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Carbon Trading for Achieving SDG 13: Climate Action and its consequences on developing countries.

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Abstract

This thesis studies the role of carbon trading in climate change mitigation, focusing on its importance for achieving Sustainable Development Goal 13 (SDG 13) - Climate Action. The study investigates how carbon markets function, the various mechanisms employed within these markets, and their implications for developing countries. Three key consequences arising from carbon trading are explored: carbon inequality, carbon colonialism, and carbon offshoring.

The thesis begins with an introduction to the SDGs and emphasizes the significance of SDG 13 in addressing climate change. It highlights the urgent need for effective strategies, such as carbon trading, to mitigate greenhouse gas emissions and achieve sustainable development objectives. The second part of the research delves into the functioning of carbon markets and the different mechanisms employed. It provides an overview of emissions trading systems, offsetting mechanisms, and the role of international cooperation in facilitating carbon trading. The thesis also investigates the strengths and limitations of these mechanisms in promoting emission reductions. Lastly, the study examines the consequences of carbon trading on developing countries. It analyzes the phenomenon of carbon inequality, exploring how carbon markets may exacerbate disparities between developed and developing nations. Additionally, the thesis investigates the potential for carbon colonialism, emphasizing power dynamics embedded within carbon trading systems. Furthermore, it explores the environmental, social, and economic impacts of carbon offshoring, which involves the relocation of carbon-intensive industries to developing countries

By addressing these critical issues, this research contributes to the understanding of carbon trading and its implications for developing countries. The findings offer insights into the challenges and opportunities associated with carbon markets, emphasizing the need for equitable and inclusive approaches to climate action and areas of further research and development.

Extended Summary

Questa tesi mira a far luce sul ruolo del commercio del carbonio nella mitigazione dei cambiamenti climatici, con un focus specifico sul suo significato per il raggiungimento dell'Obiettivo di Sviluppo Sostenibile 13 (SDG 13) - Azione per il clima. Lo studio riconosce l'urgente necessità di strategie efficaci per affrontare i cambiamenti climatici e sottolinea l'importanza dell'SDG 13 nel guidare questi sforzi.

La ricerca inizia fornendo un'introduzione agli SDG e sottolineando il ruolo critico dell'SDG 13 nell'affrontare il cambiamento climatico. Sottolinea la necessità di misure solide, come il commercio del carbonio, per mitigare le emissioni di gas serra e raggiungere gli obiettivi di sviluppo sostenibile.

Le sezioni successive approfondiscono il funzionamento dei mercati del carbonio e i diversi meccanismi utilizzati al loro interno. La tesi offre una panoramica completa dei sistemi di scambio di emissioni, dei meccanismi di compensazione e dell'importanza della cooperazione internazionale nel facilitare lo scambio di carbonio. Vengono inoltre analizzati in dettaglio i punti di forza e i limiti di questi meccanismi nel promuovere la riduzione delle emissioni.

Lo studio si concentra poi sulle conseguenze del commercio del carbonio sui Paesi in via di sviluppo. Esamina in modo approfondito il concetto di disuguaglianza del carbonio, analizzando come i mercati del carbonio possano ulteriormente esacerbare le disparità esistenti tra i Paesi sviluppati e quelli in via di sviluppo. La ricerca esplora le strategie per mitigare la disuguaglianza delle emissioni di carbonio e garantire un'equa distribuzione dei benefici derivanti dai meccanismi di scambio delle emissioni di carbonio.

Inoltre, la tesi indaga il fenomeno del colonialismo del carbonio, che evidenzia le dinamiche di potere incorporate nei sistemi di scambio di carbonio. Esamina come i mercati del carbonio possano perpetuare relazioni diseguali tra nazioni sviluppate e in via di sviluppo e propone modelli alternativi che promuovono un approccio più equo e inclusivo all'azione per il clima.

Infine, la ricerca esamina gli impatti ambientali, sociali ed economici dell'offshoring del carbonio. Analizza la pratica di delocalizzare le industrie ad alta intensità di carbonio dai Paesi sviluppati a quelli in via di sviluppo per sfruttare le normative sulle emissioni più basse. Lo studio valuta le conseguenze della delocalizzazione del carbonio sugli sforzi di riduzione delle emissioni e sugli obiettivi di sviluppo sostenibile, sia nei Paesi esportatori che in quelli importatori.

Affrontando questi aspetti cruciali, questa tesi contribuisce alla comprensione del carbon trading e delle sue implicazioni per i Paesi in via di sviluppo. I risultati sottolineano la necessità di approcci equi e inclusivi all'azione per il clima, assicurando che il commercio del carbonio si allinei con gli obiettivi dell'SDG.

Preface

The paper will study how Carbon Trading contributes to the achievement of SDG 13: Climate Action. As a complicated market topic that is presented as a solution to climate change, at the very end my personal opinion will suggest Carbon Capturing and Storage instead of Carbon Trading as a means to avoid over-commodification of our planetary boundaries.

We are facing one of the most significant challenges against our humankind that has the potential to cause severe disruptions to the ecosystems and humans all over the globe: climate change. A global crisis of unprecedented scale and severity is possessing overwhelming evidence for all citizens to take it seriously, with rising sea levels and temperatures as well as extreme weather events that influence us without looking if one country has contributed to the climate change more than the other, in contrast those who had the least contribution are the ones paying the most in facing the consequences.

As I have pursued my master's degree in Local Development, my interest in environmental issues have grown. Beyond its popularity in our present time, my personal interest in learning about climate change policies stems from a very simple perspective: humans will simply be extinct if we destroy our planet. This is beyond any political acclimation, any economic preference, any race, nation, gender, or religion. None of it will matter if the planet we live on becomes inhabitable. Our investments for the future, our dream for our generation simply becomes null and void if we fail to provide them the right to live.

Unfortunately, human myopia is very strong when it comes to considering any risks that lay in the future. The same concept is demonstrated in the COVID-19 Pandemic. The latest example of the problems with myopia can be found in the Covid-19 Pandemic that erupted in 2020. The impact of the pandemic showed that the governments must be prepared for alternatives to our uncertain future (Dixon, 2020). The focus on the current problems worldwide led to a definite lack of investment and planning for long-term issues. The human tendency to dismiss possible future threats is perfectly overlapping with short-termism in democracies and results in unpreparedness. The failure of multiple democracies to prepare for pandemics increased the death toll and put health care services under stress. We must be aware that this pandemic was not first of its kind, in fact the US Director of National Intelligence stated in 2019 that 'the United States and the world will remain vulnerable to the next flu pandemic or large-scale outbreak of a contagious disease that could lead to massive rates of death and disability, severely affect the world economy, strain international resources, and increase calls on the United States for support' (Unites States Annual Threat Assesment, 2019). This is a clear theme of 'democratic myopia' – short sightedness of democratic decision-making. The warning signs were present and announced, however due to the threat residing in the future, it was not deemed important enough to prepare for. One could observe the COVID-19 crisis as an accelerated learning experiment about how to cope with climate change (Botzen, Duijndam, & Van Beukering, 2020). One major difference would be that COVID-19 was mostly unexpected though certain scientists declare it was predicted, it took the world up by a storm and changed the way our society functions at a very high pace. Climate change has been predicted and debated for decades, in contrast to COVID-19 Pandemic however, it is not a fast-paced change but a slow and steady inclination of consequences to our livelihoods.

As climate change has gained much popularity over the years, there are many international and national policies that have been created to tackle its consequences.

Introduction

The concept of carbon trading as a method to achieve SDG:13 Climate Change will be studied with the impacts it has on the developing world. The reason I believe this must be studied is to discover if carbon trading is as innocent and simple as it is being presented or does it have unintended or even worse, hidden side effects for humanity. Is it possible for a problem that is deeply influenced by our capitalistic society of over-production and over-consumption of the market to be healed with yet another market strategy to profit from a climate crisis? Or is it focused on making profits and hiding the consequences? If Carbon Trading is proposed as the method that is going to save our planet, we must analyze and criticize it deeply.

We will be analyzing the foundation of Carbon Trading, starting from cerified emission reduction (CER) of the United Nations Clean Develoment System (CDM). The trading of carbon credits in order to achieve reduction of greenhouse gas emissions. Cap-and-Trade (another name for carbon trading) has been adopted by the European Union since 2005, we will be exploring which European countries engaged in carbon trading and what are the consequences of such trades. The main goal of this paper is to review the different perspectives of Carbon Trading in relation to different parts of our world. As it is a complex topic that involves economic, political and social components, we will try to focus on finding out if it is truly the solution it is being presented out to be for climate change and what are its repurcussions if there are any.

My hypothesis is that cap-and-trade is not the saviour of our climate as the international arena is presenting it. Instead, I assume that this review will prove its system to be complex and unreliable in regard to reaching the results it proposes. Although limiting carbon-emissions seems to be the right decision, in practice it is complicated. This paper will be explaining carbon emissions around the world, the notion of carbon inequality, carbon colonialism, carbon leakage and outsourcing in order to describe the implications of cap-and-trade on the rest of the world beyond the global north.

Chapter 1: Environmental Priorities

In the traditional '3 pillars' which were constituted by the environment, economy, and the social structure, though they are to have equal importance in practice many governments have focused on prioritizing the economic and social pillars and created a belief of 'trade-off' among the two pillars of environment and the economy. This rationale succeeded in avoiding strong environmental protections with the common strategy of 'grow first and clean up later'. (O'Connor D., 2018). This is quite visible in our daily lives as well, as the companies we purchase from that have polluted the environment with non-degradable products and contributed to high emissions of greenhouse gases are now presenting themselves with paper-packaged products to save the environment, or government initiatives that are trying to shift to zero-carbon mobility methods and living standards after utilizing oil and gas for decades to promote their economic growth.

1.1 The Importance of climate change for Agenda 2030

Human activities have dramatically modified natural processes while affecting social-ecological systems, the process that began with the Industrial Revolution in Europe has led to the current environmental crisis. An expected 'point of no return' where any further actions to be taken to limit the consequences of climate change is to be reached unless greenhouse gas emissions are reduced and environmental responsibility is promoted at a global scale (Steffen, Rockström, Richardson, & et al., 2018). Climate change is the shift in climate patterns mainly caused by greenhouse gas emissions. Greenhouse gas emissions cause heat to be trapped by the earth's atmosphere, and this has been the main driving force behind global warming (Fawzy, Osman, Doran, & Rooney, 2020). Global warming, which in recent years has touched environmental activists all around the world is one of the most urgent global problems for humanity in the 21st Century. Overpopulation, irrational use of natural resources, advanced scientific and technological progress, and overconsumption – all of them have worsened ecological problems and, most importantly, helped enhance the irreversible process of climate change (Boglov, et al. 2021). Some of these changes are visible to many if not all.

Overpopulation and overconsumption effects such as pollution whether it is air, sound, or waste are easier to notice in cities and countries belonging to developing countries and less noticeable in countries with sufficient funding and availability to mitigate and remove these unintended consequences. The shift in climate is easily noticeable by all, increased heatwaves in summer every Europe are causing fatalities frequently, worsened ecological problems are being noticed with weekly media news of yet another species of animals facing endangerment or coral reefs being damaged, heightened projects on recovering the bee population. As we are increasing our water usage due to overpopulation, countries in the middle east face drought and lack of clean water every summer, this is further pushed by the lack of rainfall as well as increasing temperatures.

The long pursuit of strengthening environmental protection and promoting a more integrated approach through UN conferences on 'environment and development' started with the Stockholm Conference on the Human Environment in 1972. In 1988, the Intergovernmental Panel on Climate Change (IPCC) was set up to provide scientific knowledge to governments and official bodies in order to formulate climate-related policies (IPCC, 2013). Among the most critical steps is the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, which went into force in 1994. Since UNFCCC is the global force of climate action. During the third UNFCCC conference in 1997, The Kyoto Protocol was adopted and went into force in 2005, in which emission reduction commitments for developed countries in a five-year plan have been outlined (UNFCCC, Kyoto Protocol to the United Nations Framework, 1997). Emission reduction has mainly been achieved through the introduction of renewable energy, energy efficiency, and afforestation/reforestation-related projects. The Kyoto Protocol's general framework introduces the concept of carbon pricing and defines four emission-saving units, each representing one metric ton of CO2 equivalent and are all tradeable (UNFCCC, 2005).

1. Certified emissions reduction unit, obtained through clean development mechanism projects.
2. Emission reduction unit, obtained through joint implementation projects.
3. Assigned amount unit, obtained through the trading of unused assigned emissions between protocol parties.
4. Removal unit, obtained through reforestation-related projects.

These various methods are emission savings, not reductions. The reduction would entail a direct cut in the production and emission phase, therefore not allowing the emissions above a certain limit in the first place. Once the emissions are already emitted, an attempt to reduce their environmental impacts would only translate to creating a mechanism of balance around the globe. Clean Development Mechanism projects, and other joint implementation projects of reforestation-related projects though they are different approaches, aim to balance out the emissions that have already been released by a certain action, instead of limiting the said action. Trading unused assigned emissions between protocol parties instead does not entail a reduction and not even a balancing action. It is simply transferring one's emission capabilities to another and monetizing the process as well. We can conclude that these attempts are not promising when it comes to reducing emissions or changing business as usual.

In 2012, the Doha Amendment to the Kyoto Protocol proposed a second commitment period of five years as well as updating the emissions reduction targets of at least 18% below the 1990 level however it is yet to be ratified by the minimum of parties required (UNFCCC, 2012). The Sustainable Development Goals were first formally discussed at the United Nations Conference on Sustainable Development which took place in Rio De Janeiro, Brazil in 2012 in the Rio+20 (Pekmezovic, 2019)

The twenty-first UNFCCC conference led to the Paris Agreement of 2015 which added further objectives, enhances compliance and reporting as well as supported mechanisms into the existing climate change combat framework. The main objective declared was to limit the global temperature to a 2-degree increase by 2100 and efforts to limit the increase to 1.5 degrees. (UN, The Paris Agreement, 2015)

In 2000, a new union between environment and development merged under the Millenium Development Goals (MDGs) with the approval of the UN Secretary-General. Millenium Development Goals prioritized social and economic goals whereas the presence of any environmental goal was limited to one. The lack of reflecting environmental concerns was seen as a failure and institutions such as the Commission on Sustainable Development (CSD) were criticized with the implementation of Agenda 21 only for show, not for taking action. Ultimately, governments decided to create Sustainable Development, while merging MDGs with Agenda 21 thus creating the Agenda 2030. Sustainable Development Goals focus on poverty reduction as well as creating stronger dynamics between the environment and development. (Elder & Olsen, 2019)

The first few SDGs (1–5) could be interpreted as 'social', addressing the MDG's poverty reduction agenda, and representing various aspects of poverty. Then, the 'economic' SDGs could be the middle ones (8–10), which should facilitate poverty reduction. Finally, SDGs 11–15 near the end could be the 'environmental' SDGs.

Among the 17 Sustainable Development Goals, we can select words such as 'environment', 'sustainability', or 'pollution' to distinguish which targets within each goal can be interpreted as environmental targets. Such an analysis shows that 73 out of 169 targets are linked to the environment, which is 53 percent of the target between SDG 1-15 (excluding targets under SDGs 16 and 17 as they apply to all goals).

The environmental targets in Table 1 can be classified into (1) means to improve the environment through sustainable agriculture, energy efficiency, and decoupling environmental degradation from economic growth; (2) conditions that should be improved; (3) other ends that would benefit for environmental improvement. (Elder & Olsen, 2019)

It must be mentioned that the SDGs present a debatable and optimistic approach that environmental protection can co-exist with economic growth, which is the reason behind its promotion since Brundtland in 1987. This approach receives much criticism as other perspectives argue that economic growth is not compatible with the achievement of long-run sustainability goals (Raworth, 2017) (Klein, 2015).

Table 1: Targets directly related to the environment.

Target No.	Content related to environment	Target No.	Content related to environment
1.5	Resilience to climate and environmental shocks and disasters	**7.b.**	**Infrastructure and technology**
2.4	**Sustainable food production systems**	**8.4**	**Resource efficiency & decoupling economic growth from environmental degradation**
2.5	Genetic diversity	**8.8**	Labor rights and safe working environment
3.3	Deaths and illness from pollution	**8.9**	**Sustainable tourism**
3.9	Water-borne diseases	**9.1**	**Sustainable and resilient infrastructure**
4.7	**Education for sustainable development**	**9.2**	**Sustainable industrialization**
5.a	**Women's equal rights to economic resources, property, natural resources**	**9.4**	**Sustainability upgrading and resource efficiency**
6.1	Access, safe water	**9.a**	**Financial, technical, & technological support for sustainable & resilient infrastructure**
6.2	**Sanitation**	**11.1**	Adequate, safe, affordable housing
6.3	**Water quality**	**11.2**	**Sustainable transport**
6.4	**Use-efficiency**, scarcity	**11.3**	**Inclusive and sustainable urbanization**
6.5	**Integrated water management**	**11.4**	Protect & safeguard cultural & natural heritage
6.6	Ecosystems	**11.6**	Environmental impact, air quality, **waste management**
6.a	**Capacity building**	**11.7**	Green and public spaces
6.b	**Local participation**	**11.a**	**National and regional development planning**
7.2	**Renewable energy**	**11.b**	**Integrated policies on inclusion, resource efficiency, climate mitigation & adaptation, resilience, disaster risk management**
7.3	**Energy efficiency**	**11.c**	**Support for sustainable & resilient buildings**
7.a	**Related investment**	**12-15: All**	**(Except 14. a)**

Gray box: environmental condition to be improved
Bold text: means to improve the environment
Gray box and bold text: the target combines the environmental condition to be improved with means to improve it
Normal text: ends which benefit from an improved environment

The Preamble to the SDGs is as follows:

> … We envisage a world of universal respect for human rights and human dignity, the rule of law, justice, equality and non-discrimination; respect for race, ethnicity and cultural diversity; and of equal opportunity permitting the full realization of human potential and contributing to shared prosperity. A world which invests in its children and in which every child grows up free from violence and exploitation. A world in which every woman and girl enjoys full gender equality and all legal, social, and economic barriers to their empowerment have been removed. . . We envisage a world in which every country enjoys sustained, inclusive, and sustainable economic growth and decent work for all. A world in which consumption and production patterns and use of all

natural resources – from air to land, from rivers, lakes, and aquifers to oceans and seas – are sustainable. One in which democracy, good governance, and the rule of law, as well as an enabling environment at the national and international levels, are essential for sustainable development, including sustained and inclusive economic growth, social development, environmental protection and the eradication of poverty and hunger.... In its scope, however, the framework we are announcing today goes far beyond the Millennium Development Goals. Alongside continuing development priorities such as poverty eradication, health, education, and food security and nutrition, it sets out a wide range of economic, social, and environmental objectives, it also, crucially, defines means of implementation." (UN, Transforming Our World: The 2030 Agenda For Sustainable Development, 2015) (Department of Economic and Social Affairs, 2015)

This preamble is presenting us with the utopic world the United Nations wants to achieve where living standards, human health, environmental protection, economic growth, and development are at their peak. Though a beautiful commitment to human lives, there are certain contradictions such as promoting economic growth and protecting the environment at the same time as there are no references to making fundamental changes in our system besides the mentioning of Millenium Development Goals, which have been superseded by Sustainable Development Goals. (UN, Global Indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development, 2017) (The United Nations, 2015).

