goals of making 50% of its energy requirements from renewable energy by 2030 and 500 GW of non- fossil fuel energy installed capacity by 2030. With these massive goals in place present along with India having the largest population and still being a developing country that requires activities such as construction and manufacturing to remain central to its economy. With these goals and problems at hand, it is integral for India to focus its local producers and consumers to maintain a climate preservation perspective. As per a S&P global analysis in January of 2023 stated that India's carbon prices are forecasted to rise to $80/metric tonne of CO2 emissions by 2050, this speed of growth is attributed to India's growing and developing carbon market, extending itself to greater parts of the country's economy.

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

So how has the Indian method performed?

Is the plan created for the future the most optimal?

Since the creation of carbon and emission trading services in India such as the PAT scheme along with India's connections and contributions to the international carbon market, there has been great progress with the country reaching its climate goals. Yet how much of an impact has it actually had in terms of emissions and Economic impact. Can carbon credits be taken as the most fool proof system for reducing emissions in the country? What gaps are present in the carbon credits system?

What Impact have carbon trading schemes had on emission levels?

Since the PAT scheme is the basis for the blue print for the Domestic market being created in India, although not entirely identical the progress made by the PAT scheme will dictate to a significant level the potential of progress that the Domestic scheme would have. Since the beginning of the PAT scheme's first cycle in 2012 by 2020 the scheme has extended to 13 high energy intensive industries, including fertiliser, thermal power, iron, steel refineries, railways and even petrochemicals leading to the savings of almost 17 million tonnes of oil equivalent along with a mitigation of 87 million tonnes of CO2 per year which is almost equivalent to the emission of a country like Bangladesh as per the press information bureau of the Indian government. Although despite this impressive progress that is presented, as the cycles of the PAT scheme go on and move forward, the progress is not all positive. The number of sectors involved are not continuously growing along with the number of designated consumers, specifically thermal power plants that are involved in the scheme have reduced since the beginning significantly.

As per a critical analysis conducted by the centre for science and environment in New Delhi the number Designated consumers involved in each of the six cycles was greatest in the first 2 with 478 and 621 respectively while in the cycles after that the number has not crossed 135. As only defaulters remain for the next cycle this allowed for a great drop after the first 2 PAT cycles. Despite that initial drop in the designated consumers as less companies defaulted the same came to a stop in the next cycles as the change from cycle 3 to 6 remained to a maximum of 25 designated consumers up and down. This is clearly indicative of how the first and second phases of the program were specifically lenient in terms of the targets as the majority of the Designated consumers were able to reach it and hence weren't present in the next cycle. Although that has improved with seeing the following cycles maintaining a lower rate of change as it becomes more difficult for the enterprises to reach their energy saving targets. In contrast to the rest of the industries, thermal power plants remained the greatest consumers of fossil fuel energy

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

throughout the phases. In the first two cycles of the scheme electricity generation was able to reduce their carbon emissions by 1.57% and 1.44% respectively. Along with that thermal plants, largest contributor to carbon emission under the scheme have increased energy consumption over the transition from the first to the second cycles, due to the leniency in the targets. Along with that looking at the overall carbon emissions caused by the country from 2012 to 2021, the value has grown by .3 metric tonnes per capita despite the drop during the pandemic. A significant increment, yet still a slowdown in carbon emission expanse as the previous .3 metric ton increment took only 3 years from 2009-2012, indicating a definite impact on the country's carbon emitting practices.

Further, Ignoring the thermal power/ energy generation sector, the rest of the scheme in its specificity has performed positively. The Deputy Director general of the Bureau of energy efficiency, Dr. Ashok Kumar, exclaimed that the second cycle of the PAT scheme alone saved the nation around 14.08 million tonnes of oil equivalent which is a 6 million tonne oil equivalent increment from the first phase. Along with that almost 65% of the designated consumers have shown positive progress reaching or even crossing their targets. In the state of Andhra Pradesh, showing significant progress in the cycle saving 3340 million units of energy worth Rs. 2350 crore along with a reduction of 1.38 million tonnes of CO2. With increasing bids and prices the cost of an energy saving certificate has increased by more than seven times between October of 2021 and June of 2023. Indicating greater developments in the certificate marking again showing positive signs for the progress of the PAT scheme.

