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KPMG

Climate Policies as a Soft-Power in Carbon-Based New World Paradigm: Planet-as-a-Service, a Holistic Framework for Global Decarbonization

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Project Overview

Background

Human activities such as burning fossil fuels, cement-making, and deforestation drive global warming. While a portion of CO2 is absorbed by oceans and land, a significant amount remains in the atmosphere. This lingering CO2 now makes up 0.0426% of the Earth's atmospheric volume, a figure that is over 52% higher than pre-industrial levels, according to Bloomberg. Geological evidence suggests that the last time CO2 levels were this high was about 3 million years ago, a period when the planet was 2°C to 3°C warmer, and sea levels were over 65 feet higher.

In 2019, the Arctic sea ice extent reached its second-lowest level since satellite monitoring began in 1979. Additionally, the world is losing tree cover at an alarming rate of over 8,000 square meters per second, equivalent to one soccer pitch per second, with almost half occurring in the tropics. These regions are among the most biologically diverse and climate-critical ecosystems on the planet.

Countries must act urgently, driven by various pressures. Voters demand protection of their rights to a safe environment, while economic pressures stem from international expectations and regulations. Wealthier nations, like the United States, China, and the European Union, utilize their influence to navigate the climate crisis for political and economic advantages. This fragmented and competition-based approach hampers global efforts to address climate change efficiently. This report, developed in collaboration with Be Node, the Finland Futures Research Center, and KPMG, aims to analyze the reasons behind this disjointed approach to climate action and propose more effective global solutions.

The world is currently facing a crisis of climate change that requires a joint effort from all countries. Ecosystems, economies, and people’s well-being are at stake because of the impacts of climate-related problems, thus there should be urgent joint action to reduce such impacts. This paper investigates how different countries leverage their climate strategies to

increase their positions in the world and looks at the relationship between economy and geopolitics from the perspective of the EU, China, and the US as they implement emissions-reduction schemes in the global economy. This research investigates how major global economies—the European Union (EU), China, and the United States (US)—employ climate policies to build up their political power and shape international relations. These economies apply various mechanisms like carbon credits trading or taxing polluting industries to achieve their goal of being more influential than other states in the world; thereby complicating this discourse by fostering unfair trade practices that can only result in heightened global conflicts due to the utilization of scarce resources.

Rationale

For effective and fair climate policies to be made, it is important to know how these leading economies apply climate initiatives as a tool for political pressure. Although these programs are mainly intended to address issues of global warming, they can also be used by participating countries to enhance their hegemony via technological exports, financial measures, and normative benchmarks. This research aims to reveal the methods used by China, the US, and the EU.

Objectives

The objective of this research is to explore how China, the EU and the US use climate initiatives as a way of enhancing their geopolitical power. This involves:

- An examination of China's superiority in exporting green technology resulting from deliberate policies and government grants.
- Examining regulatory mechanisms within the EU, for instance, the Carbon Border Adjustment Mechanism (CBAM), and how they affect efforts to reduce carbon emissions and trade across the world.
- Analysis of the investment and financing initiatives for climate in US such as the Inflation Reduction Act (IRA) in relation to global economics and climate policy.

This study highlights that we live in a competitive world where every nation wants to outshine the other in terms of climate action and calls for a new mode of operation based on networking instead of competition among nations. Enabling global agencies to play their roles independently would help the world achieve an enduring more equal future.

Abstract

This research explores how major global economies leverage climate initiatives to establish and enhance their geopolitical influence. Focusing on the strategies employed by China, the European Union, and the United States, the study examines how these regions use various policies and technologies to exert influence and promote their geopolitical interests under the guise of climate leadership. The analysis delves into China's dominance in exporting green technology, the EU's regulatory mechanisms such as the Carbon Border Adjustment Mechanism (CBAM), and the United States' climate financing and investment initiatives.

The rationale for this study is rooted in the global climate crisis, which demands collaborative international action. However, this crisis also presents opportunities for countries to extend their influence through technology exports, financial mechanisms, and regulatory frameworks. Understanding how these tools are utilized not only to address environmental challenges but also to set international standards and reshape global trade dynamics is crucial for developing effective and equitable climate policies.

China's export of green technology, supported by substantial government subsidies and strategic policies, has positioned it as a global leader in sectors like solar panels, wind turbines, electric vehicles, and lithium-ion batteries. The EU's CBAM aims to prevent carbon leakage and enforce global decarbonization, impacting countries with less stringent climate policies. The United States, through significant climate financing and legislative measures such as the Inflation Reduction Act, seeks to influence global climate policy while mitigating domestic economic risks.

This study highlights the competitive nature of national approaches to climate action, which often leads to long-term inequalities and inefficiencies in resource optimization. It argues for the strengthening and empowerment of international organizations to enforce global environmental agreements, advocating for a networked approach that prioritizes global cooperation over national competition. Such a paradigm shift is essential for addressing the climate crisis effectively and ensuring a sustainable and equitable future for all. While underscoring the need for robust global joint climate governance structures, the Planet-as-a-service (PaaS) model that can facilitate the equitable distribution of resources and ensure compliance with international climate commitments is introduced.

Acknowledgement

We extend our sincere gratitude to all individuals and institutions that have contributed to this research. Special thanks to our colleagues for their insightful feedback and unwavering support. We also appreciate the resources provided by our institutions, which were instrumental in the completion of this work. This study was conducted independently, without any commercial purposes, funding and external financial support.

I. Introduction

As the threat of climate change becomes increasingly tangible, both the public and private sectors have ramped up their efforts in various ways, particularly by prioritizing decarbonization and other methods of mitigating its effects. The recognition of climate risk as a significant threat to investments has been steadily increasing. According to KPMG, this heightened awareness is expected to drive substantial new investment and prompt significant changes in the allocation of capital across various sectors. As a result, there is growing anticipation of the development of a global market for sustainable finance. This market is likely to encompass a wide range of financial instruments and products that aim to support and fund initiatives focused on mitigating climate change, promoting environmental sustainability, and addressing related risks. The evolving landscape of green finance is expected to offer new investment opportunities and pave the way for innovative capital allocation approaches that prioritize sustainability and long-term environmental impact.