1.2 SDG 13: Take urgent action to combat climate change.

SDG 13 'Combating climate change. Take urgent action to combat climate change and its consequences' aims to determine the actions to preserve and protect our planet from the unmitigated consequences of climate change. Countries have committed to five targets and eight indicators that are related to SDG 13 which provides us with three key action areas: climate change adaptation, zero-carbon development, and climate finance. We must be aware that achieving SDG 13 entails interactions with other SDGs and a successful consideration of connections among other Sustainable Development Goals. We must note that climate change does not have the same consequences in every country. Different consequences can be answered through location, capacity as well as vulnerability. (Doni, Gasperini, & Soares, 2020)

Targets taken from the United Nations publication Transforming our World: The 2030 Agenda for Sustainable Development, published in 2015 and SDG Tracker: Measuring progress towards the Sustainable Development Goals

- 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

This target refers to natural disasters such as drought, floods, landslides, wildfires, extreme weather or temperature conditions, volcanic activity, and earthquakes. There has been a radical increase in natural disasters from the year 2000 to today as can be seen with consequential earthquakes of today in the Mediterranean region (referring to March 2023). Natural disasters have tremendous consequences for humans such as injury, homelessness, and displacement as well as people being indirectly impacted by the consequences of the disasters such as reduced access to food, water, and shelter. Natural disasters halt the development of the affected region as well as the inhabitants. SDG Indicator 13.1.1 is on 'Deaths and injuries from natural disasters' and it has been defined as 'the number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population'. Indicators measured here report mortality rates, internally displaced persons, missing persons, and total numbers affected by natural disasters. SDG Indicator 13.1.2 is focused on 'National disaster risk management.' Indicator 13.1.2 is the number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030. This indicator identifies countries that have and have not adopted and implemented disaster risk management strategies in line with the Sendai Framework for Disaster Risk Reduction. SDG Indicator 13.1.3 is on 'Local disaster risk management.' This indicator has measured the proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies. (Doni, Gasperini, & Soares, 2020)

- 13.2 Integrate climate change measures into national policies, strategies, and planning.

This indicator is defined as the number of countries that have established an integrated plan to increase their ability to adapt to the impact of climate change and foster climate change resilience as well as low GHG emissions development. While it reflects the number of countries signed up to multilateral agreements on climate change, it does not reflect any levels of operationalization. (Doni, Gasperini, & Soares, 2020)

- 13.3 Improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning.

13.3.1 is focused on 'education on climate change' which refers to the number of countries that have integrated mitigation, adaptation, impact reduction, and early warning into their education systems curricula. SDG 13.3.2 refers to 'Capacity-building for climate change' which entails the number of countries that have communicated strengthening of adaptation, mitigation, and development when it comes to strengthening institutional, systemic, and individual capacity building. (Doni, Gasperini, & Soares, 2020)

- 13.A.1 Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible.

SDG Indicator 13.A.1 refers to the 'Green Climate Fund mobilization of $100 billion' and the mobilization of these funds per year between 2020 and 2025. This indicator keeps track of the commitments from countries to the Green Climate Fund as annual contributions pledged. Contrary to other targets which have the culmination time as 2030, this target expects yearly investments of $100 billion per year from 2020 onwards. (Doni, Gasperini, & Soares, 2020)

- 13.B.1 Promote mechanisms for raising capacity for effective climate change-related planning and management in least-developed countries and small island developing States, including focusing on women, youth, and local and marginalized communities (UN, 2017).

SDG Indicator 13.B.1 refers to 'Support for planning and management in least-developed countries. It is defined as the number of developing countries as well as Small Island Developing States (SIDS) that are receiving financial, technological, and capacity-building support in order for them to raise their capacities for effective climate change planning. (Doni, Gasperini, & Soares, 2020)

SDG 13 is inherent to the entire Sustainable Development Goals as urgent action to tackle climate change is central to achieving sustainable development, (United Nations Development Programme, 2016) as well as its 'cross-cutting nature', meaning that it must be addressed for the successful implementation of the remaining 17 SDGs. This is especially visible in SDG 7: Affordable and Clean Energy, SDG 12: Responsible Consumption and Production, SDG 14: Life Below Water, and SDG 15: Life On Land support combatting climate change directly and supports zero-carbon growth. (United Nations Development Programme, 2016).

Reaching the SDG 13 targets brings us to three key action areas in which it is important to adopt certain measures, these are, climate change adaptation, zero-carbon development, and scaled-up climate finance.

Climate change adaptation refers to the design and implementation of policies and measures in order to minimize vulnerabilities of sustainable development such as improving food and water security for agricultural communities that are affected by changing rainfall patterns as a consequence of climate change or disaster risk governance coupled with an early warning system to ensure any development project or initiative is informed against potential risks. (United Nations Development Programme, 2016). Zero-carbon development refers to initiatives to reduce the levels of carbon that are already existing with the implementation of different policies. Some examples of zero-carbon development refer to investments in renewable energy solutions such as solar, wind, hydro, and geothermal power. Another way to invest in carbon reduction is fighting against deforestation as when trees perform photosynthesis, they pull carbon dioxide out of the air, bind it up in sugar, and release oxygen, making them the best carbon capture technology in the world as well as tackling land use issues and land degradation. However we must keep in mind other emission sources such as methane and nitrous oxide which are released during the combustion of fossil fuels such as coal, oil, and natural gas. It is easily observable how other SDGs complement these three main areas (Doni, Gasperini, & Soares, 2020).

1.3 Zero-Net Emissions for SDG 13

The importance given to zero-net emissions stems from the 'greenhouse effect'. The use of combustible minerals in industries such as coal, oil, and natural gas emit huge amounts of carbon dioxide (CO2) as well as other destructive components into the atmosphere; various means of transportation ranging from cars and trucks to more intense ones such as planes and big ships emit exhaust fumes that pollute the air and enhance the greenhouse effect; lack of forest protection and deforestation leads to the damages to trees which absorb carbon dioxide and release oxygen leads to the amount of CO2's in the air increasing with each tree on the planet being destroyed. Another aspect of the greenhouse effect comes with the increase in human population which causes a direct increase in demand for food, clothing, and housing. Simply put, growing demand leads to the growth of industrial production to create the supply for this demand, which leads to further pollution of air with these greenhouse gases that are produced by agricultural activities, production mechanisms, and so on. Eventually, the decomposition and burning of garbage at landfills further contribute to the increase of greenhouse gases (Levin, 2012) (Li, 2017) (Lisin, 2020). Simply put, almost every aspect of our life emits further carbon dioxide (CO2) into the atmosphere (Mikhaylov, Mosieev, Aleshin, & Burkhardt, 2020).

The International Panel On Climate Chane attributes the rising level of carbon emissions as a greenhouse gas to climatic instability and rising global temperatures. This awareness of the carbon emissions influence on global warming and consequently global warmings influence on the environment, individuals, corporate bodies, and governments led to alarms being run to initiate their tackling. The world now, besides climate deniers, acknowledges that emissions need to be reduced in order to survive the impacts of climate change. A surprising example of our world contributing to increased emissions beyond usually considered economic production and actions is the Iraqi War contribution to about 141 million metric tons of CO2 since March 2003. Of course, other simple events such as transportation, air-conditioning, seaports, production of electricity, and industrial heating, as well as the oil and gas industry, are the propellers of carbon emissions (Akadiri, Bekun, Taheri, & Akadiri, 2019). Carbon emissions account for more than 59% of the overall greenhouse gas emissions, thus their reductions are crucial for slowing down the rise of global temperatures (Bacon & Bhattacharya, 2007).

Humankind has emitted around 2500 billion tonnes of CO2 since the Industrial Revolution. Global emissions of greenhouse gases reached fifty billion tonnes of carbon dioxide (CO2) in 2019, around 6.6 tonnes of CO2 per capita. In 2021, global emissions have almost recovered their pre-pandemic peak. Globally, the top 10% of global emitters (771 million individuals) emit on average thirty-one tonnes of CO2 per person per year and are responsible for about 48% of global CO2 emissions. The bottom 50% (3.8 billion individuals) emit on average 1.6 tonnes and are responsible for close to 12% of all emissions in 2019 (UNDP, 2021). The global top 1% emits on average 110 tonnes and contributes to 17% of all emissions in a year. Global inequality in per capita emission is due to large inequalities in average emissions between countries and to even larger inequalities in emissions in each country. Currently, average emissions in Europe are close to ten tonnes of CO2 per person and per year. In North America, the average individual emits around 20 tonnes. This value is 8 tonnes in China, 2.6 tonnes in South & South-East Asia, and 1.6 tonnes in Sub-Saharan Africa (UNDP, 2021) (Chancel, 2021). This is a simple demonstration that though emissions are being considered as a unit at the global level, their emissions are not conducted in such unity.

As carbon is being emitted, the Earth's natural carbon cycle also absorbs considerable amounts of carbon dioxide, even more than we emit by using fossil fuels. Oceans and forests absorb carbon dioxide and store it for thousands of years, they are referred to as natural carbon sinks. Other parts of the planet such as undersea volcanoes and hydrothermal vents release carbon. This goes to say that the carbon cycle is an inherent part of our planet's functioning as it absorbs and emits about 100 billion tons of carbon dioxide through its natural cycle. In addition, the contribution of humanity to carbon emissions can be compared to a grain of sand on an entire beach. This information could allow us to assume that therefore there should not be an extensive worry about carbon emissions if the planet is already capable of sustaining 100 billion tons of carbon dioxide in its cycle. The problem is that although the natural carbon cycle does balance itself, firstly this is completed over long timescales. If we observe how fossil fuels are created and released, with hydrothermal vents on the seafloor providing the carbon that presses into fossil fuels and over a thousand years, the slow movement of our planet's tectonic plates brings those fossil fuels back to the Earth's surface and emits the carbon dioxide into the air. However, as we are mining and burning those fossil fuels, we are shortening this natural cycle, and therefore more carbon dioxide is being emitted to the atmosphere, at a faster rate than what the planet is capable of absorbing on its own. The other part of this equation is the absorption of carbon dioxide in the atmosphere into the oceans which takes another 10,000 years or so to return to equilibrium (Rothman, 2022). This is why the percentage of carbon dioxide in our atmosphere keeps increasing, as we are facilitating the process of emission however, we have not been facilitating the process of absorption.

The consequence of greenhouse gas emissions presents itself as the influence on the Earth's climate, which is global warming. They are not equal terms but interrelated: the greenhouse effect creates global warming. Global warming in itself describes the increase in the temperature of the world's oceans. As the average temperature of the planet increases, more liquids begin to evaporate which applies to oceans. This is also where the fear of the oceans drying outcomes from. Simultaneously, due to higher global temperatures, glaciers and sea ice will begin to melt more actively in the near future which eventually leads to an increase in the levels of the oceans. If the level of the world ocean increases, lands will be flooded which will directly culminate in the loss of agricultural harvest. It does not stop there; the consequences of the greenhouse effect are extremely harmful to humans. As the harvest is lost, there will be fewer areas available for animal grazing, sources of fresh water will be absorbed into the oceans, and this will be the first dramatic blow to humankind by the suffering of the low-income part of the population who are farmers and depend on harvest as well as domestic animals. As the temperatures increase, snow presence will decline. The soil will be over-dried as soon as the rainy season ends and will be unsuitable for growing crops. Desertification originates from a lack of moisture. Experts argue that an average temperature increase of 1 degree in ten years will lead to a reduction of forest areas by 100-200 million hectares. If the water levels of the ocean rise, temperatures will threaten biodiversity, and consequently disappear many species of wildlife due to the changes in their habitat, not every species will be able to adapt to new conditions. The same is valid for plants, animals, and birds and thus direct destruction of food chains and the equilibrium of ecosystems (Mikhaylov, Mosieev, Aleshin, & Burkhardt, 2020).

According to The Germanwatch Global Climate Risk Index conducted in 2021, we can determine which countries are to be highly impacted by the impacts of climate change. This index is not a comprehensive climate vulnerability scoring and only focuses on extreme weather events such as storms, floods, and heatwaves but is not capable of considering slow on-set processes such as rising sea levels, glacier melting, or ocean warming and acidification which are as important (if not more) than short-term consequences. The data is limited and is collected from 180 countries, unfortunately collecting sufficient data is not equally possible in all countries. According to the report, in the year 2019 Mozambique, Zimbabwe, and the Bahamas (with corresponding GDPs for 2019 stated as follows:15.39 billion $, 21.83 billion $ and 13.19 billion $) were the countries that have been affected by the impacts of extreme weather events. In the previous years between 2000 and 2019, Haiti, Puerto Rica, and Myanmar were the countries most affected by the impacts of extreme weather events.

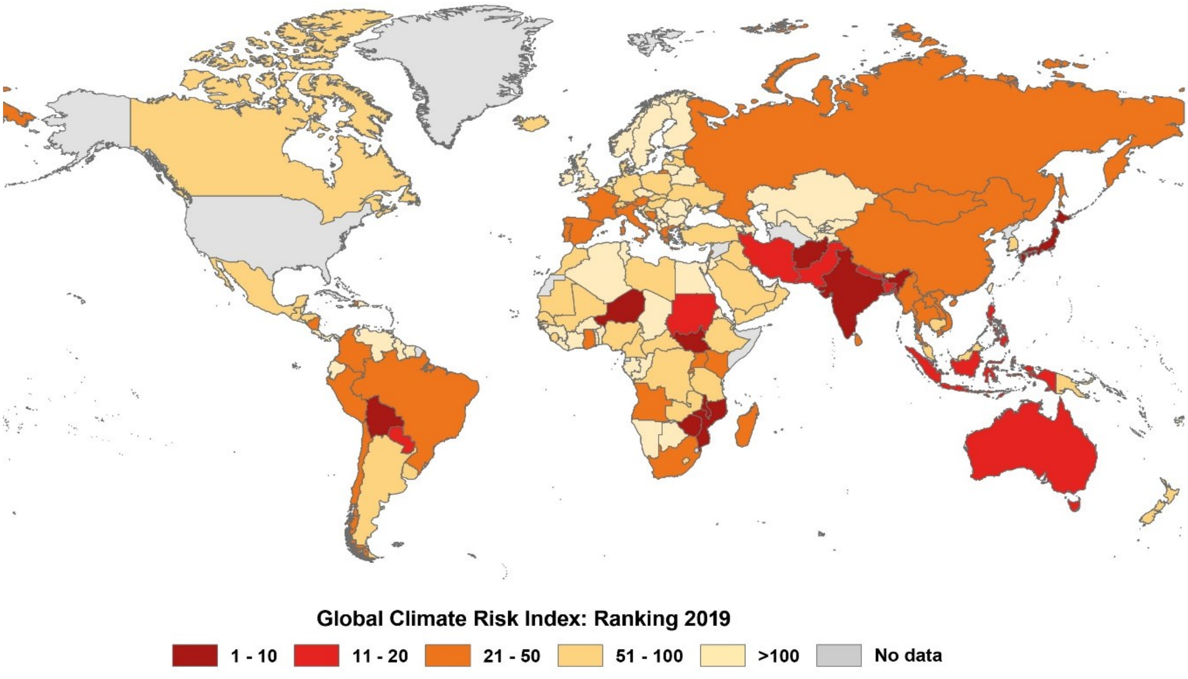

Figure 1: World Map of the Global Climate Risk Index 2019. Source: www.germanwatch.org/en/cri

In the years between 2000 and 2019, 475.000 people have lost their lives as a direct result of more than 11.000 extreme weather events globally. Besides the report belonging to the year 2021, a different category of countries has continuously ranked among the most affected countries: Haiti, the Philippines and Pakistan. Out of the ten most affected countries in 2019, six were affected by tropical cyclones and recent scientific conclusions suggest that the number of severe tropical cyclones will increase with every tenth of a degree in global average temperature rise, therefore the consequences for countries will only worsen (Germanwatch, 2021). Developing countries are particularly affected by the impacts of climate change due to their geographical locations as well as because of their lower coping capacity. In the 2019 report, eight of the ten countries that have been most affected by the extreme weather events belong to the low- to lower-middle income country categories and half of them are among “least developed countries” such as Zambia, Afghanistan, Cambodia and Haiti (Eckstein, Künzel, & Schafer, 2021).

Among those who have acknowledged that change in our planet's climate would create difficult circumstances for humankind and the ultimate objective would be the stabilization of greenhouse gas concentrations at a level that would intercept any type of dangerous interference on our climate system (United Nations, 1992). The participants to the Kyoto Convention in 1997 have agreed to measures which (United Nations, Kyoto Protocol to the United Nations Framework, 1997) if followed by the adherent countries to its completeness, would only be a simple step towards reaching this goal (Bolin B., 1998). In the Kyoto Protocol, developed countries would be reducing their emissions in the period of 2008-2012 so that their average emission rate would be 5% lower than that in 1990, with no targets appointed to developing countries (Bolin & Kheshgi, 2001).

The Kyoto Protocol offered various means for nations to achieve their emissions targets. One approach was to utilize natural processes, known as "sinks," that absorb greenhouse gases from the atmosphere. Planting trees that absorb carbon dioxide from the air was one such example. The Clean Development Mechanism (CDM), an international program, was another approach that encouraged developed countries to invest in technology and infrastructure in less-developed countries where significant opportunities to reduce emissions existed. Investing countries could claim reduction achievements in a different country under their credits, such as by investing in a clean-burning natural gas power plant to replace a coal-fired one. Carbon emissions trading is yet another approach that allows participants to buy and sell emission rights, putting an economic value on greenhouse gas emissions and placing them in the free market. Under the emissions-trading market, European countries initiated the last approach to meet their commitments under the Kyoto Protocol. Nations failing to meet their emissions targets would be required to make up the difference plus a penalty of 30 percent in the subsequent commitment period. They would also be prohibited from participating in emissions trading until they complied with the protocol. Future protocols would establish emission targets for periods beyond 2012. In 2012, delegates agreed to extend the Kyoto Protocol until 2020, reaffirming their commitment to create a comprehensive and legally binding climate treaty by 2015. This agreement would require greenhouse gas-producing countries that do not abide by the Kyoto Protocol, such as India, China, and the United States, to limit and reduce their emissions. In 2015, the Paris Agreement, a global and non-binding agreement, was signed by 196 signatories. It aimed to limit the increase of the world's average temperature to no more than 2°C above preindustrial levels and to strive to keep it below 1.5°C. This agreement effectively replaced the Kyoto Protocol after extensive negotiations in Paris, France. (Brittanica, 2022).