The blueprints made by the Indian government for the Carbon credit market to be launched in 2025, hence have a strong base in the results of the PAT scheme. Despite that there are certain factors that may still be missing. The PAT scheme was focussed only on certain energy intensive sectors, yet a national market will include all kinds of enterprises, this will lead to a greater flow of credits/certificates as less intensive industries will be more likely to reach targets with ease requiring a greater level of monitoring and moderation to be in place. This will require expansion in terms of the bureau of Energy Efficiency as the governing body, currently with a budget of Rs. 235.50 crores which only accounts for 0.7% of the GDP will need to increase to a greater portion as verification, monitoring and moderation will need to be expanded. Further the system currently created has not been effective on the thermal power generation/electricity sector despite the same being the most polluting industry in India's economy. Being the largest contributor it's management will be of utmost importance and focus. Hence smaller measured caps, and incentives will be needed to switch to sustainable practices. . As we saw in the China example, the government focused specifically first on using the carbon market to incentivize the thermal power sector to become more efficient and reduce its emissions.

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

How has the economy been impacted by emission reducing measures such as carbon credits? Do the schemes make financial sense?

The Indian economy is still in a developing stage and still aims at increasing its size to be able to compete with the developed countries in the world, yet it is difficult to do so while maintaining the climate agenda and being energy efficient. The PAT scheme that is currently in function was meant to make sure that both sides can be taken care of. Implemented in the most energy intensive industries in the country, the scheme had great success in the aluminium, cement and the pulp and paper industries. Since the implementation of the scheme in 2012, the Indian economy in terms of GDP has consistently grown from 1.8 trillion to 3.2 trillion. Yet, as we look specifically into the industries controlled and monitored under the PAT scheme the story is not exactly the same.

Looking specifically at the cement industry it is seen that in the first 2 cycles from 2012 to 2015 and from 2016 to 2019, the cement industry has been a particular positive performer, achieving savings above their provided target in both cycles by 82% in the first cycle and 41% in the second. This is a substantial achievement that is not seen in ever sector. Yet despite this the growth rate of cement production in India has also been impacted, the annual growth rate in the first cycle dropped by 1.6%, yet in the second cycle the same increased by 8.7%. This can be attributed to the credits being carried over after the achievements in the first term along with better sustainable resource development by the second, in addition to the same by the second cycle the scheme was able to cover only 70% of all cement producers. With the improvement in the second cycle and the achievements of the industry in energy savings, the cement sector can be a prime example of where the structure of the PAT scheme has worked, with the introduction of new practices and new technologies such as waste heat recovery, the industry is an example of the positives that are possible under the PAT scheme.

Another sector that has performed particularly well is the aluminium sector. With the Bharat Aluminium company or Balco, being the top performer up till the second cycle, having the most energy saving certificates in the entire scheme. Yet the aluminium sector has been facing issues with reaching the national demand level. Being a positive performer under the scheme being 60% above the target in the first cycle and 22% above the target in the second. The aluminium industry which was responsible for almost 15% of the country's emissions reductions and is projected to double in consumption from 2017 to 2021, despite this significant progress in the sector, the sector has becoming increasingly dependent on imports. As of 2019, 55% of the demands were met through imports, majorly from China. With the demand projected to grow even further and sustainability restrictions increasing, the aluminium sector displays what the negative or impractical side of the PAT scheme can turn out to be.

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

These are two of the specifically well performing sectors that are exceeding their targets of the PAT scheme while being large emission contributors. Along with the Iron and steel sector as well that has seen positive environmental progress, while contributing to 20% of the country's emissions reductions, with imports reducing and exports increasing, since the financial year 2016. The rest of the industries under the PAT scheme such as the thermal power and Electricity distribution companies the targets have not been crossed. In the financial year of 2022 renewable energies received almost 12 thousand crores in subsidies, despite the level of subsidies that are provided to these industries in the budget in terms of renewable energies and programmes such as the Grid connected rooftop solar programme. While other smaller sectors combined account for less 25% of the emission savings in the country. This indicates that the PAT scheme has been successful to an extent, in creating a better environmentally friendly market although not all industries remain in their economically dominating position while reaching the targets.