KPMG predicts that the global climate agenda will cover the following topics in the coming period;

- New business models emerging
- Growing pressure on corporations to adapt to climate risk from shareholders, employees, supply chain etc.
- Adoption of net zero carbon targets by corporations
- Fundamental changes to future building and transport infrastructure
- Public sector response through net zero legislation, carbon taxes, retrofitting etc.
- Increasing pressure on the capital markets to re-orientate capital to businesses that are sustainable in the long term and that are climate resilient
- Changes in consumer behaviors and attitudes
- Investment focused on many new investment opportunities in climate and decarbonization

As the critical issue of climate change continues to shape our world, it is imperative that governments, investors, corporations, and individuals take decisive action to combat the climate crisis, with a strong emphasis on implementing effective decarbonization strategies. Transitioning toward a decarbonized society will necessitate an unparalleled level of new capital investment, particularly within the domain of green finance. Green finance encompasses the utilization of financial mechanisms to support endeavors aimed at mitigating greenhouse gas emissions and adapting to the impacts of climate change. This encompasses investment in initiatives such as renewable energy, energy efficiency, sustainable agriculture, and climate-resilient infrastructure. Moreover, green finance assumes a pivotal role in funding research and development of innovative technologies that contribute to environmental sustainability. By directing financial resources toward these initiatives, societies can endeavor to realize a more sustainable and climate-resilient future.[1] An annual investment ranging from USD 5 to 7 trillion in infrastructure is projected to be necessary until

[1] Green financing: A necessary step towards a Greener Future. KPMG. (n.d.). https://kpmg.com/th/en/home/media/press-releases/2022/04/green-financing.html

2030 to align with climate and development objectives.[2] To facilitate the influx of investments, particularly those geared towards sustainable infrastructure, nations should emphasize specific parameters. These include the augmentation of bankable and feasible sustainable infrastructure projects, the enhancement of the appeal of local currency green bonds, and the establishment of clear reporting standards for green investments.3 The International Energy Agency (IEA) states that the energy sector alone will need a total investment of $53 trillion by 2035, while the New Climate Economy estimates that the entire global economy will require an investment of $93 trillion by 2030.

In the urgent quest for environmental sustainability, the global financial landscape has witnessed a surge in initiatives aimed at directing capital towards green and socially responsible projects. This mobilization of sustainable finance represents a critical step towards addressing pressing environmental challenges. However, amid this noble endeavor lurks a formidable challenge: the pervasive threat of greenwashing. Greenwashing, characterized by deceptive practices that mislead investors about the environmental integrity of projects, poses a significant risk to the credibility and impact of sustainable finance initiatives. Greenwashing poses significant dangers to both investors and governments, leading to a greater need to eliminate this misleading practice. The European Union's Sustainable Finance Disclosure Regulation (SFDR) is part of the EU's initiatives to promote authentic sustainable investment by mandating ESG products to disclose how their environmentally friendly products tackle climate change and meet other criteria. The enforcement of this regulation in the EU could have widespread implications, as there are increasing demands for a similar rule in some other regions such as Asia, to encourage unified efforts and openness.[4]

[2] Financing climate futures. (n.d.). https://www.oecd.org/environment/cc/climate-futures/policy-highlights-financing-climate-futures.pdf
[3] Sustainable finance – leveraging green finance for infrastructure development. KPMG. (n.d.-b). https://kpmg.com/sg/en/home/insights/2021/06/sustainable-finance-leveraging-green-finance-for-infrastructure-development.html
[4] Ibid.

In the realm of global sustainable manufacturing, China holds a preeminent position, exerting substantial influence and showcasing innovation in pivotal sectors such as electric vehicles (EVs), lithium-ion batteries, and solar panels. Through strategic development and unwavering commitment to clean energy technologies, China has firmly established itself as a significant contributor in shaping the path of sustainable energy solutions worldwide. On the other hand, the EU is taking a leading role in addressing global climate issues by implementing strict regulations and committing to sustainability. The EU's journey toward achieving carbon neutrality and reducing greenhouse gas emissions is discussed, with a focus on key milestones such as the Paris Agreement and the European Green Deal. Additionally, the study explores the EU's implementation of measures like the Carbon Border Adjustment Mechanism (CBAM) to ensure fair carbon pricing across borders and its impact on global trade relations and the shift to a sustainable economy. This analysis examines the various aspects of the EU's climate leadership and its global effects, including regulatory frameworks and socio-economic impacts on exporting nations. The United States, being one of the world's largest economies and a significant contributor to greenhouse gas emissions, holds a crucial position in the fight against climate change and the direction of global climate finance. Over time, the nation has undergone various changes and made commitments that reflect its internal dynamics and changing priorities in this arena. From initially joining the Paris Agreement to subsequent withdrawals and renewed commitments under different administrations, the U.S. has navigated a complex path toward climate action. In this context, the nation has heightened its attention on climate finance, both domestically and internationally. By making substantial contributions to global climate finance mechanisms, the U.S. has emerged as a leader, directing significant funds towards projects that promote climate resilience and sustainability. These financial commitments are aligned with broader strategies aimed at safeguarding the economy from climate-related risks while driving a transition towards a future with net-zero emissions.

The global climate crisis requires collaborative international action, but also presents opportunities for influence through technology exports, financial mechanisms, and regulatory frameworks. This study aims to understand how major economies utilize these tools not only to address environmental challenges but also to extend their geopolitical influence and set

international standards. The rationale is grounded in the need for a sustainable and equitable global approach to climate change, which also respects national interests and promotes global cooperation rather than competition.

II. China's Export of Green Technology

Overview

Given its status as the world's largest trading nation, China occupies a pivotal position in the realm of global green manufacturing. This prominence is largely attributable to its robust development and innovation in what are commonly referred to as the 'new three' clean energy technologies: electric vehicles (EVs), lithium-ion batteries, and solar panels. China's strategic focus on these transformative technologies has not only solidified its dominance in the global market but has also positioned it as a key driver of the transition towards sustainable energy solutions worldwide.