Kyoto Protocol was widely believed to be ineffective because the world’s two biggest carbon-dioxide-emitting countries, the United States and China were not participating. The absence of China from the Kyoto Protocol, which recognized it as a developing country, and the United States' officials using this fact to justify their non-participation were the reasons behind this. During the negotiation period of the Paris Meeting in December 2015, 185 countries submitted proposals to limit or decrease their greenhouse gas emissions by 2025 or 2030. One of the most difficult points of the negotiations was transferring funds from developed countries to developing countries, as developed countries did not want to be the only ones that had to bear the costs. This is a controversial point, as developing countries were also protesting their requirements to limit their emissions to compensate for the greenhouse gas emission levels contributed by the developed countries. Additionally, even if the commitments made by the countries were to be fulfilled, it was highly unlikely that temperatures would be limited to a 2 °C increase. On December 12th, 2015, the adoption of the Paris Agreement was announced. Yet again, there was no mechanism to enforce compliance with the agreement's provisions, beyond one of "promoting compliance" through a committee that would report annually. The only sovereign countries that had not signed by 2017 were Nicaragua and Syria, which changed in 2020 when U.S. President Donal Trump declared the formal exit from the Agreement in late 2020 – this absence was short-lived as on the first day of his term, President Joe Biden entered the agreement on behalf of the United States. Since the agreement came into force, its progress toward emission reduction targets has been complicated. On one hand, Chinese authorities had announced they were making great progress, noting also that China had met its 2020 commitments already in 2017. On the other hand, European Union officials announced in 2018 that they had all fallen behind in reaching their targets. Despite all efforts, several international research organizations declare that carbon emissions continue to increase. The Global Carbon Project reported that carbon emissions worldwide, which were flat from 2014 to 2016, had increased by 1.6% and by 2.7% in 2017 and 2018, respectively (Britannica, Encyclopedia Britannica., 2023)

According to other resources, China is the largest emitter of carbon dioxide, and CO_2 with 5.41 billion metric tons of carbon dioxide emissions in 2018. The primary source of CO_2 emissions in China is fossil fuels, especially coal burning as about 58% of the total energy in China came from coal alone in 2019. Coal is rich in carbon and its combustion in China's power plants and industrial plants, as well as boilers release substantial amounts of CO_2 into the atmosphere. This could be interpreted as a trajectory that we would observe from other developing countries in various periods. The United States is the second-largest emitter of CO_2 with approximately 5.41 billion metric tons of carbon dioxide emissions in 2018. Different from China, the largest sources of CO_2 emissions in the U.S. come from transportation, industry, and power generation in 2020. India is known as the third-largest emitter of CO2 in the world as it produces 2.65 billion metric tons of CO2 in 2018 (it is easy to predict the emissions have risen since their path towards urbanization and industrialization through which the consumption of solid fuels such as coal has risen to extreme amounts). Coal as a source of electricity has risen by 7% from 1992 to 2015 reaching a total of 75%. As India is abundant in coal mines, it is cheaper in the country in comparison to oil and gas that is imported from abroad. At the global level, carbon emissions from fossil fuels have increased dramatically since the 1900s, and since 1970, CO2 emissions have increased by 90% with emissions from fossil fuel combustion and industrial processes making up about 78% of the total greenhouse gas emissions increase until 2011. The second largest contributor to this increase is agriculture, deforestation as well as other changes in land use (Das, 2023). It is very simple to notice that developing countries need more energy and economics dictate to choose the option with the lowest monetary cost. In this case, fossil fuels have the lowest monetary cost for development however they also have the highest environmental cost. A country cannot plan exponential growth and development if they are not able to prompt it in the first place.

Another action that has been taken at the global level as per the urges from economists as well as environmentalist towards policymakers to draw restrictions on the industries that contribute to major portions of greenhouse gas emission have been implemented the activity known as carbon taxes, which were aimed at stimulating innovations for low-carbon technologies. Currently, twenty-five countries around the world have a national carbon tax. This is present in countries such as Canada, Singapore, Japan, Ukraine, Argentina, and the European Union. In Sweden, a carbon tax has been effectively implemented at the price of $127 per tonne. This has led to the successful reduction of 25% in emissions since 1995, while the country's economy has expanded by 75% in the same time frame (Das, 2023).

Unfortunately, due to the damage done to the atmosphere since the start of the industrial revolution, with more than 2,000 gigatons of carbon dioxide being emitted into the atmosphere, the imperative for contesting climate change is no longer only by reducing emissions through renewable energy, promoting energy efficiency, halting deforestation, and minimizing other pollutants. As we do not know the consequences of the greenhouse gases in the atmosphere over the long term, we must also take action to reverse the damage that has already been done by removing and restoring carbon from the atmosphere and using them efficiently in different forms.

Chapter 2: The Carbon Market

The Carbon Markets began to emerge in the 1990s as the main international policy response to climate change. Developed by American economists and traders in the 1970s and 1980s, it underwent multiple failed policy experiments in the United States before it took its place as the centerpiece of the United States Acid Rain Programme in the 1990s. In 1997, President Bill Clinton successfully pressured the Kyoto Protocol to absorb a set of carbon trading instruments. Later in the 2000s, Europe has taken upon itself the role to be the world's largest carbon market with the EU Emissions Trading Scheme (EU ETS). Carbon Markets are trading over US$100 billion yearly and are projected to rival the financial derivatives market (Birch & Mykhnenko, 2010). An initial environmental agenda is gaining importance in economics at a fast rate, the potential risk here is that the economics aspect of the notion will eventually dominate its environmental importance. Therefore, giving less attention to the achievement of specific targets regarding environmental protection and focusing on potential monetary gain.

2.1 Carbon emissions in growing economies

The world economy has more than tripled over the last five decades (Knox, Agnew, & McCarthy, 2014). The trade-off in this is that economic growth has raised standards of living in most countries, however, it was also responsible for a dramatic increase in carbon dioxide (CO_2) emissions and depletion of natural resources. As academic researchers have concluded, there is a linear relation between CO_2 emissions and economic growth, a reduction in emissions may not be a desirable outcome in any country, but especially in emerging economies. As we have previously mentioned, the points of reference are that economic growth causes CO_2 emissions, and consequently, the higher the growth of a country's economy is, the higher the demand for energy, which its combustion leads to CO_2 emissions, grows (Mardani, Steimikiene, Cavallaro, Loganathan, & Khoshnoudi, 2019). Presenting any country, no matter, if they are classified as developing or developed, with the pursuit of environmental protection at the cost of economic growth, would be debatable. This could be easier for a country with a high GDP per capita and sufficient development to compromise on their living standards, although it would still not be preferred in any case, in comparison to a country that already is struggling with a sufficient level of living standards, would be shameful to even propose.

An attempt to investigate the determinants of CO2 emissions for 69 countries between the period 1985 and 2005 using dynamic panel data was conducted by Sharma in 2011. He subdivided the countries into high, middle, and low income. The high income consisted of 28 countries, the middle income 27, and the low income 14. The variables used were CO2 emissions, trade openness, urbanization, GDP, and energy use. The paper found that GDP per capita and urbanization were the two main determinants of CO2 emissions in the global panel (all countries combined) (Mardani, Steimikiene, Cavallaro, Loganathan, & Khoshnoudi, 2019) (Sharma, 2011). Therefore, with the way our world and economy are shaped right now with a high reliance on fossil fuel consumption, o country will be able to preserve or increase its economic levels without contributing to further environmental damage.

The majority of the studies for the past two decades have been intensively focused on and confirmed the relationships between CO2 emissions and economic growth. This debate is widely formed around the Environmental Kuznets Curve which implies that starting from low levels of capital, environmental degradation increases, but after a certain level of income (as a turning point) it diminishes. The earlier stages of economic development are associated with comparatively slow economic activities. One may think that at such a stage, obsolete technologies are still used. At the same time, government policies are more aimed at economic development than at environmental protection. Consequently, CO2 emissions rise with economic activities. In rich countries, the positive effect on emissions due to intensive economic activities seems to exceed the reduction in emissions due to the use of modern technologies. On the whole, the economic development process always results in increased CO2 emissions (Azomahou, Laisney, & Van, 2006). Here it can be argued that from the analysis of developed countries that partook in the Industrial Revolution, their carbon emission that increased with their levels of growth have not decreased until they have discovered the potential dangers of high greenhouse gas emissions and committed to a certain reduction. The decline in greenhouse gas emissions did not occur nationally, but instead, it was the effect of policy implementation.

The concerns that are expressed for environmental damage on the global dimension, can collide with goals for expanding economic activity in a country (Cline, 1992). Since 1991, developing countries are responsible for more than 50% of the world's CO2 emissions and their share will continue to increase. (Han & Chatterjee, 1997). The ability of developing countries to respond to concerns about climate change is complicated by two facts: (a) the world's poorer countries need to increase the standard of living of the majority, and this depends on increased energy use per capita, and (b) many have a high reliance on fossil and other solid fuels like wood which have large carbon emissions. On the other hand, the per capita use of energy in developing countries is still low (Han & Chatterjee, 1997). Per capita use of energy helps to understand the living standards of a country, divided into four economic sectors of residential, commercial, transportation, and industrial. In order to provide a comparison, the energy use per capita in Sweden in 2021 was 63,260 kWh, and 2019 Cambodia's energy use per capita was 4,063 kWh (BP Statistical Review of World Energy; U.S. Energy Information Administration (EIA), 2019). This demonstrates a big disparity in the four economic sectors in Sweden and Cambodia.

The development stemming from the level of economic growth in each country, at any time, is dependent on a number of factors. In order to encourage a high rate of growth, different economies' mechanisms have involved country-specific development as well as the potential natural resources already available in the country. As we move away from outdated economic theories that solely focus on labor and capital as major factors of production and ignore the importance of energy in growth processes, we start to absorb the knowledge that both environmental degradation and energy consumption are some of the important factors of concern to both development economics and resource and environmental economists (Stern, 2011). A good number of studies have examined the causal relationship between energy consumption and several independent variables such as economic growth, financial development, employment, and population. Grossman & Krueger noted that to achieve a high level of growth a country needs more inputs to enlarge its outputs, leading to an increase in the waste and emissions generated through the production of economic activities. Kaiha, Aissa, & Lanouar noted that the depletion of non-renewable energy is the result of an unbalanced availability between finite energy resources, population growth, and industrial development. Renewable energy resources provide opportunities for economic development and environmental quality improvement (Kaiha, Aissa, & Lanouar, 2017) (Ozturk & Al-Mulali, 2015) (Grossman & Krueger, 1995). The implementation and production of renewable energy requires a substantial amount of investment that developed countries are currently shifting towards, however, the rest of the world does not have the capacity to take the same actions. The increased allocation of natural resources, accumulation of waste, and concentration of pollutants directly impact the degradation of environmental quality, leading to a decrease in human living quality, despite the rising income (Daly, 1991) (Goodness & Edoja, 2017).

There is a trade-off for growing economies: to grow or to mitigate climate change. Due to the components of the argument, it is not easy for developing countries to simply halt their economic and industrial growth and join the fight against climate change. They can simply say that it is not the fight they have started, so why should they bear the consequences? Meanwhile, an evident case of myopia would encourage any country leader to focus on the current problems of decreasing poverty, infant mortality, etc., and not on the potential (however not yet graspable) consequences of climate change.

2.2 The connection between The 2030 Agenda and the Paris Agreement on Climate Change

The 2030 Agenda which includes the Sustainable Development Goals (SDGs) and the Paris Agreement on climate change were adopted in 2015. Although they are independent of each other, the two agreements are strongly interlinked. A literature review of these two agreements reflects that climate-change mitigation measures directly affect most Sustainable Development Goals and their targets (Joy, et al, 2018). Both the Paris Agreement and the 2030 Agenda represent internationally accepted visions whose implementations are based on a “bottom-up” process’ (Dzebo, Janetschek, Brandi, & Iacobuta, 2019), as in countries identify and subsequently act and report on their priorities, ambitions, and needs (Mbeva & Pauw, 2016). As opposed to “top-down” approaches such as international mandates that are predetermined created a paradigm shift towards governance by goals, targets, and contributions set by individual countries (Biermann & Kanie, 2017) (Buoyé, Harmeling, & Schulz, 2018) (Roy, 2018).

The 2030 Agenda addresses climate change through SDG 13. The Paris Agreement emphasized the importance of sustainable development considerations while addressing climate change impacts. Lastly, climate change itself is recognized as a hindrance to development efforts worldwide (Hoegh-Guldberg, et al, 2018). The interlinkage between climate-relevant policies and the national sustainable development priorities of the countries requires ensuring the climate-change and development policy coherence and the goals that are jointly reached (Winkler, Höhne, & Elzen, Methods for quantifying the benefits of sustainable development policies and measures, 2008) (Winkler, Boyd, Gunfaus, & Raubenheimer, 2015). Thus, low-carbon (sustainable) transitions are essential to mitigate climate change as well as to continue to achieve further development objectives. As sound as this approach presents itself to be, the cost of such transition varies on the different levels of technological and infrastructural advancements of each country. The less prepared and more technologically or infrastructurally behind a country is, the higher the cost of making such a transition from fossil fuels to renewable energy resources.

The impact of climate-change mitigation on the Sustainable Development Goals are through measures that improve energy efficiency and those that reduce demand for material and energy services through strategic planning and changes of activities and processes mainly result in co-benefits across all SDGs. Furthermore, when compared with fossil-fuel alternatives, renewable energy sources have mostly co-benefits, especially for solar PV, tidal and wave energy, solar and geothermal heating, and wind. Consequently, if fuelled by clean energy sources, electric vehicles (EVs) would also predominantly provide co-benefits, although some trade-offs remain, such as battery production and disposal (Iacobuta, Höhne, Van Soest, & Leemans, 2021). There is no conviction that any of these transitions in any country are easy and cheap.

Climate-change mitigation directly affects 15 out of 17 SDGs. This advocates a high potential success when climate and development issues are simultaneously tackled. Climate-mitigation policy types with many co-benefits are energy efficiency and energy-services demand reduction. When compared with fossil fuels, most renewable energy sources also have multiple co-benefits to sustainable development (Iacobuta, Höhne, Van Soest, & Leemans, 2021). The policy areas that appear to have the most trade-offs with the SDGs are nuclear and Carbon Capture and Storage (CCS), followed by biofuels, natural gas and energy (CO2), and agriculture taxes. Among the SDGs, the environmental and economic SDG targets much better cover policy impacts than the social targets. This indicates that for the overall achievement of the Sustainable Development Goals, the environmental and economic targets should be prioritized.

The success of these two global agreements will depend heavily on the other and on the capacity of countries to develop and implement programs of action to address their climate and development goals in an integrated and coordinated way. The main objective of the two agreements would be to meet the growing needs of development while ensuring the low-carbon transition is incorporated into the agenda (Fay M, 2015). As the countries in the Asian and African continents are growing, we are observing a change from a level where the greenhouse gas emissions per capita were the lowest due to historical poverty and stagnation, to present growth and some are considered the fastest-growing cities in the world (UN, 2014). In its Review of Targets for the Sustainable Goals: The Science Perspective, the International Council for Science (ICSU) points out that the lack of a proper response to climate change would most likely make it more difficult to achieve targets related to many SDGs such as zero hunger, good health and well-being, clean water and sanitation, economic growth, industry, innovation and infrastructure, sustainable cities, and life on land and below water. Poverty, inequality, and peace and justice would also be indirectly affected (ISSC, 2015). This reiterates the stance that for the overall achievement of the Sustainable Development Goals, the environmental and economic targets should be prioritized.

The World in 2050, a new major research initiative in support of the implementation of the SDGs and the Paris Agreement, presents the following in its vision statement:

'There is an urgent need for a truly integrated, comprehensive quantitative understanding of sustainable development pathways, accounting for the interlinkages between the economy, technology, environment, climate, human development, and planetary boundaries.'

And, in its concept note, goes on to add:

'The currently used long-term projections for the world economy do not tend to account for the impact of climate change or different demographic developments. Similarly, models for climate change mitigation are poorly integrated with models for biodiversity as well as the use of land and water resources. Moreover, we lack a proper understanding of the interrelations between policies aimed at productivity growth, material welfare, energy access, and environmental sustainability" (IIASA, 2018) (Gomez-Echeverri, 2018).

These citations demonstrate that climate change is not a crisis that can be tackled alone nor by certain countries with developed economies. In order to ensure the habitability of our planet, our approach and methods must change drastically. The proper understanding of planetary boundaries must first become widespread knowledge, not only to policymakers but also to the citizens, and the approach should shift from future disaster preparation to disaster prevention.

2.3 How the carbon market functions

Though there is no single global carbon market, the economic system of the market presents the same components in all countries that partake in the practice. We will be discovering the carbon market while staying coherent with the regulations of the Kyoto Protocol.

2.3.1 Eligibility and Emission Units under the Kyoto Protocol:

The Kyoto Protocol provides three flexibility mechanisms that are aimed at reducing the overall cost of achieving emission targets. These three mechanisms are: the Joint Implementation Mechanism (Article 6), the Clean Development Mechanism (Article 12), and Emissions Trading (Article 17).

Emission Reduction Units (ERUs) can be used by the Annex I [1] country promoting a Joint Implementation Mechanism, which is an emission reduction project in another Annex I country promoting the project to meet its emissions targets under the Kyoto Protocol. This would be The Netherlands, funding and promoting a project in Italy and using the emission reductions in Italy as its own, with the aim of meeting its yearly emissions targets (Keohane & Olmstead, 2010).

Certified Emission Reductions units (CERs) belong to Clean Development Mechanisms projects that have to be approved by the Executive Committee of the CDM Board and instead of implementing the projects in Annex I countries, it is implemented in a non-Annex I (developing) country. An example of this would be the Netherlands funding and promoting a project in Cambodia and using the emission reductions that the project achieves in Cambodia as its own, with the aim of meeting its yearly emission targets.