Are carbon credits ethically correct?

Despite their world-wide implementation and clear improvements in the environment, the debate on carbon credit and emissions trading ethicality is still ongoing. This is because a lot of large countries in the developed world along with corporation partake in the action of green washing. This is essentially when an entity appears to do more for the environment than it actually is. Essentially keeping their own emissions unchanged, or even investing in unverified credits, each of these actions lead to the environment to continue to be harmed while the entire purpose of the system was to reduce the possibility of the same occurring. Another method that is often used by corporations in order to essentially cheat the emissions trading systems is to purchase credits of extremally environmentally friendly companies that say for example conserve forests and wildlife. As they continued to gain a surplus of allowances they sell them to more polluting companies. The problem remains that the environment they conserved was not under threat but the polluting companies activities do end up acting as a threat.

So the questions remain, how do the regulatory systems such as the BEE in India decide whether one corporation or industry can pollute more or less and how can cap reductions be measured accurately? Would it not lead to continuing emissions? How can we measure the speed with which they must be reduced?

Conclusively, what can make carbon credits/emissions trading more viable?

Observing the Systems in place internationally along with the structure and success of the Indian PAT scheme, certain features of the emission trading system can be identified to entail the most economically optimal and socially desirable system or form of emissions trading.

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

This would include features such as Environmental integrity, which entails that the overall cap or intensity with which the emission are topped should be aggressively controlled. In the manner that any scientifically deduced targets that showcase the level of emissions that is sustainable at a time, must be surpassed. As this will force greater transition and hence faster adoption of sustainable methods. As observed in the first pat scheme stage as the comfortable targets led to a large majority achieving them easily while not making as much progress environmentally.

Further a greater level of monitoring, certification and verification. Due to the presence of multiple verification entities, there is a level of confusion on the market. Hence as seen in the EU, there must be major third party Emission verification from corporations such as Gold standard, that work with the United Nations as well to maintain the integrity of the same.

In addition to the same, there needs to be a level of market predictability and stability. Market conditions that are steady and predictable are necessary for an effective carbon trading scheme. To promote investments and propel innovation in low-carbon solutions, it is essential to have clear regulations, extensive planning, and trustworthy policy signals. This can be achieved through third party regulators as were for monitoring.

Another feature that can improve the way an emissions trading scheme is structured could be the integration with other climate policies. As seen in the Paris agreement and the COP26 summit countries have multiple targets they are aiming to reach in the near future for a better environment similar to requirements for renewable energy or energy efficiency. Comprehensive emission reductions are possible with the coherence and coordination of many policy tools.

And lastly, the market shall still remain flexible and cost effective. The trading mechanism should allow participants to identify the emission reduction strategies that are the most affordable. Companies would be encouraged to invest in energy-efficient technology, carbon offset projects, and greener technologies since they may sell any excess allowances or buy more to fulfil their requirements.

With the application of these features, carbon markets can become a viable solution in reaching the climate sustainability goals of the future. Market based approaches such as this are the most suitable as they allow for the economy to still freely grow and be directed by market forces which can ultimately create financially stable long term solutions to these problems.

Bibliography

I. "Carbon Credit: Understanding the Concept, Its Evolution, and Implications." The

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

Economic Times.Economic Times, n.d. Web. <https://energy.economictimes.indiatimes.com/news/renewable/carbon-credit-understanding-the-concept-its-evolution-and-implications/99064759#:~:text=India%2C%20to%20boost%20its%20carbon,Exchange%20from%20January%2004%2C%202008>.

II. "Nationally Determined Contributions (NDCs)." UNFCCC. United Nations Framework Convention on Climate Change, n.d. Web. <https://unfccc.int/process-and-meetings/the-paris-agreement/nationally- determined-contributions-ndcs>.

III. "What You Need to Know About Article 6 of the Paris Agreement." World Bank. World Bank Group, 2022. Web. <https://www.worldbank.org/en/news/feature/2022/05/17/what-you-need-to-know-about- article-6-of-the-paris-agreement>.