China's emergence as a powerhouse in green manufacturing is underscored by its proactive approach to research, development, and deployment of clean energy technologies. The country's relentless pursuit of innovation, coupled with significant investments in research and development, has propelled it to the forefront of the clean energy revolution. As a result, China now stands as a leading exporter of electric vehicles, lithium-ion batteries, and solar panels, supplying these critical components to markets around the world.[5]

Subsidies and policies

China's global dominance in the export of green technology can be attributed to a comprehensive system of government support. This includes a wide array of subsidies and policies aimed at advancing the development and widespread use of renewable energy technologies. These strategic measures encompass financial incentives, tax advantages, and

[5] China's role in accelerating the global energy transition ... (n.d.-a). https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2024/02/Chinas-role-in-accelerating-the-global-energy-transition-through-green-supply-chains-and-trade.pdf

favorable regulations tailored to green technology producers. Furthermore, China's ambitious Made in China 2025 initiative prioritizes the growth of pivotal sectors such as electric vehicles, solar energy, and wind power, thus reinforcing China's competitive advantage in the international green technology market.

With the renewable energy sector being the world's largest and experiencing rapid growth, China is anticipated to lead in the deployment of battery energy storage systems (BESS) over the next decade. According to Fitch China Power Report, the Chinese government is actively supportive of BESS, evident[6] It is expected that China will leverage its extensive lithium battery supply chain, which is the largest globally, to meet the increasing domestic demand for BESS. In China's 14th Five-Year Plan (14FYP), the government has outlined objectives[7] These initiatives aim to facilitate the adoption of BESS in the market without relying heavily on aggressive subsidies and incentives.

The increase in the production of solar panels and wind turbines in China was mainly propelled by demand-side measures, including feed-in tariffs, loan guarantees, tax credits, and governmental backing for research and development (R&D).[8] In September 2022, the National Energy Authority (NEA) announced a groundbreaking decision to allow the sale of solar power generated from distributed solar installations to developers. This policy change created a significant opportunity for solar project developers to collaborate with building owners and capitalize on the growing demand for renewable energy sources. Furthermore, according to Fitch China Power Report, the government's ambitious targets for solar panel installations are as follows: 50% of government buildings, 40% of schools, 30% of industrial and commercial facilities, and 20% of residential areas. This emphasis on widespread solar panel coverage demonstrates the government's commitment to promoting sustainable energy practices and reducing carbon emissions across various sectors.

[6] Fitch China Power Report - 2024-03-08.pdf (kpmg.com)
[7] Fitch China Power Report - 2024-03-08.pdf (kpmg.com)
[8] Ibid.

In February 2023, the China Beijing Green Exchange made public the successful completion of the development of registration and trading systems for the China Certified Emission Reduction (CCER). These systems are currently undergoing inspection before commencing operations. Fitch China Power Report reveals that this development signifies the government's intentions to reintroduce CCER, as part of a broader plan to extend the market-wide Emissions Trading System (ETS) beyond power generation sectors. Companies participating in the Emissions Trading Scheme (ETS) are allocated a specific amount of carbon emissions they are permitted to release. These allocations are tradable. If they exceed their allowances and emit more than permitted, they are required to compensate by purchasing carbon credits through the Clean Development Mechanism (CDM) or similar mechanisms. The Clean Development Mechanism, however, has a cap on offsetting emissions, allowing for only up to 5% of emissions exceeding the total ETS target. Due to low utilization rates and a lack of standardization in carbon audits, new project applications for the Clean Development Mechanism were ceased in March 2017. This limitation confines the Clean Development Mechanism to existing projects, potentially posing a risk of a decline in available credits as projects may also be decommissioned.

Market Dominance

China commands a significant market share in key green technology industries, including solar panels, wind turbines, electric vehicles, and lithium-ion batteries. The country's manufacturing prowess and economies of scale have enabled it to produce these technologies at competitive prices, capturing a substantial portion of the global market. Chinese companies such as BYD, CATL, and Huawei have emerged as leaders in their respective fields, driving innovation and setting new standards for green technology worldwide.

In 2022, the global export of lithium-ion batteries by country amounted to US$3.26 billion. The top five exporters of lithium batteries were the United States of America, mainland China, Singapore, Hong Kong, and Indonesia. These five major suppliers collectively contributed to

over half (55.2%) of the total global exports for lithium batteries in 2022. Notably, China emerged as a significant player in this market, with an export value of $476.7 million, accounting for 14.6% of the total export value.[9] In 2022, China's share of the total global lithium-ion battery exports was 14.6%, indicating its significant role in the global market. Meanwhile, the United States maintained its leading position with a 15% share, reflecting its strong presence in the industry. It's interesting to note that while the United States currently holds the top spot, China's proportional increase in this sector is higher, suggesting a potential shift in the dynamics of global lithium-ion battery exports.[10] This trend underscores China's growing influence and competitiveness in the market, which could have broader implications for the industry in the coming years. According to Fitch China Power Report, in April 2023, Tesla revealed intentions to build a factory for manufacturing Tesla Megapacks. These Megapacks are sizable rechargeable lithium-ion batteries primarily used to support grid infrastructure, with the goal of stabilizing the grid and averting power outages. As China progresses with its plans to deploy more battery energy storage systems, this could create opportunities for battery manufacturers to grow their presence in the market and take advantage of these potential opportunities.