Lastly, the most economic advantage is found in the Emission Trading Mechanisms (ETM) which provides the possibility to trade all different types of units we have mentioned as well as

[1] Annex I Countries are Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, European Union, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America. (OECD, 1998)

Assigned Amount Units (AAUs) that are received by the government of each country depending on its fixed target as well as Removal Units (RMUs) which are tradable carbon credits under the Kyoto Protocol representing an allowance to emit one metric tonne of greenhouse gases absorbed by a removal or carbon sink activity in an Annex I country, among all countries.

The condition for an Annex I country to be able to trade various units is to be eligible. Being eligible means that the country is able to use international emissions trading under Article 17 of the Kyoto Protocol. One of the requirements to be eligible is to establish a record registry where the Assigned Amount Units (AAUs), the net position in the emissions markets, and the units achieved by CDM and JI projects are registered. Once eligible, an Annex I country can transfer, acquire, or use ERUs, CERs, and AAUs in order to achieve its emission reduction targets. The balance of the registry will be compared to the real emissions of the country to determine if the Kyoto objectives have been committed. At the end of the period, each country would provide and cancel the number of permits that equals its real emissions.

$$R = AAU + ERU + CER + P - S + RMU + B \ \{ \geq E \Rightarrow \text{Commitment or} < E \Rightarrow \text{Penalty} = P^{*}(E - R)$$

(Keohane & Olmstead, 2010). R is the balance of the allowances register, P is the Purchases in the allowance market, S is Sales, and B is the result of banking (transfer of allowances from one year to the year after which was allowed on the commitment period of 2008-2012), and E is the verified emissions. On the right side of the equation, we see the real emissions. If the commitment to the Kyoto Protocol has been achieved, $R > E$. If not, the country would have to pay a penalty for each extra tonne of carbon dioxide it emitted. All trades are supervised by the International Transaction Log (ITL) which is the central administrator and guarantees the realization of all trades under certain criteria (Mansanet-Bataller & Pardo, 2008) (Birch & Mykhnenko, 2010)

2.3.2 Permit Allocation and Emission Rights:

Permit allocations and determining the allocation principle are crucial for an emissions trading system. In literature, different allocation criteria have been advocated and applied. The indicator Approach is the most commonly used emissions allocation approach, the permits or reduction targets are allocated based on certain indicators: single or composite indicator approaches. The single Indicator Approach has been widely used to allocate carbon dioxide emission permits since the 1990s due to its simplicity. An example is a GDP indicator which belongs to the economic activity criterion, the amounts of emission permits allocated to participating entities are proportional to their GDP. Another allocation criteria are Historical Responsibility, which entails that nations with more historical emissions need to take more burdens and therefore distribute reduction responsibility in proportion to cumulated emissions. The main allocation criterion that we observe is the Sovereignty criterion which is also known as "Grandfathering." This entails that all nations and firms have equal rights to pollute and to be protected from pollution. The operational rule accompanied by Grandfathering is to distribute permits in proportion to historical emissions. Free emission permits are allocated in proportion to historical emissions of the entity which suffers from the limitations of rewarding carbon-intensive firms as it allows the continuation of previous levels of carbon dioxide emissions, punished carbon-efficient firms as with lower carbon permits due to their efficiency, they are not given the opportunity to trade their excess allowances and creates a hinder for new firms. In the third phase of EU ETS, the transition from grandfathering to auctioning permits instead of distributing them freely is noted and it is to avoid these problems as well as ensure efficiency and transparency. ((Rose, 1990) (Grubb, 1990) (Larsen & Shah, 1994) (Böhringer & Lange, 2005) (Zetterberg, Wrake, Sterner, Fischer, & Burtraw, 2012) (Zhou & Wang, 2016))

The process of allocation belongs to the "cap" or cap-and-trade. As the allowances are distributed, companies receive or buy further emission allowances which they can trade as needed. The important point here is that the pre-determined overall cap, or limit of emissions, is to decrease every year and therefore ensure that total emissions will decline and each time, the price of the allowances will increase and therefore it will only get more and more expensive to emit greenhouse gases. There is no global limit and environmental regulations across the globe vary in regard to their strictness and therefore in regard to the level of “cap” enforced on the emissions. The allowances are the first component of the commodity pool.

2.3.3 Carbon Offsets:

Further tradeable emissions ‘equivalents’ are invented through special compensatory projects, usually in regions not covered by any cap, for additional corporate cost savings, and added to the commodity pool for enhanced liquidity as well as further efficiencies (Birch & Mykhnenko, 2010). They are created under the Kyoto Protocol to refer to emissions reductions that are not covered by the cap in an ETS. Offsets are based upon projects which are disassociated from the polluting source and either reduce GHG emissions elsewhere or increase the capacity of a sink (such as forests or soils) to absorb GHG pollution (such as carbon). Offsets are also traded outside of the Kyoto-compliance market, by individuals and firms voluntarily aiming to offset their GHG emissions. Any offset projects under Kyoto are considered under either the Clean Development Mechanism (CDM) or Joint Implementation (JI) and create credits which are named Certified Emission Reduction (CER) and Emission Reduction Unit (ERU) respectively. Kyoto offsets are referred to as ‘flexibility mechanisms’ and are intended to provide industrialized countries with further flexibility in order to meet their emission reduction while also supporting their developments.

Even though they are officially named as ‘emission reductions,’ offsets do not actually require the polluting source to reduce emissions themselves, but instead allow them to increase their own emissions while aiming to offset them elsewhere. The implementation of this strategy results in the formation of "sinks", which refer to natural or artificial substances capable of collecting and retaining carbon-containing chemicals for an indefinite period. As a result, these "sinks" effectively decrease the amount of carbon dioxide (CO2) present in the atmosphere.

The danger of allowing a global market of sources and sinks complicates the equivalences among them. As an example, the amount of carbon uptake in trees and soils is highly variable on the local environmental conditions, forester capacities, and enforcement regulations (Spash, 2010). It is not as simple as planting a tree in a location in order to increase production by a single item.

Offsets assume physical equivalence for diverse points in a GHG cycle where serious non-equivalence exists. 'A tonne of carbon in wood is not going to be "sequestered" from the atmosphere as safely, or as long, as a tonne of carbon in an unmined underground coal deposit' (Lohmann L., 2006). This points out the intricate nature of the carbon sequestration process which is actively going unnoticed. Different natural processes might translate into similar numbers on a paper under the scope of the perspective however the ecology is more complex than those numbers. Before the 2009 Copenhagen summit for determining new Kyoto targets, it was put forwards that natural disasters should be excluded as if a forest planted as offsets burnt down, they would be treated as still existing (Spash, 2010)[2] This would be an inaccurate representation of the situation and could be seen as not declaring the loss of an asset in a company balance sheet.

Carbon offsetting entails that instead of cutting emissions at source, companies, institutions, governments or even individuals can finance 'emission-saving projects' outside the capped limit. This practice is associated with Clean Development Mechanism with more than 1,800 projects registered. Offsets do not actually reduce emissions; they are investments into projects that potentially would counterbalance emissions one day. Since carbon offsets replace a requirement to verify emissions reductions in one location with a set of stories about what would have happened in an imagined future elsewhere, the net result tends to be an increase in greenhouse gas emissions (Gilbertson & Reyes, 2009). A forest that is created elsewhere than

[2] http://business.theage.com.au/business/australia-demands-bushfire-exemption-in-carbon-treaty20090613-c6h4.html

the company with the emissions being emitted does not take into consideration the air, noise, and waste pollution at the original place. Therefore, it is also not contributing directly to some of its own environmental impacts. Despite these worrisome notes, there is a very high possibility for Kyoto offsets to take over any ETS function as the number of CDM projects keep rising (Birch & Mykhnenko, 2010). Unfortunately, that would be on the grounds of cost efficiency instead of environmental protection.

2.3.4 The Carbon Price:

The price of carbon is composed of both the supply and demand of the carbon emission allowances and offsets, merged with the expectation by market participants of future price direction. In an ideal scenario, a uniform global carbon price based on the concept of "polluter pays" would be delivered by carbon trading. However, carbon inequality (see later in Chapter 3) as well as the lack of global coherence on the matter makes this difficult to achieve. The UK's Committee on Climate Change has suggested that a price of £30 per tonne of carbon dioxide equivalent in 2020, rising to £70 in 2030, would be consistent with achieving UK Government targets for emissions reductions (Bowen, 2014). Some scholars and economists argue that it would be more efficient to increase the prices more rapidly. The importance is that the carbon price is not supposed to be a one-time settled conversation, instead it should be increased frequently while taking into consideration the environmental and macroeconomic components. The increase in the carbon price per tonne will serve to deter companies and industries from continuing their practices (London School of Economics and Political Science, 2019). A carbon price for each tonne of carbon dioxide emissions is to be accompanied by a penalty that is for each additional tonne of carbon dioxide emissions beyond the entities previously given emittance. The importance here is that the contrast between the price of the emission allowance, and the price of the penalty should be strong, otherwise, the penalty system will not be effective. Carbon Pricing has been a controversial policy, especially accompanied by intense conflicts at the domestic levels of countries with higher emissions such as Australia, the United States, and Canada.

The common criticism against carbon prices is that they are simply not high enough to generate substantial emissions reductions, this observation is coherent with how low the prices are. It is not expensive to exceed the given number of emissions. Most nationally or regionally determined carbon prices are well below the most conservative estimates of the 'social cost of carbon' (SCC), which internalizes the environmental and health effects of greenhouse gas emissions. A recent study concluded the estimation of SCC which ranged between $80 and $300 ton−1. Another study estimates a global median price of $417, with a substantial national-level variation. A more conservative estimate puts the SCC between $50 and $100 by 2030. On the other hand, the reality is that the World Bank survey in 2017 of carbon pricing shows that half of the sixty-one carbon pricing policies around the globe have a price lower than $10.

(Harrison, 2012) (Mildenberger, 2020) (Pindyck, 2019) (Rick, Drouet, Caldeira, & Tavoni, 2018) (Carbon Pricing Leadership Coalition, 2017) (Green, 2021) (RBC Corporate Governance and Responsible Team, 2021)

2.3.5 The Trade:

Now that the commodity pool is created with the allowances of entities and the carbon offset projects, the trading part is the simplest to understand. Companies that exceed their allowances, and those that have surplus allowances, can trade these in the carbon market. In some regions, such as East Asia and North America, regulated entities may buy carbon offsets (or credits) to meet their obligations (RBC Corporate Governance and Responsible Team, 2021).

A large pool of 'equivalent' emissions reductions is created through regulatory means by abstracting from a place, technology, history, and gas, making a liquid market and various 'efficiencies' possible. These permits can be auctioned with the revenues going to a public reserve which would allow a reduction on discretionary taxes such as labor and savings or even better, targeting infrastructural change for greenhouse gas reduction (Birch & Mykhnenko, 2010). This provides us with a very straightforward free market where supply and demand meet each other, however, the concern for environmental protection is not as predominant as it should be.

Under the Kyoto Protocol, we have mentioned that there are three flexibility mechanisms: the Joint Implementation Mechanism (Article 6), the Clean Development Mechanism (Article 12), and Emissions Trading (Article 17). Any entity belonging to a country that is eligible to trade under the Kyoto Protocol can utilize its allowances and available offsets to reach its targets in its commitments to the Kyoto Protocol. If an entity were to be unhappy with the number of emissions allowances they have been given, either due to the knowledge that it will be exceeding them or with the desire to produce more than what they are allowed, can utilize carbon trading in the three mechanisms to achieve its goals. In contrast, a company with a certain emission allowance that is not intending to use all of their allowances, can sell their allowance to companies that need them and make a further profit out of it.

There are many examples where various trading alternatives can be troublesome, Australia has some prior experience in this area. The New South Wales (NSW) Greenhouse Gas Abatement Scheme (GGAS) commenced in January 2003 as a pioneering carbon ETS [3]. This involved no actual emissions measurements. The liable entities were retailers and some large industrial electricity users. For electricity generators, the scheme was a potential source of revenue as they could generate permits if their emission intensity was below the baseline. Using high average historical baselines meant even brown coal-fired power stations obtained permits. The majority of initial permits were emissions reductions attributed to existing or already commissioned electricity-generating plants (Passey, MacGill, & Outhred, 2008). Controversially, the scheme included permits for reducing electricity consumption. Commercial providers (or 'eco-entrepreneurs') claimed permits for 'residential projects' which consisted of handing out (mostly in shopping centers) free low-energy light bulbs and water-efficient showerheads. A

[3] See http://www.greenhousegas.nsw.gov.au.

subsequent audit found that fewer than half of these devices were actually installed, leading to a tightening of the regulations, but not before the commercial providers had been allocated millions of permits (Crossley, 2008). Permits created from demand-side abatement jumped from 1.5 million in 2005 (15 percent of the total) to 8.9 million in 2006 (45 percent) (IPART, 2008). Unsurprisingly, permit prices fell dramatically from AU$14 in mid-2006 to AU$6 in late 2007. During the scheme, projects offering genuine new emissions reductions, over 'business as usual', are likely to have been priced out of the market (Spash, 2010). The importance of proper initial permits being distributed and enforcing an accountability procedure is crucial if the actual aim is to achieve environmental protection. Otherwise, it will only be another market to make profits without any significant contribution.

Very simply put, once a climate benefit is identified with emissions reductions, emissions cut in one place becomes climatically equivalent to, and thus according to the market logic, exchangeable with a cut of the same magnitude elsewhere. This automatically assumes that an emission cut associated with one set of social, environmental, and economic effects is considered equivalent to a cut achieved at another location with its own set of social, environmental, and economic effects. This concept is often repeated with 'a carbon dioxide molecule released in Samarkand has the same climatic effect as one released in Sandusky.' (Birch & Mykhnenko, 2010).

In summary, the Cap-and-trade system entails governments or intergovernmental bodies such as the European Commission to distribute carbon permits to major industries. These industries can later trade these permits with another in order to meet their emission reduction goals. The theory would be that the availability of carbon permits would gradually be reduced, in order to ensure that the market retains its value and at the same time forces a reduction in the overall level of CO2 emission. The cap part is supposed to achieve the environmental goal by setting a legal limit.

2.4 Criticism Against Carbon Market

Pollution trading was developed first in the United States in the 1980s and 1990s in order to make reducing emissions cheaper and attractive to heavy polluters. The simple approach there was if Business A can reduce emissions in a cheaper manner than Business B, then Business B can pay Business A to make emission reductions for both of them. Putting a price on emitting greenhouse gases encourages trading and also the invention of new technologies that would replace fossil fuels. However, this approach is fallacious. If we look back to the US sulfur dioxide trading program of the 1990s which helped businesses save money in exchange for achieving the short-term and bare minimum reduction targets for a single substance was successful, however, the complexity and the severity of global warming require a radical solution. This cannot be achieved by a simple re-shuffling or a reorganization of the supply and demand relations, therefore the carbon market is not equipped to achieve this, as it inherently encourages industries addicted to coal, oil, and gas to carry on "business as usual". Why would any company make expensive and long-term structural changes if they can meet the targets through buying pollution rights from operations? On the other hand, it must be recognized that carbon trading schemes reward the heaviest polluters in the carbon pollution rights appointment stage. Heavily polluting industries are granted as many free pollution rights as they need to cover their current emissions. While renewable energy developers suffer from a lack of funds and ordinary citizens are subjected to higher electricity prices, companies earn millions in windfall profits even without changing their structural basis (Lohmann L., 2006). The underlying issue here is that the entire mechanisms are merely supplementing fossil fuel use, not replacing it.

The understanding that the Clean Development Mechanisms are promoting sustainable development is being questioned, primarily in terms of promoting renewable energies in developing countries in order to transition away from fossil fuels. However, even back in 2006, the evidence suggested that most industrialized country governments and corporations use

CDM simply to reduce the costs of complying with their Kyoto Protocol targets and consequently search for projects that deliver large volumes of cheap credits. These projects are commonly capturing or destroying gases that have high levels of risk for global warning such as methane, nitrous oxide, and hydrofluorocarbons that already exist. An OECD overview in 2004 summarised:

"a large and rapidly growing portion of the CDM project portfolio has few direct environmental, economic, or social effects other than GHG mitigation, and produces few outputs other than emissions credits. These project types involve an incremental investment to an already-existing system in order to reduce emissions of a waste stream of GHG (e.g., F-gases or CH4)[4] without increasing other outputs of the system"[5]

This report does confirm that the targets of the Clean Development Mechanisms have not been as successful in their prospects of reducing greenhouse gas emissions. Therefore, a more direct focus on reducing emissions instead of trading the is necessary in order to truly reach the targets established.

The World Bank's Prototype Carbon Fund (PCF) - the biggest fund developing CDM projects has eleven renewables' projects in its portfolio. Yet it only generated about 6.5 million credits by 2012, compared to 10 million from a single coal-bed methane project within the same time scope. Authors attribute these early failures of CDM not promoting renewables projects despite its claims to the fact that CDM is a market. It is not a development fund, not a carbon reduction project, not a renewables promotion mechanism. It only aimed to provide tradable emission reduction credits at the lowest cost in a limited timeframe, initially up to 2012. It is not aiming to direct funding projects with the greatest environmental and social benefit or that help direct a developing country down a sustainable path. The main complaint regarding the initiative is that it does not drive sustainable development, however, the real problem is that, in truth, it is

[4] Fluorinated greenhouse gases and Methane.

[5] Ellis, J., et al, "Taking stock of progress under the CDM", OECD, June 2004.

doing exactly what it is designed to do as a market-based mechanism: discover and direct funding to projects that will produce the maximum volume of carbon credits for every dollar invested. This demonstrates that while the CDM is presented as assistance to sustainable development, which should benefit renewable energy as well, no part of its architecture specifically monetizes those benefits. Even more dangerous is that the project-based structure fails to penalize any consequences that are to be considered negative. There is dominance of non-CO2 projects in the market in a project-based CDM creates inevitable consequences as they are made of inexpensive, quick, and common-practice additions to existing activities, on top of that, they generate huge volumes of carbon credits because of the global warming potential of the gases they capture. The carbon revenues from these projects can pay off the initial investment in less than a year. Such a short payback time will always be an attractive feature for investors. In complete contrast, renewable energy projects have the exact opposite financial profile. They are capital-intensive, provide low rates of return and generate relatively small volumes of carbon credits. These simple observations from the beginning of the CDM show that there is either a big flaw in its creation, or it is functioning exactly as how it is supposed to be while fooling the observers. (Pearson, 2007)

There must be better ways of tackling climate change than by privatizing the Earth's carbon-cycling capacity and making profits off of it. The approach of carbon trading treats the earth's capacity to regulate its climate as well as the whole purpose of safekeeping our earth as a market commodity. After being granted or auctioned off to private firms or other polluters, the commodity can then be allocated 'cost-effectively' via market mechanisms. In fact, this was never meant to be for sale. Although difficult to define or even locate, capacity forms part of the background 'infrastructure' for human survival. Framing it as a commodity, moreover, involves complex contradictions (Lohmann 2009). The assembling of carbon markets according to the current efforts is very likely to initiate systemic crises when pushed beyond a certain tipping point. The earth's climate-regulating capacity is thus a quintessential Polanyian ‘fictitious commodity’. Accordingly, illuminating comparisons and contrasts can be drawn with Polanyi’s original ‘fictitious commodities’ of land, labor, and money, as well as with other candidates for ‘fictitious commodity’ status that have been proposed since, including knowledge, health, genes and uncertainty (Birch & Mykhnenko, 2010).