IV. "Comparison of CarbonCredits: CER, VER, TER." Tergo. Tergo, n.d. Web.<https://tergo.io/blog/carbon-offsetting/comparison-of-carbon-credits-cer-ver-ter/>.

V. "Q&A: What Does India's Updated Paris Agreement Pledge Mean for Climate Change?" Carbon Brief.Carbon Brief, n.d. Web.<https://www.carbonbrief.org/qa-what-does-indias-updated-paris-agreement-pledge-mean-forclimatechange/#:~:text=India%27s%202030%20pledge%20under%20the,than%20a%20full%20second%20N DC>.

VI. United Nations Framework Convention on Climate Change. "The United Nations FrameworkConvention on Climate Change." United Nations,1992.Web. <https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conve ng.pdf>.

VII. "Social Cost of Carbon 101." Resources for the Future. Resources for the Future, n.d. Web.<https://www.rff.org/publications/explainers/social-cost-carbon-101/>.

VIII. "Nationally Determined Contributions (NDCs)." UNFCCC. United Nations Framework Convention on Climate Change, n.d. Web. 7 July 2023. <https://unfccc.int/process-and-meetings/the-paris- agreement/nationally-determined-contributions-ndcs>.

IX. "CBDR." Google Search. Google, n.d. Web. 7July2023. <https://www.google.com/search?client=safari&rls=en&q=cbdr&ie=UTF-8&oe=UTF-8>.

X. "The Clean Development Mechanism." UNFCCC. United Nations Framework

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

Convention on Climate Change, n.d. Web. 7 July 2023. <https://unfccc.int/process-and-meetings/the-kyoto- protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism>.

XI. "Kyoto Protocol." BYJU'S Free IAS Prep. BYJU'S, n.d. Web. 7 July 2023. <https://byjus.com/free-ias- prep/kyoto-protocol/>.

XII. "Social Cost of Carbon 101." Resources for the Future. Resources for the Future, n.d. Web. 7 July 2023.<https://www.rff.org/publications/explainers/social-cost-carbon-101/>.

XIII. "The EU Emissions Trading System (EU ETS) and the International Carbon Market." EuropeanCommission. European Commission, n.d. Web. <https://climate.ec.europa.eu/eu-action/eu-emissions- trading-system-eu-ets/international-carbon-market_en>.

XIV. "The First Year of China's National Carbon Market, Reviewed." China Dialogue. China Dialogue, n.d. Web. <https://chinadialogue.net/en/climate/the-first-year-of-chinas-national-carbon-market- reviewed/>.

XV. "China's ETS." Refinitiv Perspectives. Refinitiv, 2022. Web. <http://perspectives.refinitiv.com/wp-content/uploads/2022/07/3-China-ETS-19-07-2022.jpg>.

XVI. "Carbon Trading: The Chinese Way." Energy Monitor. Energy Monitor, n.d. Web.<https://www.energymonitor.ai/policy/carbon-markets/carbon-trading-the-chinese-way/>.

XVII. International Energy Agency. "China Emissions Trading Scheme." International Energy Agency, 2022.Web. <https://iea.blob.core.windows.net/assets/d21bfabc-ac8a-4c41-bba7-e792cf29945c/China_Emissions_Trading_Scheme.pdf>.

XVIII. Pandey, Disha. "China's New National Carbon Trading Market: Between Promise and Pessimism."Center for Strategic and International Studies, 1 July 2021. Web. 7 July 2023.<https://www.csis.org/analysis/chinas-new-national-carbon-trading-market-between-promise-and-pessimism>.

XIX. European Commission. "Proposal for a Regulation of the European Parliament and of the Council Establishing the European Climate Change Programme and Setting Out the Framework for Achieving Climate Neutrality and Amending Regulations (EU) 2018/1999, (EU) 2019/631 and (EU) 2021/1119." COM(2021) 962 final, 14 October

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

2021. Web. 7 July 2023.<https://climate.ec.europa.eu/system/files/2021-10/com_2021_962_en.pdf>.

XX. "EU Emissions Trading System (EU ETS)." European Commission. European Commission, n.d. Web.7 July 2023. <https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en>.