The global market for electric cars experienced robust expansion in 2022, with the collective value of electricity-powered automobile exports reaching an impressive US$93.5 billion (See Fig 1). Notably, China emerged as a key player in this arena, with its export value of electric cars during the same period amounting to $20.1 billion, representing a notable 21.5% share of the global market.[11] This data underscores China's substantial presence in the electric vehicle industry and its significant impact on the international market landscape. In 2022, China's electric car exports amounted to $20,088,878,000, positioning the country as the second-largest exporter globally, following Germany, whose electric car exports stood at $26,361,572,000. Upon closer examination of the one-year growth rates, it becomes evident that China experienced an impressive growth rate of 133.7%, which notably exceeds

[9] Workman, D. (n.d.). Lithium Ion Batteries Exports by Country. Lithium Ion Batteries Exports 2022. https://www.worldstopexports.com/lithium-ion-batteries-exports-by-country/?expand_article=1
[10] Ibid.
[11] Workman, D. (n.d.-b). Electric Cars Exports by Country. World's Top Exports. https://www.worldstopexports.com/electric-cars-exports-by-country/

Germany's growth rate of 68.6% by more than double. This substantial growth underscores China's growing influence and prominence in the international electric car market.[12] Four years ago, it was thought that Chinese car companies were merely following global manufacturers, but now it seems like everything has changed. German automaker Volkswagen has made significant partnerships with Chinese tech companies. Additionally, South Korean and Japanese car manufacturers have also recognized the importance of incorporating Chinese-made technology to stay competitive in China's challenging car market. Toyota recently revealed a new collaboration with Chinese superapp owner Tencent at the Beijing auto show, while Nissan announced a partnership with Baidu to utilize its generative AI technology in its vehicles. Hyundai, facing declining sales in China, declared a partnership with China's CATL to develop batteries. Furthermore, Tesla is teaming up with Baidu to integrate mapping and navigation technology in the Chinese market, aligning with Elon Musk's plans to introduce advanced driver assistance features.[13]

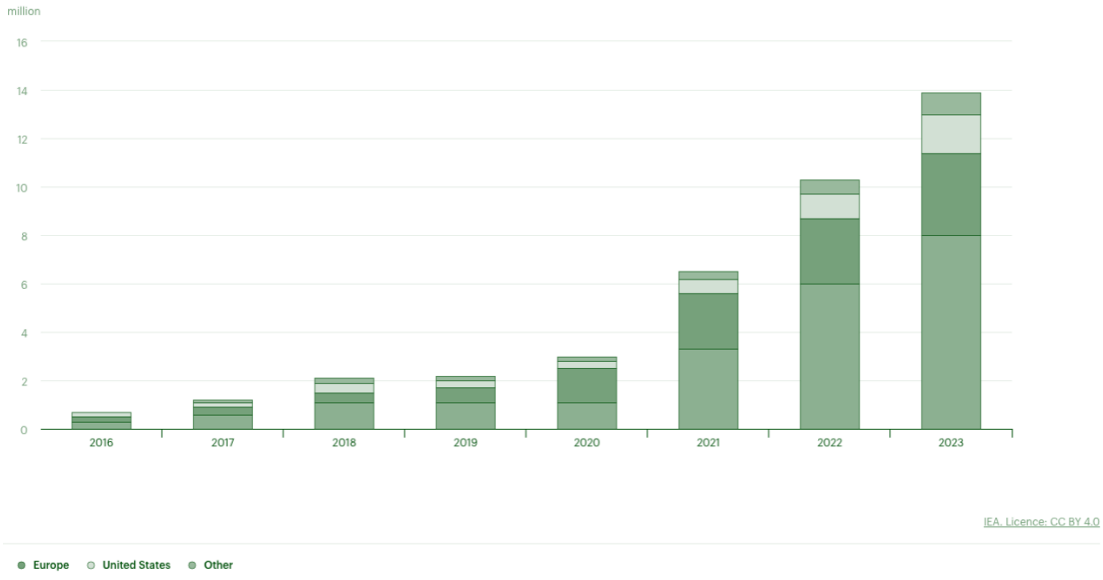

Figure 1- Electric Car Sales, 2016-2023. Source: IEA.

[12] Ibid.

[13] 'Everything has changed': foreign auto groups embrace local technology in China. Financial Times. (n.d.). https://www.ft.com/content/676941d1-43bd-4f5a-9f01-d3312bfa470d

In the upcoming years, pumped storage facilities are expected to play a crucial role in balancing China's power grid. According to Fitch China Power Report, this is due to the strong expansion of wind and solar energy generation, as well as the growing significance of storage in mitigating the intermittency of these renewable energy sources, especially with increased inter-provincial electricity trading. China is set to play a pivotal role in driving the growth of pumped hydropower storage capacity in Asia. The country is actively commissioning pumped hydropower stations as part of its efforts to achieve the National Energy Administration's ambitious target of reaching 62GW by 2025. This surge in hydropower capacity is indicative of China's commitment to meeting its energy goals and contributing to the region's overall energy landscape. With China's proactive stance on expanding pumped hydropower infrastructure, the country is poised to significantly impact the development and deployment of renewable energy resources in the region.

The increase in solar panel exports from China is contributing to fulfilling the rising need for clean and affordable energy. This demand is being driven by regions such as Europe and South Africa, which are striving to enhance their energy security. Solar power is projected to become the primary source of electricity capacity by 2027 and will play a crucial role in swiftly lowering emissions in the energy sector. Meeting the pathways that align with limiting global warming to 1.5 degrees Celsius necessitates a threefold increase in renewable capacity by 2030, with solar energy expected to have the most significant impact. With China holding approximately 80% of the global market share in solar manufacturing capacity, the export of solar panels from China is an essential metric for monitoring the shift to clean energy. In the first half of 2023, exports of solar panels from China saw a 34% increase, with the highest growth observed in Europe and Africa. Currently, China produces around eight out of every ten solar panels, and the surge in Chinese exports has worldwide implications for the expansion of clean energy.[14] This trend is significant as it reflects China's dominance in the solar industry and its influence on global efforts to adopt renewable energy sources.

[14] Hawkins, S. (2023, September 15). Solar exports from China Increase by a third. Ember. https://ember-climate.org/insights/research/china-solar-exports/

Implications on Global Markets and Relations

China's growing dominance in exporting green technology has profound implications for global markets and international relations. On one hand, it presents opportunities for collaboration and technology transfer, as countries seek to adopt sustainable energy solutions to address climate change. However, it also raises concerns about market competition, intellectual property rights, and geopolitical tensions. The expansion of China's influence in green technology markets could potentially reshape global supply chains and trade dynamics, prompting other countries to reassess their strategies and policies in response to China's growing economic and technological prowess.