The attempt of slowing down global warming and the various approaches are still being debated for decades and the scene is dominated by economists. Economists are by profession skeptical of voluntary restraint or the government’s capability to find cost-effective ways of regulating emissions. The initial instinct by economists to support mechanisms that curb emissions was by making them costly. A carbon tax could do that but however, the cap-and-trade schemes have taken over instead. When the government sets a cap on emissions, sells, or gives a certain number of allowances, and later monitors emissions to fine anyone who emits without the requisite allowances. If trading works, this system works in a cost-efficient way. The Kyoto Protocol's flexibility stems from sulfur dioxide trading, which originated in the US in 1995. The environmental and human health impacts of sulfur dioxide emissions had been acknowledged for decades, particularly from coal-fired power plants that release pollutants leading to 'acid rain' and other acidic deposits. Despite various bills presented in Congress in the 1980s to address the issue, opposition from the Reagan administration and Democrats representing states dependent on high-sulfur coal resulted in the bills' failure. Sulfur trading emerged as a solution that combined a clear environmental goal with a market mechanism appealing to Republicans. The process was complicated and influenced by lobbying, with companies ultimately receiving free rights allocation rather than being charged for the actual number of emissions they required. A "ratchet" was imposed, which aggregated over-allocation by imposing a uniform cut-in allowance. Once special interests were appeased with the 10 percent over-allocation, everyone's allocation was reduced by a tenth. The Environmental Protection Agency made the detailed calculations, imposing the ratchet months after the legislation was set in stone. The cut was achieved more cheaply than anticipated, with the actual cost being around $1 billion, much less than the industry lobbyists' claim of $10 billion a year. Prices averaged around $150 or less in the scheme's early years, much lower than the predicted $400 per ton (MacKenzie, 2007). The success of the flexibility of the sulfur trading brought the insistence of the United States to Kyoto regarding its flexibility mechanisms to meet their commitments. The new system allowed a nation-state signatory can pay another signatory for the reduction the latter has made beyond its commitments. The introduction of international trading to reduce carbon emissions caused concern in the developing world, as it was feared that developed countries would use this approach to shrink their responsibilities. This phenomenon became known as "carbon colonialism." In contrast, the European Union favored harmonized carbon taxes and government-led initiatives to promote low-carbon technologies. This preference, however, led to the United States' withdrawal from the Kyoto Protocol in 2001 during the Bush Administration. By 2001, the idea of carbon trading has come to be favored in Europe (MacKenzie, 2007).

Any market-based approach towards climate change is greeted with a similar criticism that prevails; the earth is not a measurable commodity. In the words of the UK Government's influential Stern Review on the Economics of Climate Change, climate change is 'the greatest market failure the world has ever seen [6]. The problem is, while commodity prices can achieve many things, they have never achieved a solution to a problem that requires structural changes in many fundamental areas of agricultural practices and industry. In the 1970s, despite high oil prices, industrial societies were not deterred from using oil, and it's doubtful that a carbon price could be any more effective in promoting a shift away from carbon-intensive practice. While proponents of carbon trading argue that a long-term infrastructural change can take place only if a stable price signal could be achieved. However, carbon prices are volatile. Mainly because the commodity traded as 'carbon' does not actually exist outside the numbers on trading screens or administration registries. It is not a single tradable unit that is necessary to create a market,

[6] Nicholas Stern et al., Stern Review on the Economics of Climate Change, HM Treasury, London, 2006, p. viii.

this leads to an unprofessional lump sum of activities that are completed at different places and times to be treated as though they hold the same values – such as industrial processes that capture coalmine methane being considered equal to generating hydro-electric power. This is why the price put on carbon is at best guesswork. Currently, traders may attempt to track carbon prices merely by looking at energy prices, calculating the difference between coal and gas prices, or speculating about future political decisions. That is an unlikely recipe for instituting the deep structural changes that the global warming problem demands (Gilbertson & Reyes, 2009) (Global Forest Coalition and Transnational Institute, 2007).

The carbon trading system entails that greenhouse gases are equivalent among them and thus treated as quantifiable 'things' that can be exchanged. An emission cut in one place is equivalent to, and thus exchangeable with, a cut or a compensatory measure elsewhere. Though this might seem uncontroversial at first glance, it is not difficult to notice how this is an amateur approach to a very complex situation. The World Bank states that 'greenhouse gases mix uniformly in the atmosphere, which makes it possible to reduce carbon emissions at any point in the atmosphere, which makes it possible to reduce carbon emissions at any point on Earth and have the same effect.'[7]. Climate change is a global problem and not dependent on a single location, regardless of if the cause is in a single location, the consequences will be felt all around the globe. However, by producing such equivalences we drift away from tackling climate change. In order to tackle the process of climate change, we must tackle the historical pathway that starts without dependence on fossil fuels as they are the major contributor to anthropogenic climate change. Once coal, oil, and gas are taken out from the ground and burned, they add to the process of carbon cycling between the atmosphere, oceans, soil, rock, and vegetation. This transfer is irreversible from the human perspective as well as unsustainable, as biologist Tim Flannery puts it: 'There is so much carbon buried in the world's coal seams [alone] that, should

[7] World Bank, Community Development Carbon Fund Annual Report 2004 World Bank, Washington, 2005, p.5.

it find its way back to the surface, it would make the planet hostile to life as we know it.'[8] (Global Forest Coalition and Transnational Institute, 2007). Most of the fossil fuels that have not been yet tapped, must stay in the ground. Thus, countries that are currently dependent on fossil fuels need to switch to dependency on, or rather 'lock in' to non-fossil energy in order to keep their economic growth rising without risking the environmental limits of the planet (Gilbertson & Reyes, 2009).

The Fourth Assessment Report of the IPCC has been criticized for its assumption that an international carbon market will be a 'foundation for future mitigation efforts'[9]. An organization that recognizes the urgency to reduce greenhouse gas emissions is either not capable of thinking outside the box of the economic systems that are contributing to it in the first place, or it is trying to mitigate a system that would not accept any structural changes in the first place. IPCC is giving industrialized societies a free cheque to use fossil fuels while creating new markets to ensure others can clean up their 'contributions.' This is a market, politicians and business leaders assure the public, in which you will be able to 'pay' the environmental costs of continuing to drill oil by screwing inefficient light bulbs, or for the costs of opening a new coal mine by burning the methane that seeps out of the same mine. As we have seen in this chapter, this is not the correct mitigation mentality we need to employ in order to tackle the consequences of climate change.

2.5 Carbon Taxing As The Alternative

Among the two options between a carbon tax or cap-and-trade, we have seen cap-and-trade system has prevailed even though there are enthusiastic advocates on both sides. Taxes have advantages such as the possibility of implementation by governments without international agreements, they have a strong impact (as in actual reductions) in addition to various beneficial effects when it comes to addressing externalities (Anandarajah, Kesicki, & Pye, 2010).

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[8] Tim Flannery, 'Monstrous Carbuncle', London Review of Books, vol. 27, no. 1, 6 January 2005.

[9] Intergovernmental Panel on Climate Change

Raising the price of carbon through taxation is mandatory to implement carbon policies that will have an impact throughout decision-making. Raising the market price of carbon provides strong incentives to reduce carbon emissions through four mechanisms:

- it provides signals to consumers about what goods and services produce high carbon emissions and should therefore be used more sparingly.
- it provides signals to producers about which inputs (such as electricity from coal) emit more carbon, and which inputs (such as electricity from wind) emit less or none. It thereby induces producers to move to low-carbon technologies.
- high carbon prices provide market signals and financial incentives to inventors and innovators to develop and introduce low-carbon products and processes, which can eventually replace the current generation of carbon-intensive technologies.
- most subtle of all, the use of carbon pricing economizes on the information requirements that market participants need to undertake each of these three tasks (Anandarajah, Kesicki, & Pye, 2010).

All components of the economic system as producers, consumers, and the market must be aware of the actual consequences that stem from the attempts to reduce carbon emissions. If a European customer is trying to save money from their monthly expenses and is presented at the supermarket with two fruits: a mango that is exported from Latin America and an apple produced locally, the prices should reflect the carbon emissions that have been emitted in the trading and transportation process of the said mango. This would directly translate to a higher tax on the product and thus a higher price. Any customer that is opting to reduce their monthly expenses will also opt for the apple that is produced locally and thus will have lower carbon emissions attached to its transportation. If the apple production facility at the local level is presented with two options to source their energy production, to generate light, operate machinery that collects or plants the produce, etc., one of which is fossil fuels with a higher government tax due to its environmental consequences, and solar energy that is presented with a lower cost – we would assume that the company will choose the option with lower taxes and overall lower cost in order to reduce its costs and increase their profits. If both the producers and consumers are signalling to the market that they are preferring products and energy sources with lower carbon impacts because they are taxed less (and also environmentally friendly but let's assume that we are only interested in the money aspect), the market will start to shift the financial focus on products that are under a lower carbon tax and enhance their investments. This would entail a new level of transparency and have a blow on our current world system that functions by lowering production costs by any means in order to increase supply. Many industries would no longer be able to profit as much, as their customers no longer would be able to, or willing to afford such prices that contribute directly to global warming. Yet another aspect of carbon taxing that must be considered is the commonly agreed notion that developing countries need to be emitting in order to arrive at the economic balance of developed countries (otherwise their participation would require heavy financial incentives so that any action does not compromise their economic growth), meanwhile, developed countries cannot reduce carbon emissions enough to stabilize greenhouse gas concentration to a level where the risk of global temperature exceeding 2C is minimized. Kyoto Protocol has been deemed both inefficient and that it should be replaced by a tax approach (Nordhaus, 2009), on the other hand, the nature of quotas and trading are inherent to our international efficiency and collaboration (Stern, 2008). The true purpose of a carbon tax is to reflect the true cost of burning carbon and its consequences on our livelihoods. Therefore, ensuring that both companies and consumers pay for the external cost that stems from any production that takes place, is also called a Pigouvian tax[10]. The lack of a carbon tax is being blamed for global warming and as businesses and consumers are not accurately charged for their fossil fuel consumption, it is referred to as a" fundamental market failure" by the Federal Bank Reserve of San Francisco (Federal Reserve Bank of San Francisco., 2019)

[10] A Pigouvian tax is a government cost on any activity that creates socially harmful externalities.

The first problem with the implementation of a carbon tax is that the external cost of each ton of greenhouse gas emission is not determined, thus there is no fixed price of a unit of carbon emissions. A carbon tax could help us build a cleaner, more efficient economy. But moving from the whiteboard to reality is the challenge (Marron, Toder, & Austin, 2015). There is a clear difference between cap-and-trade and carbon tax, which is the strike between certainty and uncertainty [11]. In the case of the carbon tax, the price of carbon emissions is set, and the level of emissions depends on the possible future economic conditions. Under the cap-and-trade, the emissions level from past activities and the price of carbon are determined by the market, which is the opposite. This venture however comes with four challenges:

1. the difficulty of monitoring emissions: policymakers could require emitters to install monitoring equipment and tax based on actual emissions however in practice this would be expensive.
2. the multiple ways carbon emissions are created: taxing carbon emissions from fuels include only emissions from combustions while leaving aside processes such as cement manufacturing or certain chemicals. Taxing other emissions would be straightforward however many already report their emissions through the Environmental Protection Agency's (EPA) Greenhouse Gas Reporting Program.
3. the greenhouse gases other than carbon dioxide: Carbon dioxide is the most prevalent greenhouse gas; however, it is not the only one. Taxes should also apply to methane, nitrous oxide, hydrofluorocarbons, and other greenhouse gases. Incorporating these sources would require a broader industrial overview such as the inclusion of natural gas systems, cattle, landfills, and agriculture, and therefore increase the administrative burden. Policymakers have to address the fact that greenhouse gases differ in their chemical and atmospheric properties. Methane, for example, traps more heat, gram-for-

[11] Taxes and cap-and-trade approaches can also differ politically. A cap-and-trade system would create a valuable new asset, tradable emission rights, that legislators could allocate to build support for the system (or for less salutary reasons). In principle, the same is true of revenue from a tax, but in practice, the public may find the allocation of emission rights less salient than a redistribution of tax revenue (Marron, Toder, & Austin, 2015).

gram, than carbon dioxide does, but it has a shorter atmospheric lifetime. A cost-effective tax should reflect such differences, raising the tax rate for gases that are more potent and lowering it for gases that stay in the atmosphere for less time. Such a system already exists and gives us the information that methane is twenty-one times more potent than carbon dioxide over a century. By those measures, a $10 per ton tax on carbon dioxide would imply a $210 per ton tax on methane and a $3,100 per ton tax on nitrous oxide.

4. the need to give credit for efforts to capture carbon emissions or remove them from the atmosphere: a truly efficient system should give appropriate credit reimbursement for actions that avoid previously taxed carbon emissions. For example, a power plant that employs carbon capture and storage should receive a tax rebate for any carbon that does not get emitted (Marron & Toder, 2014).

There is a general agreement that market-based instruments of carbon control will achieve reductions at a lower cost in comparison to governmental regulations. However, among these market instruments, only carbon taxing has the capacity to raise revenue and recycle it through the economy by reducing pre-existing taxes., thus it should be preferred over the cap-and-trade system. Regardless of this understanding, carbon taxes have only been introduced in a few countries and at low levels (Ekins & Barker, 2001). We could argue that the implementation of carbon taxes would actually enforce the change that is being stated on paper. If for each ton of emission an enterprise emits, they need to pay a certain amount of taxes and if the tax is heavier on fossil fuels or other methods that are carbon intensive, the market logic will follow through with a decrease in the implementation of such methods in order to preserve their profits. This also does not allow the trade of emission rights, which only shifts emissions instead of providing an actual incentive to reduce emissions.

Chapter 3: Carbon Trading in Developing Countries

Scientists argue that economic growth is damaging to the environment of the processes of industrialization in countries and also partly as developing countries seek to raise their income levels, increasingly places more stress on the environment. The literature investigates whether or not an environmental Kuznets curve exists (representing an inverted-U-shaped relationship between GDPs per capita and various measures of environmental degradation). The majority conclusion points towards the existence of such a curve (Koop, 1998) though we must acknowledge that certain studies deny the existence of an environmental Kuznets curve which entails that regarding a country's GDP growth and the measure of environmental degradation, initially as the GDP grows, the environmental degradation also grows, however after peaking at a certain level of 'development', due to the new technologies and mitigation capacities of the country, even though the GDP continues to increase, the environmental degradation becomes uncoupled from this relationship and starts to decline.

We can safely assume that any country in the process of transition from a 'developing country' to a 'developed' one, must increase their GDP per capita which is linked with the industrialization in countries, and thus contribute to the indirect relationship of increased global GDP and decreased environmental quality. Due to the consequences of anthropogenic climate change presenting itself, however, the global stance no longer supports the industrial growth in countries and instead proposes investments in new and thus expensive technologies that do not have the same intensity of negative consequences on the climate. The double bind presents itself here as the quarrel to find the balance between allowing developing countries to pursue higher standards of living, as it is the right for each while ensuring the anthropogenic climate change is mitigated. This is a very tricky balance that countries that we have named as Carbon Legacy Economies never had to take into consideration.

3.1 Carbon emissions around the world

We have been observing substantial changes in population size, age structure, urbanization, economic ventures, and political instability all over the world. For example, during the 2020 COVID-19 Pandemic with the influence of global lockdowns, the CO2 emissions witnessed a temporary reduction. The Carbon Monitor program — which provides near-real-time daily global CO2 emissions from power generation (29 countries), industry (73 countries), road transportation (406 cities), aviation and maritime transportation, and commercial and residential sectors (206 countries) — offers an opportunity to track the evolution of these CO2 emissions, and in doing so, assess remaining carbon budgets and progress in reaching the Paris Agreement (Nature Reviews Earth & Environment, 2022)(Liu, Deng, Davis, Giron, & Ciais, 2022).

As a process of rebound after the pandemic, global annual emissions increased from 33.3 GtCO2 in 2020 (with a range of 33.0–33.6 GtCO2, including the leap day of February 29, 2020) to 34.9 GtCO2 (with a range of 34.6–35.2 GtCO2) in 2021, representing a 4.8% increase (3.8–5.7% range). Despite the pandemic continuing to have a strong grasp on our lives even in 2021 and 2022, the impact of the pandemic on emissions appears to have decreased due to the reduction in restrictive policies. When we observe the bounce back, it is predominant in most sectors and especially among big-emitting nations.

Table 2: Rebound emissions by sector in the years of 2020-2021 after COVID-19 Pandemic. Source: (Liu, Deng, Davis, Giron, & Ciais, 2022)

Sector	Percentage of Rebound in Emissions from 2020-2021	Emissions
Power	5,0%	657 MtCO2
Industry	2,6%	256 MtCO2
Ground Transport	8.9%	513 MtCO2
Domestic Aviation	25.8%	65 MtCO2
International Aviation	18,1%	50 MtCO2

The emissions data from power, industry, and ground transport in 2021, as highlighted in a study published in Nature Reviews Earth & Environment in 2022, reveals a concerning trend of rebounding greenhouse gas emissions. These sectors, which are known to be major contributors to global emissions, experienced notable increases compared to the levels recorded in 2020. Specifically, the emissions from power generation witnessed a significant rise of 5.0%, equivalent to 657 MtCO2. This increase indicates a rebound in energy-related emissions, potentially reflecting a rebound in economic activity and energy demand. Similarly, emissions from the industrial sector rose by 2.6%, accounting for an additional 256 MtCO2. This suggests that industrial activities, such as manufacturing and production processes, have resumed or intensified, contributing to the overall emissions rebound. One of the most alarming findings is the substantial increase in emissions from ground transport, which surged by 8.9% and added 513 MtCO2. This sharp rise in emissions highlights the growing reliance on transportation, particularly automobiles and trucks, and the challenges associated with decarbonizing this sector. The surge in ground transport emissions is indicative of increased travel and mobility patterns, potentially driven by factors such as economic recovery or changing societal behaviors. Collectively, these three sectors - power, industry, and ground transport - accounted for a significant portion of the total global emissions rebound, contributing 89% or 1.4 GtCO2.