XXI. "Carbon Price." Trading Economics. Trading Economics, n.d. Web.<https://tradingeconomics.com/commodity/carbon>.

XXII. Press Information Bureau. "India Approves Methodologies for Carbon Markets under the India ClimateModel (ICM) to Support Climate Finance and Sustainable Development." Ministry of Environment, Forest and Climate Change, Government of India, 2022. Web.<https://pib.gov.in/PressReleasePage.aspx?PRID=1923458#:~:text=The%20ICM%20will%20develop%20methodologies,processes%20to%20operationalize%20the%20scheme.>.

XXIII. "World Bank Approves $625 Million to Support Grid-Connected Rooftop Solar Program in India."World Bank Group. World Bank Group, 2016. Web.<https://www.worldbank.org/en/news/press-release/2016/05/13/world-bank-approves-625-million-to-support-grid-connected-rooftop-solar- program-in-india>.

XXIV. "The Energy Conservation (Amendment) Act, 2022: Key Highlights." Cyril Amarchand Mangaldas.Cyril Amarchand Mangaldas, 2023. Web. <https://corporate.cyrilamarchandblogs.com/2023/01/the-energy-conservation-amendment-act-2022-key-highlights/#:~:text=The%20Amendment%20Act%20introduces%20new,be%20notified%20in%20the%20future>.

XXV. "Renewable Energy Certificates (RECs)." Investopedia. Investopedia, n.d. Web.<https://www.investopedia.com/terms/r/rec.asp#:~:text=Renewable%20Energy%20Certificates%20(R ECs)%20are,market%20as%20an%20energy%20commodity>.

XXVI. "India's Climate Change Policy: Challenges and Recommendations." ISPPI Policy Review Blog. ISPPI,n.d. Web. 7 July 2023. <https://www.ispp.org.in/policyreview_blog/indias-climate-change-policy-challenges-and-recommendations/>.

XXVII. "Renewable Energy Certificates (RECs)." Investopedia. Investopedia, n.d. Web. 7

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

July 2023.<https://www.investopedia.com/terms/r/rec.asp#:~:text=Renewable%20Energy%20Certificates%20(R ECs)%20are,market%20as%20an%20energy%20commodity>.

XXVIII. "India's Climate Change Policy: Challenges and Recommendations." ISPPI Policy Review Blog. ISPPI,n.d.Web.<https://www.ispp.org.in/policyreview_blog/indias-climate-change-policy-challenges-and-recommendations/>.

XXIX. "Perform, Achieve, and Trade (PAT)." Bureau of Energy Efficiency. Bureau of Energy Efficiency, n.d.Web. 7 July 2023. <https://beeindia.gov.in/en/programmes/perform-achieve-and-trade-pat>.

XXX. "Bureau of Energy Efficiency (BEE) India." Google Search. Google, n.d. Web. 7 July 2023.<https://www.google.com/search?client=safari&rls=en&q=B.E.E+india&ie=UTF-8&oe=UTF-8>.

XXXI. Press Information Bureau. "India Approves Methodologies for Carbon Markets under the India ClimateModel (ICM) to Support Climate Finance and Sustainable Development." Ministry of Environment, Forest and Climate Change, Government of India, 2022. Web. 7 July 2023. <https://pib.gov.in/PressReleasePage.aspx?PRID=1923458#:~:text=The%20ICM%20will%20develop%20methodologies,processes%20to%20operationalize%20the%20scheme.>

XXXII. "Indian Carbon Credit Market." Confederation of Indian Industry Blog. Confederation of Indian Industry, n.d. Web. 7 July 2023. <https://www.ciiblog.in/indian-carbon-credit-market/>.

XXXIII. "Perform, Achieve, and Trade (PAT)." Bureau of Energy Efficiency. Bureau of Energy Efficiency, n.d.Web. <https://beeindia.gov.in/en/programmes/perform-achieve-and-trade-pat>.

XXXIV. "Bureau of Energy Efficiency(BEE) India." GoogleSearch.Google,n.d. Web.<https://www.google.com/search?client=safari&rls=en&q=B.E.E+india&ie=UTF8&oe=UTF-8>.