The United States of America (USA) and the European Union (EU) have recently expressed their concerns regarding China's energy production, alleging that it exceeds its capacity and has resulted in disruptions to the global energy balance. US president Joe Biden stated that the Chinese government has been providing extensive subsidies to industries such as semiconductors, electric vehicles, and solar panels for an extended period. This has led to an oversupply of products that are then sold at unfairly low prices, putting other manufacturers at a disadvantage.[15] This issue has prompted discussions at both national and international levels as the impacted parties seek to address the challenges posed by these disruptions and work towards restoring equilibrium in the global energy sector. Us President has recently raised tariffs on clean energy products from China and increased the tariff on electric vehicles from 25 percent to 100 percent.[16] The assertions made by the USA and the EU have underscored the significance of maintaining stability and sustainability in energy production and consumption on a global scale. These concerns are part of ongoing dialogues and efforts to ensure that energy production aligns with global demand in a way conducive to all nations' well-being.

[15] Kelly, P. (2024, May 31). US tariff increases on China EV's have wider ramifications. Metro. https://metro.global/news/us-tariff-increases-on-china-evs-have-wider-ramifications/

[16] BBC. (n.d.). Çin'in Enerji ürünleri üretimindeki Atılımı Küresel Bir Ticaret Savaşına Yol Açabilir Mi? BBC News Türkçe. https://www.bbc.com/turkce/articles/c51nn2rvrl4o

III. The European Journey Towards Net-zero Emissions World

The EU is a global leader in the fight against climate change by producing strict regulations, innovative and binding policies and mechanisms within and outside its borders.[17][18] These regulations are designed as sanctions on energy efficiency and sustainability covering all members for the reduction of greenhouse gas emissions with innovative green transformation technologies to achieve carbon neutrality targets. For example, as a party to international multilateral treaties on behalf of all members, EU enacts laws and launches encompassing climate regulations binding all members and occasionally non-member states by using the mechanisms such as Council of Europe and the European Parliament.

Paris Agreement, which holds a legally binding international treaty status, is a milestone in the fight against Global Climate Change.[19] The agreement was an unprecedented global achievement on climate change action of the 21st Conference of the Parties (COP21) to the 1992 United Nations Framework Convention on Climate Change. The Paris Agreement aims to strengthen global sustainability and socioeconomic resilience against the jeopardy of climate change and targets a long-term goal keeping the global temperature increase as below 2°C as much as possible (at 1.5 degrees if possible) compared to the pre-industrialization period. This goal requires gradually reducing the use of fossil fuels (oil, coal) by adapting innovative renewable energy sources (e.g., Wind and Solar) and systemic changes to shift towards net zero emissions world.[20][21]

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[17] Exploring the potential implications of the EU's new Carbon Border Adjustment Mechanism for Southeast Asian economies. NewClimate Institute. (n.d.). https://newclimate.org/news/trading-off-exploring-the-potential-implications-of-the-eus-new-carbon-border-adjustment

[18] Hadjiyianni, I. (2020, December 3). The European Union as a global regulatory power. OUP Academic. https://academic.oup.com/ojls/article-abstract/41/1/243/6017945?redirectedFrom=fulltext

[19] United Nations. (n.d.). The Paris Agreement. United Nations. https://www.un.org/en/climatechange/paris-agreement

[20] Iklim.gov.tr. (n.d.). Paris Anlaşması. İklim Değişikliği Başkanlığı. https://iklim.gov.tr/paris-anlasmasi-i-34

[21] Fit for 55 - the EU's plan for a green transition - consilium. European Council. (n.d.). https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55/

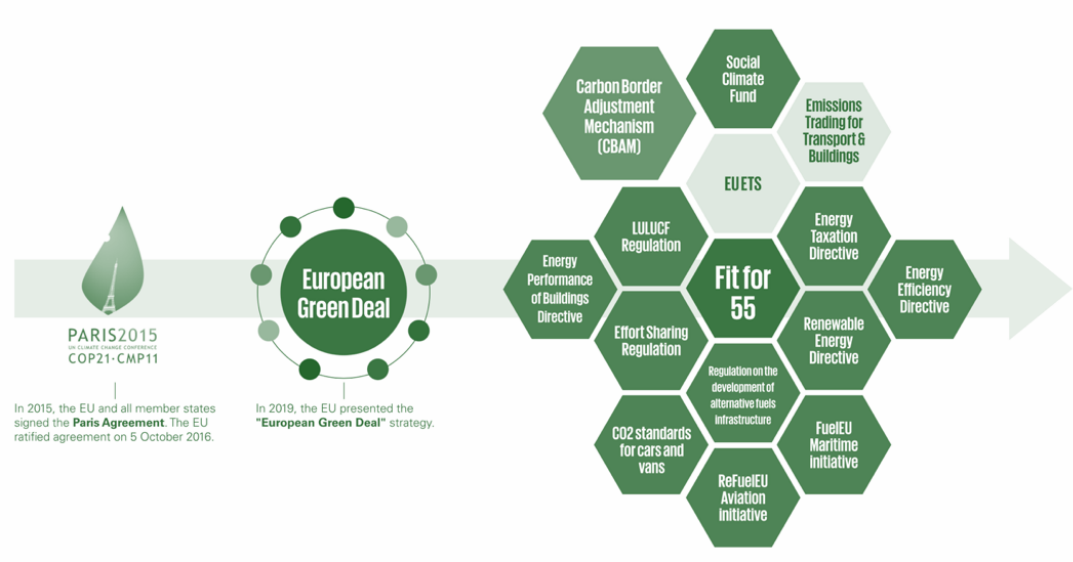

Figure 2- From Paris Agreement to CBAM Regulation, Source: KPMG.