This highlights their central role in shaping global emissions trends and the urgent need to address their environmental impact. However, the study also sheds light on other sectors that experienced even more pronounced rebounds. The domestic and international aviation sectors, for instance, witnessed the largest increases in emissions, with a staggering rise of 25.8% (65 MtCO2) and 18.1% (50 MtCO2), respectively. These figures underscore the challenges faced in decarbonizing the aviation industry and highlight the need for sustainable alternatives and technologies to mitigate the sector's impact on climate change. Overall, the data presented in the study provides a sobering reminder of the challenges in achieving global emission reduction goals. Efforts to tackle climate change must prioritize the power, industry, ground transport, and aviation sectors, implementing sustainable practices, technological advancements, and robust policies to curtail their emissions and transition to a greener, low-carbon future. (Nature Reviews Earth & Environment, 2022).

Table 3: Table 2: Rebound emissions by country in the years of 2020-2021 after COVID-19 Pandemic. Source: (Liu, Deng, Davis, Giron, & Ciais, 2022)

Countries	Percentage of Rebound in Emissions from 2020-2021	Emissions
China	5,7%	597 MtCO2
The United States	6.5%	296 MtCO2
27 EU Countries + the United Kingdom	6.7%	193 MtCO2
India	9.4%	212 MtCO2
Russia	6%	91 MtCO2
Japan	-0.3%	-3 MtCO2

The emissions data at the country level provides interesting insights into the rebound trends and varied performance across different nations. Among the major emitters, several countries experienced rebounds in their greenhouse gas emissions, while others deviated from this pattern. China, as the world's largest emitter, recorded a rebound of 5.7%, equivalent to 597 MtCO2. This increase highlights the challenges faced by China in balancing economic growth with environmental sustainability, as its industrial and energy sectors continue to expand. The United States, the second-largest emitter, also saw a significant rebound of 6.5%, accounting for an additional 296 MtCO2. This rise suggests a resurgence in economic activity and energy consumption, emphasizing the need for robust climate policies and renewable energy transition in the country. India, Russia, the United Kingdom, and the 27 European countries collectively demonstrated rebounds ranging from 6.7% to 9.4%, indicating a common trend of increased emissions. These numbers underscore the need for continued efforts in these regions to prioritize decarbonization and transition to cleaner energy sources. It is worth noting that Japan deviated from the rebound pattern, disappointing the expectations of a rise in emissions. Instead, Japan managed to reduce its emissions by 4.7% (51 MtCO2) from 2019 levels in 2020, followed by an additional 5% reduction (54 MtCO2) in 2021. This indicates a commendable effort by Japan to implement effective emission reduction strategies and highlights its commitment to combating climate change. The disparities in emission trends among countries underscore the complexities and unique challenges each nation faces in transitioning to a low-carbon economy. It is crucial for countries worldwide to collaborate, share best practices, and learn from each other's successes and setbacks to accelerate global emission reductions. The data presented serves as a reminder that achieving substantial emission reductions on a global scale requires concerted efforts and ambitious actions from all countries. It is essential for nations to strengthen their commitments under international agreements like the Paris Agreement and implement comprehensive policies that promote sustainable development, renewable energy, energy efficiency, and innovation. By learning from countries that have successfully reduced emissions and addressing the specific challenges faced by countries experiencing rebounds, the international community can work together to create a sustainable future and mitigate the impacts of climate change.

Since the 1970s, global events took place every decade with a negative growth in global CO2 emissions: the energy (oil) crises of 1974, 1980–1982, and 1992, and the financial crisis of 2008. In all cases, emissions rebounded substantially after the event. This pattern of history repeating itself reduces confidence in global climate mitigation efforts (Liu, Deng, Davis, Giron, & Ciais, 2022). The decrease in greenhouse gas emissions in 2020 was largely due to the pandemic-related halt of economic activity, rather than the implementation of the Kyoto Protocol commitments.

To achieve the goals of the Paris Agreement, the IPCC (2021) has set a global carbon budget of 1.5°C and 2°C warming at 400 GtCO2 and 1,150 GtCO2 with 67% likelihood, respectively, or 300 GtCO2 and 900 GtCO2 with 83% likelihood. Despite the substantial reductions in 2020, emissions still consumed 8.3 ± 0.07% of the remaining 1.5°C budget, or 2.9 ± 0.02% of the remaining 2°C budget with 67% likelihood. In the following year, the budget use increased further. Based on projected emission rates, it is possible to estimate when the limits of the Paris Agreement will be exceeded. For example, to stay within only 1.5°C warming, the remaining CO2 budget might be used up within 9.5 ± 0.1 years (in 2031) with 67% likelihood, or 6.6 ± 0.1 years (in 2028) with 83% likelihood. For 2°C warming, budgets could be used up within 31.0 ± 0.3 years (in 2052) (Nature Reviews Earth & Environment, 2022).These calculations demonstrate the likelihood that we do not have as much time as we expected if there is not an immediate application of strict action toward achieving carbon neutrality.

The United States, the European Union, and the United Kingdom plan to reach net zero carbon emissions by 2050, while China and Russia have the target year 2060, and India by 2070. We must keep in mind that such a target requires intense decreases in emissions while maintaining their current GDP. Even if the nations would achieve their minimum annual emission reduction targets, these nations alone would emit over four hundred GtCO2 cumulatively from 2020 to 2045, using up all of the remaining 1.5 °C budgets (67% likelihood) by 2045. Once again, we are faced with the importance of a global commitment and action plan and its dilemma with forcing the maintenance of unequal living standards among the countries. If India were to commit to the same year of 2050 as the United States, the European Union, and the United Kingdom – the differences in life quality among the countries would be drastic even though they were both to achieve net zero carbon emissions. Is that fair to the citizens of India?

Another country example is Türkiye, an important economy connecting Europe and Asia and the twentieth-largest emitter of greenhouse gases in the world. But it occupies an unusual position in the United Nations climate negotiations: Despite being a low-and middle-income country with historical emissions, Turkey is a member of the group that makes up the OECD, the Organisation for Economic Co-operation and Development, which is made up of developed countries. Türkiye presents a high vulnerability to the impacts of climate change and other environmental hazards due to its geographic, climatic, and socioeconomic conditions. Türkiye is one of the fastest-growing emerging economies and is suitable to analyze empirical determinants of environmental degradation due to increases in greenhouse gas emissions that result from economic growth, energy consumption, trade openness, and financial development. The country has been criticized for not adequately tackling climate change, as it has not implemented its national strategy in with the EU 2030 Climate and Energy Framework, the report states:

"[Türkiye's] national climate change strategy and action plan contradict other strategies, such as its energy strategy. A climate change adaptation strategy needs to be adopted and put into practice. Efforts to increase the know-how to combat climate change in government institutions and to mainstream climate change in different sectoral policies are still at a weak level."

This is a clear example of how a country can attend a series of international proceedings, participate, and negotiate, even sign the agreement to ratify it – yet might still not take real steps to enact and enforce the said agreement. This can simply be an intention to pretend and receive praise in the international arena without any consequences. International agreements must have stricter and stronger accountability measures to ensure no dishonesty or fraud is committed.

It is easy to observe that Türkiye's economy has tripled in the last two decades, and the government hopes to continue this economic growth. The focus on energy growth over the past fifteen years also means that the emissions have increased and plan to increase to support the country's economy. Under the Kyoto Protocol, Türkiye has had the greatest increase rate in carbon emissions among forty-two countries for the observation period of 1990-2010 (UNFCCC, 2012). This suggests that for Türkiye to achieve its 2053 net zero emissions target, major changes in many economic sectors are required. This transformation would require deep decarbonization of the power sector, energy efficiency, electrification in transport, and other emissions reduction efforts. Politically, the country signed the Kyoto Protocol in 2008, however, remains the only party that has not committed to emission reductions. Türkiye has also signed the Paris Agreement but has not formally ratified it, alongside Russia, it is the only G20 country that has not yet ratified it. (We must note, of the 195 signatories of the Paris Agreement, only twenty-two have yet ratified the Paris Agreement). The political statement is not coherent with the prominent economic actions taken in the country. The Climate Action Tracker (CAT) assesses Turkey's Paris commitment as "critically inadequate", which means that it is not at all compatible with the Paris Agreement's goal of keeping warming well below 1°C, let alone 5.2°C. CAT's rating means that in a scenario where all country targets are similar to Turkey's, warming will rise above 4°C (Timperley, 2018).

This demonstrates that the target established by the Paris Agreement is not attainable with business-as-usual, and barely possible with drastic and immediate measures to achieve carbon neutrality with all countries. (World Bank Group, 2022).

3.2 Carbon Inequality

As we examine global emissions rates, the disparities among countries' carbon emissions prompt an investigation into the underlying causes of this inequality. The interconnectedness of climate change and inequality becomes evident when considering both the contributors to climate change and the individuals who bear its consequences. The Paris Agreement, which addresses climate change mitigation and poverty reduction, highlights the need for aggressive decarbonization in wealthier nations. However, this approach may limit the aspirations and goals of poorer countries, as economic growth is closely tied to greenhouse gas emissions. This discourse aims to explore the carbon inequality between Carbon Legacy Economies (CLE) and Carbon Emergent Economies (CEE) and the associated implications. (Steckel, Brecha, Jakob, Strefler, & Luderer, 2013).

For the sake of generalization, the causes and effects of climate change represent an equity problem involving two global stakeholder groups: Carbon Legacy Economies (CLE) and Carbon Emergent Economies (CEE) (Smith, 2010). Carbon Legacy Economies are countries responsible for the majority of greenhouse gas stocks, which will continue to represent a significant share of the future greenhouse gas flows and are referred to as ‘developed countries. Carbon Emergent Economies are those countries that will be responsible for the majority of growth in greenhouse gas flows and will possess an increasing share of future atmospheric greenhouse gas stocks, also referred to as ‘developing countries. A useful device to visualize CLE-CEE carbon inequality is the Lorenz curve, a cumulative frequency distribution used in economics to illustrate income distribution and other equity variables. In the present context, “CO2 emissions” or carbon Lorenz curves show the distribution of energy-related CO2 stocks and flows among countries on an implied per capita basis, with the cumulative percent of energy-related CO2 emissions on the y-axis and the cumulative percent of the population on the x-axis, ranked by per capita income (Smith, 2010)(Kahrl, 2007).

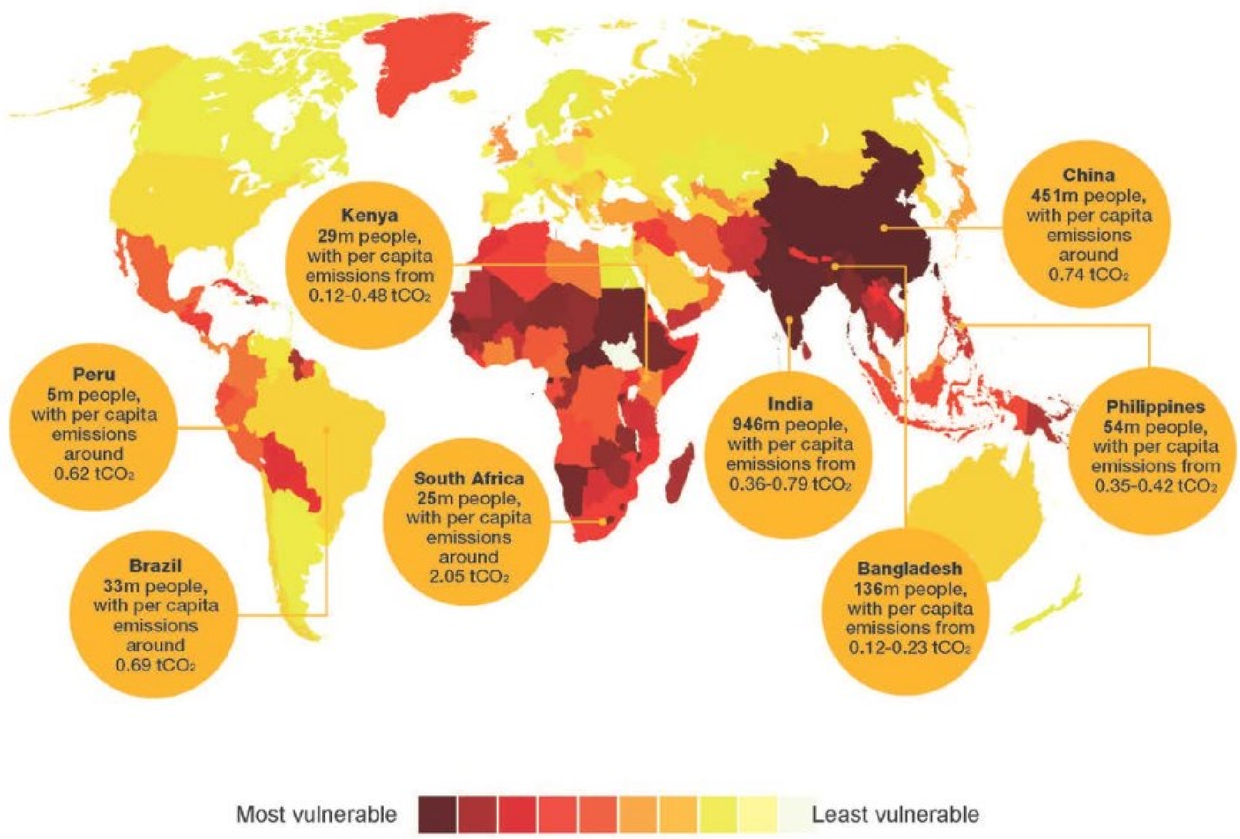
According to the World Bank's Global Consumption Database, in developing countries, households were categorized into four different consumption partitions: lowest, low, middle, and higher. The lowest expenditure partition with a daily expenditure below $2.97 PPP per capita forms the bottom half of the global distribution, as in the 50th percentile and below; the low-consumption partition with a daily expenditure between $2.97 PPP and $8.44 PPP per capita a day corresponds to the 51st -75th percentile; the middle-consumption partition with a consumption between $8.44 and $23.03 PPP per capita a day belongs to the 76th – 90th percentiles; and the higher consumption segment with consumption above $23.03 PPP per capita a day belongs to the 91st percentile and above. PPP is purchasing power parity and tells us how many dollars are needed to buy one dollar's worth of goods in a country as compared to the United States. Upon further observation, World Bank's Global Consumption database shows that half of the global population lives on less than $2.97(PPP) a day. The top 10% spend more than $23 (PPP) per day. The PPP here is associated with their lifestyles and expenditure patterns which translated into per capita footprints of each stratum of the population. The top 10% of the emitters cause more than one-third of global greenhouse gas emissions, whereas in comparison the bottom 50% are responsible only for 15% of the global emissions. This hints at the carbon inequality on an individual level for each population which can be expected to replicate itself when the same concepts are observed at the industrial level in each country (Steckel, Brecha, Jakob, Strefler, & Luderer, 2013).

These differences we observe between global expenditure groups are potentially starker within countries in terms of expenditure patterns and associated carbon footprints. For example, Democratic Republic of Congo with 99% of the population, in Madagascar and Burundi 98%, Tanzania 95%, Mozambique 94%, Niger 93 and in Nigeria 90%, were situated in the lowest expenditure category in 2010 which hints the stark differences among countries and their carbon emissions (Steckel, Brecha, Jakob, Strefler, & Luderer, 2013).

The negotiations for reducing emissions among developed and developing countries have always been troublesome. While developed countries have claimed that they will not be going beyond their incremental targets to cut their emissions unless rapidly growing developing countries with increased emissions start to cut their emissions as well (Stavins, 2012), developing countries have protested that they must limit their growths to make up for the dangerous situation developed countries have created by their growth in the first place. To avert the impacts of climate change all developing countries must play their part, however, it is illogical to treat all countries as they are a single unit.

A further dividing line in climate negotiations is the contrast between past emissions and future emissions. Although developed economies, also known as Carbon Legacy Economies, have historically been responsible for the majority of greenhouse gas emissions, many of these countries, including the EU, are now taking steps to reduce their emissions.On the other hand,

Figure 1: Examples of where in the world people in the poorest half of global population live, and the scale of their lifestyle consumption emissions footprints. Source: Oxfam; Centre for Global Development Climate Change Vulnerability Index



the emissions of most developing or Carbon Emergent Economies remain on an upward trajectory, and they will not reach peak emissions for their respective countries for at least another decade (Ülgen, 2021). If we refer back to the Environmental Kuznets Curve, this would indicate that if there is any hope of developing countries reaching a similar level of GDP as developed countries, they will keep increasing their emissions for another decade – afterward if their technological advancements and infrastructural capabilities are sufficient to transform to renewable energy sources, their carbon emissions might start to decline. However, the already present emissions of greenhouse gases in the atmosphere have proven that there is no availability for another decade of increased emissions.

Carbon inequality has significant consequences for developing countries, affecting their socio-economic development, environmental sustainability, and vulnerability to climate change. Developing countries with high carbon emissions face increased climate vulnerability, experiencing more frequent and severe natural disasters, reduced crop yields, water scarcity, and health risks. The reliance on fossil fuels and carbon-intensive industries hinders their transition to cleaner and more sustainable development pathways, resulting in limited access to international markets and reduced foreign investment. Carbon inequality reinforces socio-economic disparities within developing countries, burdening marginalized communities with the impacts of environmental degradation and climate change. This perpetuates cycles of poverty, inequality, and social unrest. Additionally, carbon inequality poses challenges to achieving sustainable development goals, hindering efforts to address poverty, improve living standards, ensure food security, and protect natural resources. Addressing carbon inequality requires global cooperation, financial and technological assistance, capacity building, and an inclusive framework that recognizes different historical responsibilities and capabilities. By addressing carbon inequality, developing countries can pursue sustainable development while mitigating climate change and reducing vulnerability to its adverse effects. (IPCC, 2014)

(United Nations Development Programme, 2017) (World Bank, 2018) (United Nations Framework Convention on Climate Change, 2015)

The playing field of the carbon market is trenched with inequalities ranging from national to international levels. It is uneven, and requires an unavoidable trade-off for developing countries to contribute to the Paris Agreement: do they sacrifice the pursuit of higher living standards or do they sacrifice the pursuit to contribute to our planet's habitable status?