XXXV. "India Prepares for a Domestic Carbon Market with Release of a Draft Carbon Trading Scheme." Mongabay India. Mongabay, 2023. Web. 7 July 2023. <https://india.mongabay.com/2023/04/india-prepares-for-a-domestic-carbon-market-

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

with-release-of-a-draft-carbon-trading-scheme/>.

XXXVI. "PAT Scheme Sets Industries on Path of Energy Efficiency." The Times of India. The Times Group, 26 August 2021. Web. 7 July 2023. <https://timesofindia.indiatimes.com/city/visakhapatnam/pat-scheme- sets-industries-on-path-of-energy-efficiency/articleshow/85776249.cms>.

XXXVII. "ESCerts Market." Indian Energy Exchange. Indian Energy Exchange Limited, n.d. Web. 7 July 2023.<https://www.iexindia.com/marketdata/ESCerts_Market.aspx>.

XXXVIII. "Cement Production Growth Rate in India from FY 2013 to FY 2020." Statista. Statista, n.d. Web. 7 July2023. <https://www.statista.com/statistics/662463/cement-production-growth-rate-india/>.

XXXIX. Press Information Bureau. "PM Launches National Programme on Energy Efficiency of MSMEs." Ministry of Micro, Small and Medium Enterprises, Government of India, 30 June 2021. Web. 7 July 2023. <https://pib.gov.in/PressReleseDetailm.aspx?PRID=1725448>.

XL. Press Information Bureau. "India Saves 17 Million Tonnes of Oil Equivalent per Year under PATScheme." Ministry of Power, Government of India, 27 May 2021. Web. 7 July 2023. <https://timesofindia.indiatimes.com/business/india-business/india-saves-17-million-tonnes-of-oil- equivalent-per-year-under-pat-scheme/articleshow/83348286.cms>.

XLI. "PAT Centre's Decarbonisation Scheme Not Effective Enough, Says New CSE Report." Down To Earth. Society for Environmental Communications, 3 February 2022. Web. 7 July2023.<https://www.downtoearth.org.in/news/pollution/pat-centre-s-decarbonisation-scheme-not-effective-enough-says-new-cse-report-80500>.

XLII. "Energy Efficiency."Ministry of Power, Government of India, n.d. Web.7 July2023.<https://powermin.gov.in/en/content/energyefficiency#:~:text=235.50%20crore.,establishment%20expenditure%20during%2011th%20Pla>.

XLIII. Zha, Xiaoyang, and Xiaoqiong Zhang. "Promoting Energy Efficiency in India's Small and Medium-SizedEnterprises." Asian Development Bank Institute Working Paper Series, no. 1177, 2021. Web. 7 July 2023. <https://www.adb.org/sites/default/files/publication/634746/adbi-wp1177.pdf>.

XLIV. "Indian Steel Industry." India Brand Equity Foundation. India Brand Equity Foundation,

ISSN: 2455-8834

Volume:08, Issue:07 "July 2023"

n.d. Web. 7 July2023. <https://www.ibef.org/industry/steel>.

XLV. "Outcomes PAT Cycle-II (2016-17 to 2018-19)." Bureau of Energy Efficiency. Bureau of EnergyEfficiency, n.d. Web. 7 July 2023. <https://beeindia.gov.in/sites/default/files/Outcomes%20PAT%20cycle%20-II.pdf>.

XLVI. "Aluminium Industry Dying a Slow Death." Trade Promotion Council of India Blog. Trade Promotion Council of India, n.d. Web. 7 July 2023. <https://www.tpci.in/indiabusinesstrade/blogs/aluminium- industry-dying-a-slow-death/>.

XLVII. "Carbon Trade." Investopedia. Investopedia, n.d. Web.7July 2023. <https://www.investopedia.com/terms/c/carbontrade.asp#citation-15>.

XLVIII. "Booklet: Achievements under PAT (May 2017)." Bureau of Energy Efficiency. Bureau of EnergyEfficiency, n.d. Web. 7 July 2023. <https://beeindia.gov.in/sites/default/files/Booklet_Achievements%20under%20PAT_May%202017.pd f>.