The **European Green Deal**, introduced in 2019 and entered into force in 2020, is a strategic policy roadmap designed to make the EU carbon-neutral by 2050.[22] The strategy, which determines many dynamic and radical transformations, is a unique initiative for green transformation European-wide, aiming to transform the EU into a modern, resource-efficient and competitive economy with a holistic and sustainable strategies against climate change.[23] At the European level, its importance was recognised during and after the Covid-19 pandemic, which has shaken the world socio-economically and whose effects are still felt today. For instance, Green Deal is also seen as a safer of the EU from COVID-19 pandemic, with almost €1.5 trillion investments in single market and innovation, cohesion and resilience from the Next Generation EU Recovery Plan.[24]

[22] The European Green deal. European Commission. (n.d.). https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

[23] United Nations. (n.d.). Paris Agreement. Sustainable Development Goals Knowledge Platform. https://sustainabledevelopment.un.org/frameworks/parisagreement/

[24] Recovery plan for Europe. European Commission. (n.d.-a). https://commission.europa.eu/strategy-and-policy/recovery-plan-europe_en#:~:text=NextGenerationEU%20is%20a%20more%20than,the%20current%20and%20forthcoming%20challenges

Under the European Climate Law, aligning with the European Green Deal the EU has committed to reduce net greenhouse gas emissions by at least 55% compared to 1990 by 2030. The 'Fit for 55' legislative package is a framework making all sectors of the EU economy fit to achieve this goal. It puts the EU-members on track to achieve its climate goals in a fair, cost-effective and competitive way.[25]

Adapted and regulated 15 Fit for 55 proposals by EU[26]:

- **EU Emissions Trading System (ETS) Reform**: Adopted changes to the EU's carbon market to make it more ambitious, including extending it to maritime transport and reducing emission allowances.
- **New Emissions Trading System**: Implemented for mainly building and road transport fuels.
- **Social Climate Fund**: Established to support citizens in the transition.
- **Effort Sharing Regulation**: Adopted to ensure member states' accountability for emissions reduction.
- **Land Use, Forestry, and Agriculture Regulation (LULUCF)**: Adopted to address emissions and removals from land use and forestry.
- **CO2 Emissions Standards**: Updated for cars and vans to reduce emissions.
- **Carbon Border Adjustment Mechanism (CBAM)**: Adopted to prevent carbon leakage and promote global decarbonization.
- **Renewable Energy Directive**: Adopted to increase the use of renewable energy sources.
- **Energy Efficiency Directive**: Adopted to improve energy efficiency.
- **Alternative Fuels Infrastructure Regulation (AFIR)**: Adopted to support the deployment of alternative fuel infrastructure.
- **ReFuel EU Aviation Regulation**: Adopted to promote sustainable aviation fuels.

[25] Fit for 55: Delivering on the proposals. European Commission. (n.d.-a). https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal/fit-55-delivering-proposals_en
[26] Ibid.

- **FuelEU Maritime Regulation**: Adopted to reduce the environmental impact of maritime transport.
- **Energy Performance of Buildings Directive**: Updated to improve the energy performance of buildings.
- **Decarbonisation of Gas Markets**: Adopted updated rules to promote hydrogen and decarbonize gas markets.
- **EU Methane Regulation**: Implemented for the energy sector to reduce methane emissions.

These measures are designed to track the progress of the EU's commitment to the Paris Agreement and its own climate targets determined by Green Deal.

While "Fit for 55" brought radical regulations at the EU level, especially against climate change, its sanctions on global trade relations also had radical effects on countries and businesses exporting to the EU. Reminding EU's Life Cycle Assessment (compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle[27][28]), the Carbon Border Adjustment Mechanism (CBAM) has brought the obligation of exporting countries to EU to be a partner in global decarbonization efforts and, ultimately, the obligation to make intense systemic investments, if they want to maintain trade relations with the EU.

Carbon Border Adjustment Mechanism (CBAM)

CBAM was introduced as part of the European Green Deal and the Fit for 55 frameworks, and it is a tool designed for countries with less strict climate policies, carbon tracking mechanisms and regulations at the production stages.[29][30] CBAM, which provides the EU with

[27] Life cycle assessment (LCA). European Commission. (n.d.-b). https://eplca.jrc.ec.europa.eu/lifecycleassessment.html
[28] European Commission, Joint Research Centre, Cristobal-Garcia, J., Pant, R., Reale, F. (2016). *Life cycle assessment for the impact assessment of policies*, Publications Office. https://data.europa.eu/doi/10.2788/318544
[29] Ibid.
[30] Carbon Border Adjustment Mechanism. Taxation and Customs Union. (n.d.). https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

the characteristics of being a global regulatory power in climate policies, effectively exports environmental standards and forces exporter countries that trade or develop a trade strategy with the EU to implement sustainable climate policies. Essentially, it also encourages countries that are not parties to the Paris Agreement to coercive regulations.

As a means of setting a fair price on carbon emitted during the production of carbon-intensive goods entering to the EU, the CBAM ensures that the carbon price of imports is equivalent to the carbon price of goods produced within the EU, preventing the EU's Paris Agreement and European Green Deal goals from being undermined.[31]

The CBAM instrument, which came into effect on October 1, 2023, with the reporting requirement phase and will be fully operational as of January 1, 2026, applies to the import of selected products which have carbon-intensive production phases: Fertilizer, energy (sectors like battery, EVs, green technologies) hydrogen, cement, iron and steel and aluminium (See Fig 3).

Figure 3- Products initially covered by CBAM. Source: KPMG.

According to KPMG's recent report, these products account for 45% of the EU ETS sectors.[32] EU importer of these goods under the CBAM will register with the national authorities where they can purchase the CBAM certificates by 1st January 2025 with CBAM Authorization. The

[31] Ibid.
[32] Eu Carbon Border Adjustment Mechanism (CBAM). KPMG. (n.d.-a). https://kpmg.com/xx/en/home/insights/2021/06/carbon-border-adjustment-mechanism-cbam.html

price of the CBAM certificates will be calculated based on the weekly average auction price of the EU ETS allowances (which will be replaced by CBAM by 2034), expressed in CO2 €/tonne emitted during the production of the product to be imported.

CBAM Influence on Global Trade and Green Transition

Since the introduction of the CBAM in 2019, its multifaceted implications for global trade and green transition are still being debated. The EU's regulatory effects in terms of global climate action; The development of Data and Traceability Based New Business Models[33], its role in advancing EU integration[34], its compelling effects on encouraging Green Transition Innovations and technological transformations within and outside Europe[35] are the main ones. Announcing CBAM, UNTAD (2021)'s comprehensive report based on 2019 Export value of CBAM-relevant commodities to the EU included very striking trading data findings, especially for the 20 countries that will be most exposed to the CBAM's devastating and expensive impacts (See Fig 4).