In conclusion, the investigation of carbon emissions rates across different countries highlights the inherent link between climate change and inequality, encompassing both contributors to climate change and those affected by its consequences. The Paris Agreement aims to address climate mitigation and poverty reduction, but achieving its targets requires aggressive decarbonization in wealthy nations, potentially limiting the aspirations of poorer countries. Carbon inequality is observed between Carbon Legacy Economies (CLE) and Carbon Emergent Economies (CEE), with developed countries responsible for historical emissions and developing countries driving future emission growth. The distribution of emissions within countries further accentuates these disparities, with stark differences in expenditure patterns and associated carbon footprints. Negotiations between developed and developing countries encounter challenges as they navigate the division between past and future emissions. The carbon market itself is plagued with inequalities at various levels, posing a trade-off for developing countries between pursuing higher living standards and contributing to a habitable planet. Urgent and equitable actions are necessary to address these inequalities and ensure a sustainable future for all.

Remedying carbon inequality requires a comprehensive and multi-faceted approach that addresses the root causes and promotes fairness and sustainability. It involves setting fair and ambitious climate targets that consider historical emissions, current capabilities, and development needs of countries. Developed nations should lead the way in emission reductions while supporting developing countries for their sustainable development. Facilitating technology transfer and capacity building is crucial, enabling developing countries to adopt cleaner and more sustainable technologies. Adequate and predictable financial support is needed to assist developing countries in their climate actions, including fulfilling commitments to provide climate finance and encouraging private sector investments in clean technologies. International cooperation, knowledge sharing, and collaboration are important for promoting best practices and innovation across countries. Additionally, addressing poverty and inequality within countries is essential, as they are closely linked to carbon inequality. Education and awareness efforts can empower communities to actively participate in decision-making and advocate for equitable and sustainable policies. Strengthening international institutions and governance mechanisms is necessary to ensure transparency, accountability, and fairness in climate negotiations and implementation. By implementing these strategies, we can promote a more equitable and sustainable transition to a low-carbon future, where the burdens and benefits of climate action are shared fairly among nations and communities. (IPCC, 2014) (World Bank, 2018) (United Nations Development Programme, 2017) (United Nations Framework Convention on Climate Change, 2015).

3.3 Carbon Colonialism

The notion of colonialism is being increasingly used to imply a variety of acts of domination and control associated with the injustices produced by climate change (Mahony & Endfield, 2018) (Sultana, 2022). Though it does not imply direct violence and appropriation of humans, it implies an appropriation of land and opportunities. Colonialism is invoked as a metaphor for expansionism to refer to occupying atmospheric space, seizing resources such as land and minerals as well as owing ecological debts to the developing countries and the entire planet (Bhambra & Newell, 2022).

The key question revolves around whether the concept of "carbon offsetting" is desirable. The various approaches of the Clean Development Mechanisms and Joint Implementation

Mechanisms of the Kyoto Protocol rest on the concept that emissions from a polluting source can be “nullified” through investments in renewables or other activities also defined as “carbon sinks”. Even though these compensation mechanisms should be complex in design, they are being approached quite simplistically and promoted enthusiastically by the offset industry developed to serve the new market. We can easily observe the offset culture in the private sector through companies that brand their products as Carbon Neutral Living or the gathering of World Economic Forum promoting their events as Carbon Neutral with the aid of the new self-styled “offset” businesses. This is visibly a quick-fix solution for corporations that do not require radical changes to their business practices (Bachram, 2004). There is no scientific evidence that the emissions in a specific location are balanced out by offset projects in a different location. The promotion of such an approach that is not scientifically verified can lead to undesired and dangerous consequences at a future date.

On the other hand, offset culture has attracted private investments that have become a ‘new salvation’ for developing countries. This is particularly visible in the African continent, where sectors of agriculture, timber, biofuels, oil, and mining are attracting private investment activities through the promises of strong economic returns (McMichael, 2013) (Carmody, 2013). These private activities are now synonymous with green development; investment activities that claim to have environmental benefits or sustainable development, including carbon offset and other mitigation initiatives (Lyons & Westboy, 2014). One of the biggest practices of carbon offsetting is forests and plantations forestry, with foreign investors now being dominant in African forestry in particular, further supported by the government (Germanwatch., 2014). The reason for the new market of forest planting is that three-quarters of all the carbon dioxide emissions emitted by human activities are from burning fossil fuels and the rest is mostly attributed to deforestation.

The solutions put forward by the Carbon Legacy Economies lend themselves to the entrenchment of patterns of socially and ecologically uneven exchange rather than resolving these in a globally just manner. Carbon reductions in developed countries, for example, are achieved by outsourcing more carbon-intensive processes to the South through the use of spatial (displacing responsibility) and temporal (pushing responsibility into the future) fixes (Newell, 2021). The neoliberal logic presents itself in the combination of scientific rationality (even though the scientific basis of carbon sinks is not elaborately presented and the concept of emissions being equal all around the world, thus they can be offset anywhere in the world requires further research).

The World Bank is actively providing funding in Brazil that is being managed by an existing plantation company called Plantar, to be a Clean Development Mechanism Project. The Norwegian company Tree Frams (1996) enacted one afforestation project in Uganda, additionally, the Norwegian Afforestation Group managed the local authorities' agreement on a project in November 1999. The former -which operates in the Bukaleba Reserve area under its subsidiary's name Busoga Forestry Company Ltd.- has already started a project to set up between 80,000 and 100,000 hectares of plantations of pines and eucalyptus. The Tree Farms project has evited 8,000 people from 13 villages from their lands, which are mainly farmers and fisherfolk. The company is now occupying its lands to grant carbon offsets or emission trading to Norway, meanwhile condemning the evicted locals to poverty due to the loss of their livelihoods and creating local as well as environmental conflicts. Additionally, after the end of the 50-year lease, even when Norway is no longer paying for the land, Uganda cannot repurpose that territory as the so-called carbon-storing plantations have to remain as such to maintain the carbon capture. This deprives the country's authorities of the choice of using the areas for other purposes in the foreseeable future. Furthermore, Uganda is not allowed to use these carbon sinks for its carbon accounts because the credits will already have been sold to Carbon Legacy Economies and their companies. (World Rainforest Movement, 2012) It is unclear whether this project will survive the social conflicts and problems with profitability. A recent EU-financed study, covering among others the mentioned Tree Farms project, concluded that there would be a "loss-loss" situation both for forestry and the local people". NorWatch has got the view that the Tree Farms project is a "loss-loss-loss" situation: forestry is ailing, local people are suffering, and Uganda is being "CO2lonized" (Eraker, 2000) (The Republic of Uganda, 1998) (WRM Bulletin 35, 2000) (World Rainforest Movement, 2012) Even if we were to accept a world-wide forestation project, the planet Earth does not have enough free land to soak up corporate greenhouse gas emissions. Oxfam reports that meeting the carbon removal targets set by companies could require a land area up to five times the size of India (Oxfam, 2021). That is not a solution to reduce fossil-fuel dependency in the long term.

Carbon colonialism profoundly impacts developing countries in various ways. Firstly, it perpetuates historical patterns of exploitation and resource extraction, where developed countries historically emitted vast amounts of greenhouse gases during their industrialization process. Developing countries often bear the brunt of the consequences of climate change, despite contributing relatively little to global emissions. This inequality heightens existing socioeconomic disparities and hinders the efforts of these countries to achieve sustainable development (Pulido, 2016). Secondly, carbon colonialism reinforces power imbalances in global decision-making processes related to climate change. Developed countries, with their greater financial and political influence, often dictate the terms of international climate agreements, disadvantaging developing nations. This unequal representation undermines the voices and interests of those most affected by climate change and limits their ability to shape policies and strategies that address their specific needs (Rajamani, 2016). Furthermore, carbon colonialism affects developing countries' access to clean and sustainable technologies. Developed nations often retain control over advanced technologies, making them less accessible and affordable for developing countries. This technological disparity perpetuates a dependence on fossil fuels, hindering the transition to low-carbon economies. It limits the capacity of developing nations to mitigate and adapt to climate change, while increasing their vulnerability to its negative impacts (Gupta, Carbon colonialism and the governance of ecosystem services in the Himalayas, 2017). Moreover, carbon colonialism hampers the development of renewable energy industries in developing countries. Developed nations tend to dominate the production and distribution of renewable technologies, creating a dependency on imports. This dependence on external sources stifles local entrepreneurship, job creation, and economic growth potential in developing countries, preventing them from harnessing their own renewable energy resources (Bhattacharyya, 2013).

Mitigating carbon colonialism necessitates a comprehensive approach that tackles the underlying power dynamics and promotes equitable actions to address climate change. One strategy is to empower and involve marginalized communities, indigenous peoples, and local stakeholders in decision-making processes. Their participation should be valued, and their knowledge and rights should be respected and integrated into climate policies and projects. Another crucial aspect is facilitating technology transfer from developed to developing countries, enabling the adoption of cleaner and sustainable technologies. This includes supporting the development and deployment of renewable energy systems and providing technical assistance to bridge the technological gap. Additionally, financial mechanisms should be established to provide adequate and predictable support to developing countries, ensuring they have the necessary resources to implement climate actions effectively. This includes fulfilling commitments to provide climate finance and encouraging private sector investments in clean technologies. Strengthening international cooperation and knowledge sharing is essential to promote best practices, capacity building, and innovation across countries. It is also important to address the historical and structural injustices embedded in global climate governance by reforming international institutions and governance mechanisms to ensure transparency, accountability, and fair representation of all countries. By implementing these strategies, we can work towards mitigating carbon colonialism and fostering a more equitable and sustainable approach to addressing climate change (Caney, 2010) (McAdam & Saul, 2013) (Shue, 2014) (UNDP, 2019)

Carbon colonialism perpetuates global inequalities and reinforces a system where developing countries bear the burden of climate change impacts while having limited agency and resources to address them effectively. It is crucial to address and dismantle these power dynamics to promote a more equitable and sustainable approach to climate action and ensure that developing countries have the means to pursue their own sustainable development pathways.

3.4 Carbon Offshoring

Carbon Offshoring, also known as Carbon Leakage, occurs when enterprises shift their energy-intensive productions to countries with significantly comfortable emission constraints in comparison to the enterprises' country of origin, and import goods produced from such processes instead of manufacturing them domestically (European Commission, 2020). There are two measurement methods for carbon emissions: territorial-based carbon emissions (TBEs) which include only emissions generated within a country's territory, and consumption-based carbon emissions (CBEs) where it is equal to TBEs plus carbon emissions in imports minus the carbon emissions in exports (Shigeto, Yamagata, Ii, Hidaka, & Horio, 2012) (Zhang, Qiao, Chen, & Chen, 2016). Most studies conducted in the past have only used TBEs, and as it determines responsibility only for the emissions that rise from a country's territorial area, disregards carbon offshoring. Using the CBE methods would clarify the responsibility distribution for carbon emissions and thus provide a healthier approach when distributing required efforts from countries (Qin, ve diğerleri, 2021). This approach, as in finding a loophole in the international climate policy differences among countries impacts trade flows as well as fraud for certain countries' emission reductions. This is a convergence of international competitiveness crossing with carbon emission calculations.

Currently, there is no single climate policy that is applied globally. This leads to asymmetric climate policies composed of a range of policy tools to mitigate climate change such as cap-and-trade, taxes, subsidies, and voluntary agreements. As countries, as well as companies located in them, are bound by the specific amounts of emission allowances, they cannot exceed the cap. As we have already seen, there are further methods to circumvent these limits through carbon offsetting in a different location, or trading emission rights from the market. The prevalent fear for policymakers is competitiveness-driven carbon offshoring which can manifest in two manners. Firstly, the differences among carbon dioxide cost levels could trigger an immediate loss of market share for carbon-constrained industrial products, which would benefit non-carbon-constrained countries as companies shift to the sourcing of emissions-intensive products from abroad. Second, in the long run, differences in cost levels would trigger changes in investment patterns as energy-intensive industries would locate in countries with less stringent climate policies (Reinaud J., 2008). Outsourcing the most energy and pollution-intensive parts of the production process may be a way for firms to avoid domestic regulation costs or can also be a very simple and well-known side effect of outsourcing for more traditional economic reasons such as avoiding high energy, wage, or capital costs (Cole, Elliot, Okubo, & Zhang, 2021) (Reinaud J., 2009). In the future, the potential presence of stringent climate targets accompanied by tighter climate policies might provoke potential carbon leakage if these tighter policies are only adopted by certain countries (Jakob, 2021). Such a shift would re-name countries with less stringent climate policies as pollution havens.

The environmental impacts of carbon offshoring on developing countries are manifold. These nations bear the burden of increased pollution, leading to degraded air quality, water contamination, and soil degradation. This pollution not only harms the environment but also poses risks to the health and well-being of local communities, particularly those living in proximity to industrial sites or affected ecosystems. Furthermore, carbon offshoring can exacerbate socioeconomic disparities within developing countries. While these countries may benefit from increased economic activity and job creation associated with carbon-intensive industries, the benefits are often outweighed by the negative consequences. The extraction of natural resources, deforestation, and the displacement of local communities to make way for carbon-intensive projects can result in the loss of livelihoods, cultural disruption, and increased inequality. Another impact of carbon offshoring is the hindrance it poses to sustainable development in developing countries. By outsourcing carbon-intensive activities, these nations may become locked into a cycle of dependency on polluting industries, hampering their transition to low-carbon and sustainable economies. The lack of investment in clean technologies and renewable energy infrastructure further limits their capacity to mitigate climate change and adapt to its impacts. Moreover, carbon offshoring can lead to a loss of local control and sovereignty over natural resources. Developing countries may face pressure from multinational corporations and foreign investors, who often prioritize their own interests and profit margins over environmental and social considerations. This can result in the exploitation of resources without adequate benefit-sharing for local communities or the country as a whole. (Akpan & Elkan, 2016) (Cohen, 2017) (Akadiri, Bekun, Taheri, & Akadiri, 2019) (Dasgupta, De Cian, Hof, & van Sluiseld, 2020)

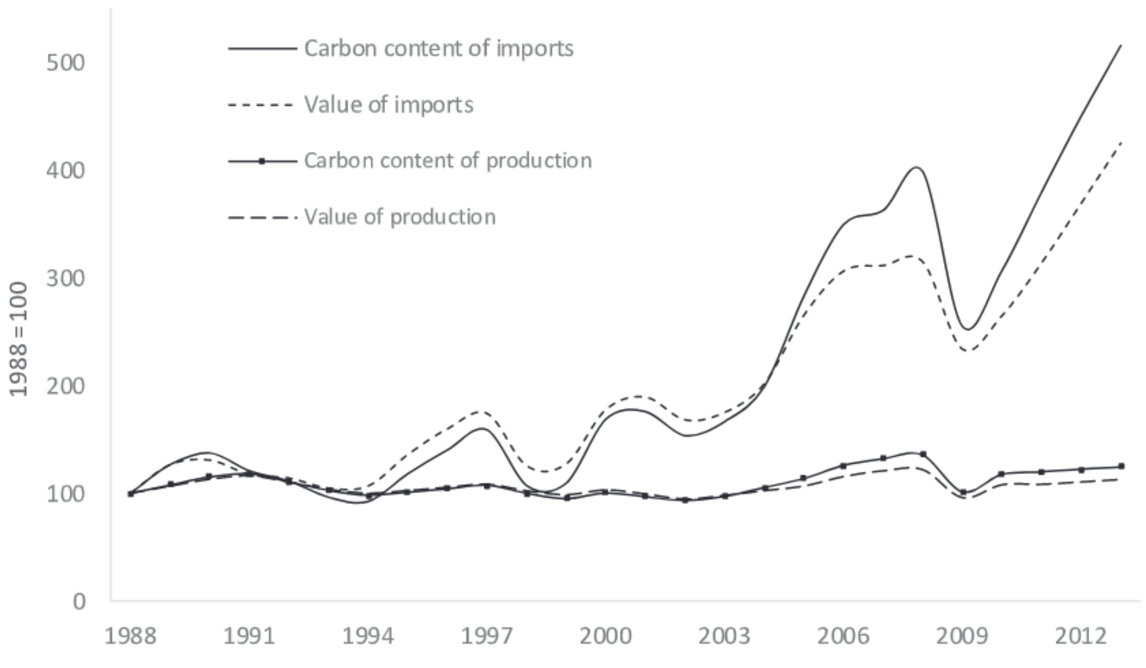
In the context of a case study in Japan, an empirical analysis focuses on a specific question: What would have been the incremental pollution impact if Japan had produced its imports domestically instead of relying on international trade? To answer this question, the study utilized industry-specific pollution intensities, which are calculated based on the volume of pollution generated per unit of output within each industry. The firm-level CO2 emissions data used in the calculation were obtained from the Mandatory Greenhouse Gas Accounting and Reporting System, provided by the Japanese Ministry of the Environment, for the period between 2009 and 2013. Only firms that reported total energy use greater than 1500 km per year were included in the dataset. The CO2 emissions data were then merged with the Annual Survey of Japanese Firms and the Basic Survey of Japanese Business Structure and Activities, both provided by the Japanese Ministry of Economy, Trade, and Industry (Brounen, Kok, & Quigley, 2014)

Table 1: Pollution intensities and import shares by industry. Source: (Cole, Elliot, Okubo, & Zhang, 2021)

	Carbondioxide Intenstiy	Import Share in 1988	Import Share in 2013
Food and Beverages	0.56	17.5	8.7
Textiles and textile products	0.70	7.2	5.0
Wood and wood products	0.76	7.3	2.3
Chemicals and allied products	0.19	7.8	8.0
Petroleum and coal products	4.75	21.5	34.3
Rubber and plastic products	2.14	2.0	2.5
Leather and leather products	1.55	1.5	0.8
Glass and ceramics	1.26	5.9	2.1
Basic Metals	5.57	10.6	6.5
Industrial Machinery	1.73	12.8	23.0
Other manufacturing	0.28	6.0	6.8

According to the research done by Matthew A. Cole, Robert J.R. Elliott, Toshihiro Okubo, and Liyun Zhang, the table above provides the share of manufacturing imports for eleven industries for 1988 and 2013, and shows the changes among imports in the same period. In 2013 we can see that imports of petroleum and coal products as well as industrial machinery, relatively pollution-intensive industries, have decreased since 1988 and now form over half of all manufacturing imports. Upon the research, it is demonstrated that the value of Japanese imports increased by approximately 325%. If each industry's share of total imports has remained constant over this tie period, the carbon emission total of those imports would also have grown by 325%. However, because imports by some industries grew more than others as well as pollution intensity differences across industries, we observe the content of those imports increased by 415% over the same period. This conclusion demonstrates that the composition of

Table 2: The value and carbon content of Japanese overseas production outsourcing 2009–2013 (2009 = 100). M.A. Cole et al.



Japanese imports became more pollution-intensive between 1988 and 2013 or, to be more precise, the pollution that would have been emitted to domestically produce Japanese imports increased over the period. This analysis suggests that the composition of Japanese imports became more pollution-intensive between 1988 and 2013. In other words, the pollution that would have been emitted if these imports were domestically produced increased over time.