[33] Case Studies on the Regulatory Challenges Raised by Innovation and the Regulatory Responses. OECD iLibrary. (n.d.). https://www.oecd-ilibrary.org/sites/70df2cab-en/index.html?itemId=%2Fcontent%2Fcomponent%2F70df2cab-en

[34] DI, B. A., BASYTE, F. E., SMITS, P., & HARDY, M. Modelling for EU Policy Support: Analysis of the Use of Models in European Commission's Impact Assessments in 2019-2022.

[35] Case Studies on the Regulatory Challenges Raised by Innovation and the Regulatory Responses. OECD iLibrary. (n.d.). https://www.oecd-ilibrary.org/sites/70df2cab-en/index.html?itemId=%2Fcontent%2Fcomponent%2F70df2cab-en

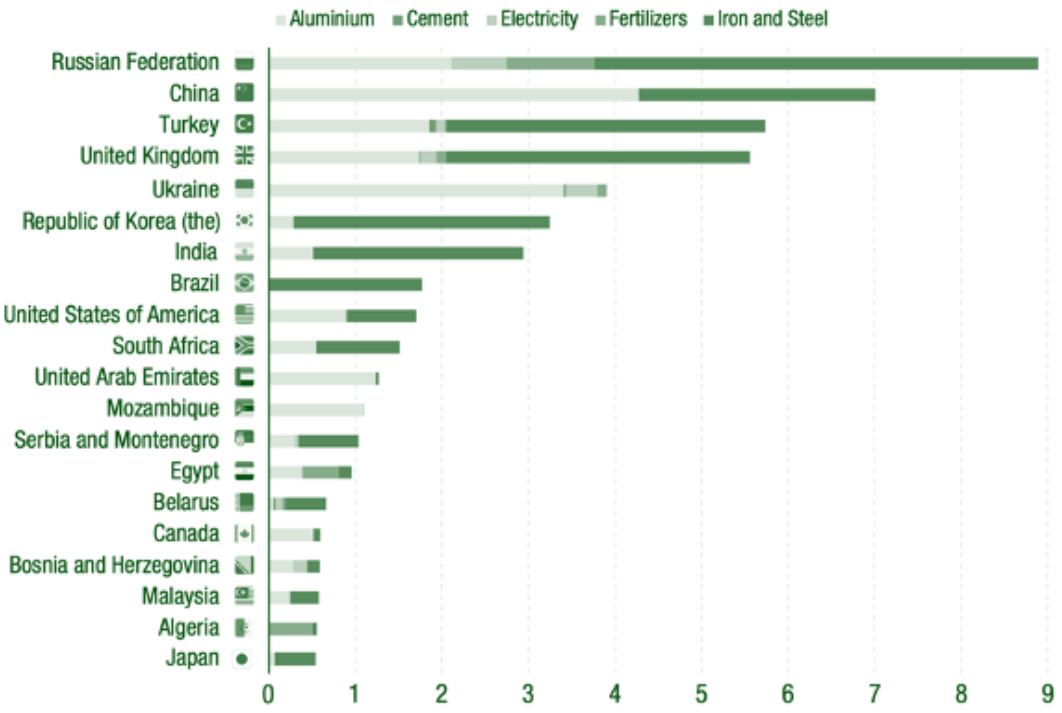

Figure 4- Exports to the European Union 2019 in selected sectors likely to be considered in the CBAM. 20 Most exposed countries in terms of aggregated value of exports (billion $). Source: UNCTAD.

According to 2019 data, the commodity exports of countries such as Russia, China and Turkiye within the scope of CBAM have a value of 8.7, 7 and 5.6 billion dollars, respectively, while the United States, which is the subject of this report, has an export value of 2.8 billion dollars.