These findings provide evidence of a degree of pollution offshoring in Japan, where the country has shifted the environmental burden associated with production to other nations through its import practices. Overall, the research highlights the importance of considering both the changes in the composition of imports and the pollution intensity of industries when assessing the environmental implications of international trade. It presents the need for further examination of the factors driving these shifts and the potential consequences for global pollution patterns.

Table 2 demonstrates the pollution content of imports has always been higher than that of exports and this difference has only increased over time. This implies that a significant amount of pollution or environmental harm is being generated during the production, extraction, or manufacturing processes of the goods imported by Japan. Furthermore, the widening gap over time suggests an increasing trend in pollution offshoring by Japan. As the pollution content of imports surpasses that of exports to a greater extent, it implies that Japan is outsourcing its pollution-intensive activities to other countries. This practice enables Japan to benefit from the consumption of goods produced with higher pollution levels, while potentially shifting the environmental burden and associated consequences to other nations. The reasons behind this increasing trend of pollution offshoring by Japan can be multifaceted. Factors such as cost considerations, differences in environmental regulations, access to resources, and global supply chain dynamics may all contribute to this phenomenon. By importing goods with higher pollution content, Japan may be able to maintain lower domestic pollution levels and prioritize its environmental goals within its borders. However, this approach may result in transferring environmental impacts to other countries, particularly those where the goods are produced or extracted. While it is crucial to consider economic and trade benefits, it is equally important to address the associated environmental costs and strive for sustainable practices in global supply chains. Efforts to promote transparency, accountability, and international cooperation in addressing pollution offshoring are necessary to ensure a more equitable and environmentally responsible global trade system. (Cole, Elliot, Okubo, & Zhang, 2021) (Brounen, Kok, & Quigley, 2014).

The practice of offshoring which is tightly linked to international trade as the abroad productions enter the country through import is a potential hazard for climate change mitigation. Though in practice it does not differ from pursuing overseas production for traditional economic pursuits, in action it can lead to fraud, unreliability as well as no significant greenhouse gas reductions at the global level. As if Japan is facing stringent policies and thus uses offshoring to reduce its pollution levels, another country with less stringent policies can simply welcome its practices. The result would be no change in terms of reducing greenhouse gas emissions, and simply continuing business as usual while pretending to submit and observe the international agreements the countries are signatories to. This could be solved by the implementation of Consumption-Based Emissions regarding national pollution levels, thus holding countries responsible for the actual levels of emissions they are producing instead of simply focusing on the Territorial Based Emissions that are only produced within the physical borders of a country.

In order to remedy the negative impacts of carbon offshoring, one strategy is to strengthen environmental regulations by implementing and enforcing stringent standards in both the host countries where carbon-intensive industries operate and the countries where the products are consumed. This approach involves setting limits on emissions, promoting cleaner production technologies, and ensuring proper waste management practices (Huanh, Chen, Peng, & Wang, 2017). Another important step is to promote clean technologies and facilitate the transition to low-carbon energy sources. Investing in renewable energy infrastructure and supporting research and development of clean technologies can help reduce dependence on carbon-intensive industries and encourage sustainable economic growth (Acemoğlu, Akciğit, & Hanley, 2012). International cooperation and collaboration are essential in addressing the global nature of carbon offshoring. Governments, international organizations, and stakeholders should work together to establish transparent and accountable supply chains, promote responsible investment practices, and share best practices for sustainable production and consumption (Bridge, McCarthy, & Watson, 2019). It is important to note that the effectiveness of these strategies may vary depending on the specific context and characteristics of each country. Therefore, a context-specific approach that considers local conditions, challenges, and opportunities is necessary.

3.5 Implications on Developing Countries

Under the Kyoto Protocol, Annex I countries of Canada, France, Germany, Italy, Japan, Spain, the United Kingdom, and the United States have signed binding commitments to reduce their greenhouse gas emissions. The same agreement also requires these countries to be attentive to minimize unintended influences on developing countries, mainly transmitted through trade. Any economic trade links among countries will the mitigation measures adopted by a set of nations to countries that may not have agreed to share the burdens, in a ripple effect (Ramachandreaiah & Michaelowa, 2003). For example, signatories of the Kyoto Protocol (the Annex I countries) will need to increase the cost of using carbon-emitting fuels, which will translate into raising manufacturing costs of the energy-intensive goods, among which some would be exported to developing countries that are not signatories of the Kyoto Protocol (Babiker, Reilly, & Jacoby, 2000).

It is accepted throughout nations regardless of their GDP that for the Kyoto Protocol to be successful in its targets, it needs both developing and developed countries to cooperate on the goals. As only a handful of countries, if they were to transparently reduce their emissions, will not be successful in limiting the global temperature to 2 degrees Celsius by their efforts alone (Müller, 2002). First of all, the fear from developing countries was that the desire to get developed countries to accede to the Protocol has structured the agreement in such a way that it will be detrimental to the rest of the world when they eventually are obligated to be signatories as well (Agarwal & Narain, 1991), an example of many to this is the decision to set first emission targets as a percentage of 1990 emissions rather than an allowance of emissions per capita. This approach benefits countries with high current emissions rather than developing countries with lower emissions which would be condemned to lower emission allowances than their industrialized counterparts (Najam, Huq, & Sokona, 2011).

UNFCCC was not seen as a great accomplishment from the perspective of developing countries as it lacked a focus on issues of historical responsibility, and immediate mitigative action and failed to demand assistance for the most vulnerable countries (Dasgupta, 1994). Developing countries have raised specific concerns about the direction of the global climate regime that relate to three large categories of concerns:

- There is no specified and explained reason why the Kyoto Protocol has set a target of 7% below the base year emissions for the United Kingdom, 6% for Japan, and 0% for New Zealand. This sets a bad precedent for the future as it shows the lack of a clear and predictable basis for emissions reduction for other countries that will be entering the Kyoto Protocol at a later date. The principle of 'common but differentiated responsibility' is slowly fading and received a blow from the US Congress (Byrd-Hagel Resolution, 1997) by stating "disparity of treatment between Annex I Parties and Developing Countries" in terms of emission reduction requirements and demanded equity of a different kind, without it the US Congress states they would now approve any agreement that would "mandate new commitments to limit or reduce greenhouse gas emissions for the Annex I Parties unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period." (Zelli & van Asselt, 2013). This statement meant that the distinction between 'luxury' and 'survival' emissions is no longer present. (Agarwal & Narain, 1991) (Meyer, 1999) (Najam, Huq, & Sokona, 2011)

- The focus of the regime skewing towards minimizing the burden of implementation on polluter industries: also referred to as 'capacity building', or 'technology transfer' in climate policy. The poorest and most vulnerable countries against extreme climatic events need the most aid in their 'adaptive' and 'mitigative' capacities. (Najam, Huq, & Sokona, 2011). The oversimplification of carbon reduction through the offsetting approach has disregarded the consequences for developing countries.
- The primary focus becomes global carbon trade and meeting short-term targets which distract from the longer-term challenges: the pursuit of sustainable development is integrated into climate change mitigation. However, it is not only a concern of the developing world, but also a common interest as it provides the best condition in which climate policies are properly implemented (Munasinghr, 2000) (Najam, Huq, & Sokona, 2011).

There is a contrast between what developing countries should do in order to increase their GDP per capita, and what developing countries should do in order to mitigate climate change. The development of energy systems and infrastructure in developing countries presents a challenge, as later targeting of these countries will result in higher costs due to the inefficiency and high carbon footprint of their energy systems. While imposing a high carbon tax on these countries in the near term may not be appropriate, as their immediate goal is economic development, they will benefit from financial and technology support to invest in clean energy infrastructure under a cap-and-trade policy as their economy develops. This situation is actually a great advocate for the three flexibility mechanisms that have been approved under the Kyoto Protocol with Clean Development Projects (an international program which encourages developed countries to invest in technology and To foster development in developing countries while decreasing greenhouse gas emissions, Clean Development Mechanisms (CDMs) would need to undergo significant changes.

First and foremost, there needs to be a shift towards promoting more sustainable development practices and technologies that generate co-benefits for both economic and environmental goals. This means that CDM projects should not only focus on reducing emissions but also on contributing to poverty reduction, social equity, and environmental sustainability. Secondly, there needs to be more equitable distribution of benefits among stakeholders. Developing countries often have limited negotiating power compared to developed countries and large corporations in the CDM project cycle. This leads to an imbalance of power and the potential for unfair distribution of benefits, where local communities and small-scale actors may not receive adequate compensation for their participation in CDM projects. CDMs must be reformed to include the participation of all relevant stakeholders, including local communities, small and medium-sized enterprises, and civil society organizations. Thirdly, there needs to be greater transparency and accountability in the CDM project cycle. There have been instances where CDM projects have failed to deliver the expected emissions reductions, or have caused unintended negative impacts on local communities and the environment. Developing countries must be empowered to effectively monitor and enforce CDM projects, and to hold project developers and other stakeholders accountable for their actions. Finally, CDMs should be designed to promote technology transfer and capacity building. Developing countries need access to new technologies and expertise to effectively reduce emissions while promoting sustainable development. CDMs should prioritize projects that facilitate technology transfer and build local capacity to implement and maintain sustainable development initiatives. Overall, to foster development in developing countries while decreasing greenhouse gas emissions, Clean Development Mechanisms must shift towards more sustainable development practices and technologies, ensure equitable distribution of benefits, increase transparency and accountability, and promote technology transfer and capacity building. This requires a significant change in how we approach Clean Development Mechanisms. Achieving SDGs with CDMs require an effective grasp the multifaceted nuances of climate mitigation and clean development, a multidisciplinary research agenda is necessary, incorporating both technical and critical elements. This approach will enable a better understanding of how the CDM, whether reformed or not, can contribute to sustainable development goals (Bumpus & Cole, 2010) (Ellerman, Decaux, & Jacoby, 1998).

It is the responsibility of developed countries, which have contributed greatly to climate change through greenhouse gas emissions, to assist developing countries in investing in cleaner technologies while they build their energy systems. To effectively implement policies and involve developing countries in the process, a cap-and-trade policy is preferred as it provides financial support and technology transfer. In the long term, a carbon tax policy can be effective in developing countries if early investments are made in clean energy infrastructure and technologies under a cap-and-trade policy. (Anandarajah, Kesicki, & Pye, 2010).

To ensure that the carbon market does not limit the growth of developing countries, several changes are needed. The carbon market needs to provide more access to financing for developing countries to invest in low-carbon technologies and sustainable development. This would require an increase in funding mechanisms and resources available to developing countries, particularly for those that lack the financial capacity to invest in clean energy. Further, the carbon market needs to promote technology transfer and capacity building in developing countries. This would entail the transfer of knowledge, skills, and technologies from developed countries to developing countries, which would enable them to build and maintain their sustainable development projects. The carbon market should encourage a more equitable distribution of benefits. This means that developing countries should receive a greater share of the benefits from carbon trading and carbon finance, to help bridge the development gap between developed and developing countries. There needs to be a stronger focus on environmental integrity, to ensure that emissions reductions are real, measurable, and verifiable. This would require more rigorous monitoring, reporting, and verification mechanisms for carbon offset projects. Lastly, the carbon market should take into account the unique circumstances and development needs of each developing country. One size does not fit all, and carbon market policies should be tailored to the specific needs and goals of each country, rather than imposing a uniform approach across all countries. Overall, the carbon market needs to prioritize the needs and interests of developing countries, by providing greater access to financing, promoting technology transfer and capacity building, encouraging more equitable distribution of benefits, ensuring environmental integrity, and taking into account the unique circumstances of each country.

Conclusion

In this review, we have seen the emergence of the Kyoto Protocol and the Carbon Market in the junction of achieving Sustainable Development Goal 13: Climate Action, and further considered the implications this climate change mitigation strategy has on developing countries.

Climate change adaptation involves developing and implementing policies and measures aimed at reducing the vulnerabilities of sustainable development. For instance, this could entail improving food and water security for agricultural communities affected by changing rainfall patterns caused by climate change, or implementing disaster risk governance along with an early warning system to ensure that any development project or initiative considers potential risks. The goal of climate change adaptation is to minimize the adverse impacts of climate change on communities and economies, while also promoting sustainable development. The carbon market is a system designed to put a price on carbon emissions and create economic incentives to reduce greenhouse gas emissions. It functions by setting a cap on the total amount of emissions that participating entities, such as companies or countries, are allowed to emit. These entities are then issued a certain number of carbon credits, which represent the right to emit a certain amount of greenhouse gases. If an entity exceeds its allotted emissions, it must purchase additional credits on the carbon market from entities that have reduced their emissions below their allotted amount or under the flexibility mechanism presented by the Kyoto Protocol, they can take other routes. This creates a financial incentive for entities to reduce their emissions and to invest in cleaner technologies. However, any market-based approach towards climate change is greeted with a similar criticism that prevails; the earth is not a measurable commodity.

Climate change is an unprecedented market failure, and the creation of a carbon market to address it has been described as the largest privatization of a natural asset the world has ever seen. However, the current carbon market is a small and imperfect solution. In the next decade, a critical challenge for climate policy is to expand the scope of emissions trading to include more countries, sectors, and longer time periods. Tightening caps and auctioning allowances are also necessary to improve environmental effectiveness and address inefficiencies in allocation and fairness. While other climate policies, such as regulation, carbon taxes, and information provision, are well understood and essential, the institutions of the flexible mechanisms under the Kyoto Protocol have already invested significant human, social, and negotiating capital. Despite the serious problems in the current system, these flexible mechanisms provide an important foundation on which to build a more effective global climate policy (Hepburn, 2007).

Carbon trading, touted as a mechanism to mitigate greenhouse gas emissions and combat climate change, is not without its fallacies, particularly for developing countries. One major concern is the inherent inequality embedded within carbon trading systems. Developing countries, already burdened with economic challenges and limited resources, often lack the capacity to participate fully and benefit from carbon markets (Newell & Paterson, 2010). This inequality arises from various factors such as the high costs associated with implementing emissions reduction projects, limited access to financial and technological resources, and a lack of bargaining power in international negotiations (Grubb, 2003). Another fallacy of carbon trading is the potential for market speculation and manipulation. The carbon market operates based on the principle of trading emissions allowances and offsets, which can be bought, sold, and traded as commodities. This opens the door for financial speculators who may exploit price fluctuations and distort the market (Lohmann L. , 2006). Such speculative activities can lead to volatility and instability, undermining the effectiveness of carbon trading as a tool for emissions reduction and sustainable development. Furthermore, carbon trading can perpetuate a "pollution haven" phenomenon, where industries from developed countries outsource their carbon-intensive activities to developing countries with lax environmental regulations . This offshoring of emissions not only shifts the environmental burden but also undermines local efforts to achieve sustainable development and transition to cleaner technologies. It exacerbates environmental degradation and social injustices in developing countries, as they bear the brunt of increased pollution and suffer from adverse health effects and ecological damage (Gupta & Chandak, 2016). The reliance on carbon offset projects, another component of carbon trading, also raises concerns. Offsetting emissions through projects such as forest conservation or renewable energy initiatives may seem appealing, but they can be prone to issues such as additionality and double counting. Additionality refers to the concept that offset projects should generate emission reductions that would not have occurred otherwise. However, there is evidence that some offset projects do not meet this criterion, leading to an overestimation of emission reductions. Moreover, double counting occurs when the same offset is claimed and counted towards emissions reductions by multiple parties, undermining the integrity of the carbon market. (Müller, 2010) (Caney, 2010) (Haya & Olmstead, 2016).

In conclusion, carbon trading presents several fallacies when applied to developing countries. The inherent inequality, potential for market speculation, pollution haven effects, and issues with offset projects all contribute to a system that may not effectively address climate change while exacerbating environmental and social injustices. To ensure a fair and sustainable approach to emissions reduction, it is crucial to consider alternative strategies that prioritize the unique challenges and needs of developing countries, including technology transfer, capacity building, and targeted financial support. By addressing these fallacies, the international community can work towards a more equitable and effective framework for mitigating climate change.

The carbon market, intended to promote emissions reduction, often disadvantages developing nations due to their limited capacity to participate effectively. They face challenges in accessing financial resources, technology, and expertise required to participate in carbon trading, leading to unequal opportunities for economic growth and development. This carbon inequality further exacerbates existing socioeconomic disparities and hampers the ability of developing countries to address climate change effectively. Carbon colonialism, a term used to describe the exploitation of land, resources, and opportunities by developed countries, reinforces power imbalances and perpetuates historical patterns of exploitation. Developing nations, already vulnerable to climate change impacts, bear the brunt of environmental and social injustices associated with carbon colonialism. They often experience the displacement of local communities, loss of livelihoods, and degradation of ecosystems as carbon-intensive industries and projects are outsourced to their territories. Carbon offshoring, the practice of shifting carbon-intensive activities to developing countries, has significant implications. While it may provide short-term economic benefits through job creation and increased economic activity, it contributes to environmental degradation and pollution in the host countries. These nations experience air and water pollution, soil degradation, and negative health impacts, particularly in communities living near industrial sites or affected ecosystems. The combination of carbon market mechanisms, carbon inequality, carbon colonialism, and carbon offshoring further compounds the challenges faced by developing countries in achieving sustainable development. They often become locked into polluting industries and face barriers in transitioning to low-carbon and sustainable economies. Limited access to clean technologies and renewable energy infrastructure inhibits their ability to mitigate climate change and adapt to its impacts, perpetuating their vulnerability and hindering their long-term development prospects. It is crucial to address these issues through equitable and sustainable approaches. This includes providing support to developing countries in accessing financial resources, technology transfer, and capacity building to participate effectively in carbon markets. International cooperation and collaboration are essential in ensuring that climate action initiatives do not perpetuate inequalities and environmental injustices. Promoting inclusive decision-making processes, respecting the rights and knowledge of local communities, and fostering sustainable development practices are fundamental steps toward a more just and sustainable future for all (Bailey, Gouldson, & Newell, 2014) (Michaelowa & Jotzo, 2005) (Park & Sovacool, 2017) (Skovgaard & Van Asselt, 2019).

It is evident that the current carbon market is not designed to foster development in develoing countries, but rather to allow developed countries to continue emitting greenhouse gases while purchasing offsets from developing countries. To address this, reforms are needed to ensure that carbon trading benefits developing countries and aligns with the principles of sustainable development. These reforms could include the establishment of a fair carbon price, the promotion of renewable energy, the provision of technology transfer, and the recognition of historical responsibility for emissions. Only by addressing the negative implications of carbon trading can we achieve the dual objectives of mitigating climate change and promoting development in developing countries.

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