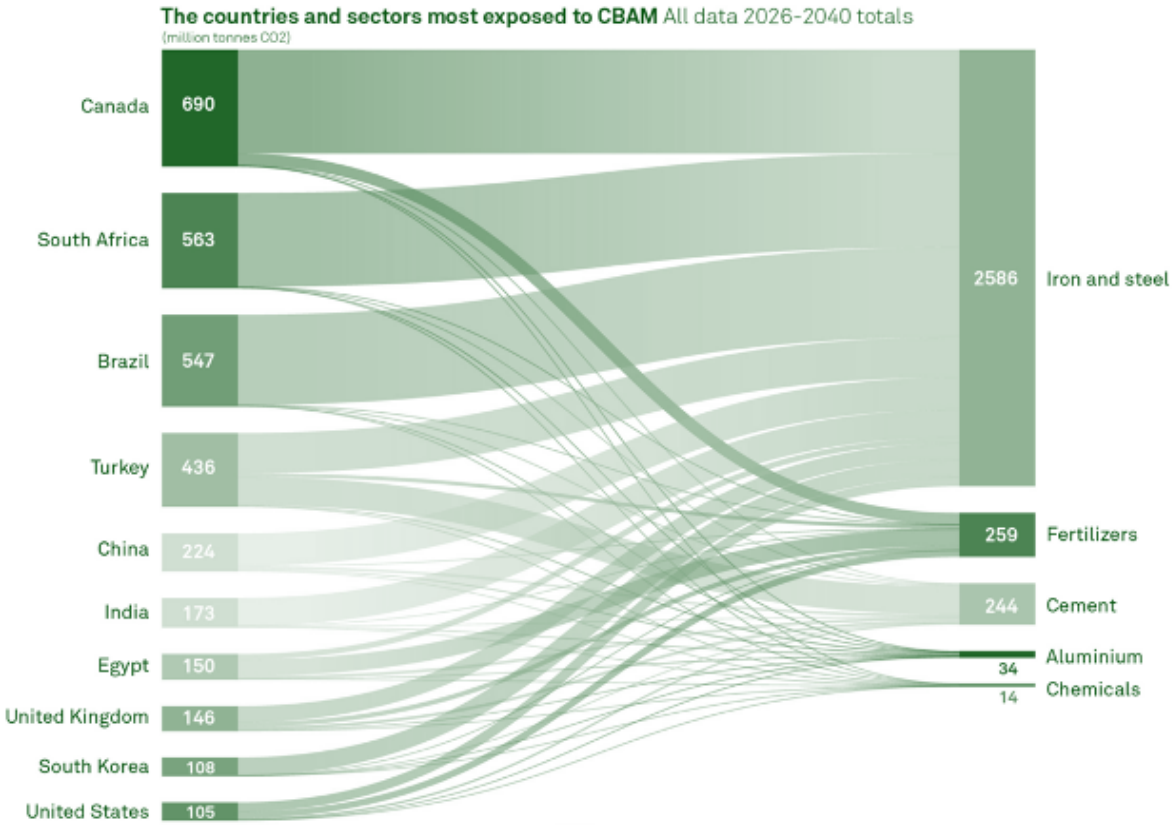

Figure 5- Developing economies hit hardest by EU's carbon border tax. Source: S&P Global Commodity Insights, Global Trade Atlas. Copyright (2023) by S&P Global Inc. (Developed by Eklavya Gupte & Nick Coles)

A broad perspective on the 2026 – 2040 projections on the countries and sectors that will be exposed to the CBAM from 2026 onwards was provided by S&P Global Commodity Insights in February 2023[36] (See Fig 5). While China and the United States, which are the subject of the 2021 UNTAD report above, are expected to reduce their exposure. However, it shows that countries such as Canada, Turkiye and South Africa will be most exposed to the CBAM mechanism, with iron and steel being by far the largest targeted sector with 2.586 million tonnes CO2.

[36] Gupte, E. (2023, February 24). Infographic: Developing economies hit hardest by EU's Carbon Border Tax. S&P Global Commodity Insights. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/022423-infographic-cbam-countries-hit-hardest-eu-carbon-border-tax

Statista reports[37] that EU Emissions Trading System's (EU-ETS) carbon allowances are estimated to average 65 euros per metric ton of carbon dioxide (tCO_2e). However, 65 euros/tCO_2e is also projected to more than double by the end of the 2030 to almost 150 euros/tCO_2e, before reaching nearly 200 euros/tCO_2e by 2035. It is expected that when the average scenario outputs are analysed, the CBAM mechanism could rise more than US$80 billion for EU per year by 2040.[38]

High cost of CBAM mechanism to exposed countries, encourage other countries to develop their ETS systems since the CBAM recognizes the carbon pricing policies in the countries of origin.[39] For example, Turkiye, one of the countries that will be most exposed to CBAM, recently has completed and published a report titled "The Potential Impact of the CBAM on the Turkish Economy"[40]. It is stated that if the CBAM cost rises to 150 €/tCO2e, as the Statista data given above, it will impose a financial burden of 2.5 billion Euros annually on the Turkish Economy until 2032. In this context, report with various scenarios reveals that if Turkiye implements a 20€/tCO2e local ETS, the potential CBAM costs to the Turkish sector can be reduced to €56 million per year by 2027, and if a scenario such as the €50/tCO2e Turkish-ETS is implemented, CBAM costs can decrease to €1.08 billion annually by 2032, reducing costs by €1.5 billion.

Nonetheless, reports and research reveal that the CBAM's mechanism for carbon leakage will have positive results on carbon emissions with diverse challenges. For example, Perdana et al. (2022) state that this mechanism will reduce the leakage rate by a one-third by 2040 and

[37] Published by Ian Tiseo, & 8, M. (2024, May 8). Forecast EU-ETS Carbon Prices 2024-2035. Statista. https://www.statista.com/statistics/1401657/forecast-average-carbon-price-eu-emissions-trading-system/#:~:text=Europ%20ean%20Union%20Emissions%20Trading%20System,200%20euros%2FtCO

[38] Eu Carbon Border Adjustment Mechanism to raise $80B per year by 2040. S&P Global. (n.d.). https://www.spglobal.com/esg/insights/featured/special-editorial/eu-carbon-border-adjustment-mechanism-to-raise-80b-per-year-by-2040

[39] Carbon Border Adjustment Mechanism. Taxation and Customs Union. (n.d.). https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

[40] Potential effects of the carbon border adjustment mechanism on the Turkish economy has been completed. Directorate of Climate Change. (n.d.). https://iklim.gov.tr/en/potential-effects-of-the-carbon-border-adjustment-mechanism-on-the-turkish-economy-has-been-completed-news-4148

conclude that it will also lead to a loss of welfare in Low Development Countries.[41] Similarly, the UNTAD 2021[42] report states that the CBAM mechanism can help prevent "carbon leakage", but its impact on climate change will be limited – with only a 0.1% reduction in global CO2 emissions due to expected higher trade costs and challenges for non-EU and developing countries.

S&P Global Commodity Insights (2023)[43] reported CBAM from 2026 onwards will have costly impacts on non-EU countries (See Fig 6). According to the 2026-2040 projection, which is the subject of the report, countries exporting products to the EU are forced to make large investments for CBAM mechanism liabilities. Considering the uncertainty on minerals in the production of Lithium-ion batteries (such as lithium, cobalt, nickel and manganese) which are the leading components for green transformation and e-transport technologies, the CBAM's potential costs to Africa as a natural resource is undeniable.[44] [45]

[41] Perdana, S., & Vielle, M. (2022). Making the EU Carbon Border Adjustment Mechanism acceptable and climate friendly for least developed countries. *Energy Policy*, *170*, 113245.
[42] EU should consider trade impacts of new climate change mechanism. UNCTAD. (2021, July 14). https://unctad.org/news/eu-should-consider-trade-impacts-new-climate-change-mechanism
[43] Gupte, E. (2023a, February 24). Infographic: Developing economies hit hardest by EU's Carbon Border Tax. S&P Global Commodity Insights. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/022423-infographic-cbam-countries-hit-hardest-eu-carbon-border-tax
[44] Bridge, G., & Faigen, E. (2022). Towards the lithium-ion battery production network: Thinking beyond mineral supply chains. *Energy Research & Social Science*, *89*, 102659.
[45] Goodenough, K., Deady, E., & Shaw, R. (2021). Lithium resources, and their potential to support battery supply chains. *Africa. Nottingham: British Geological Survey*.

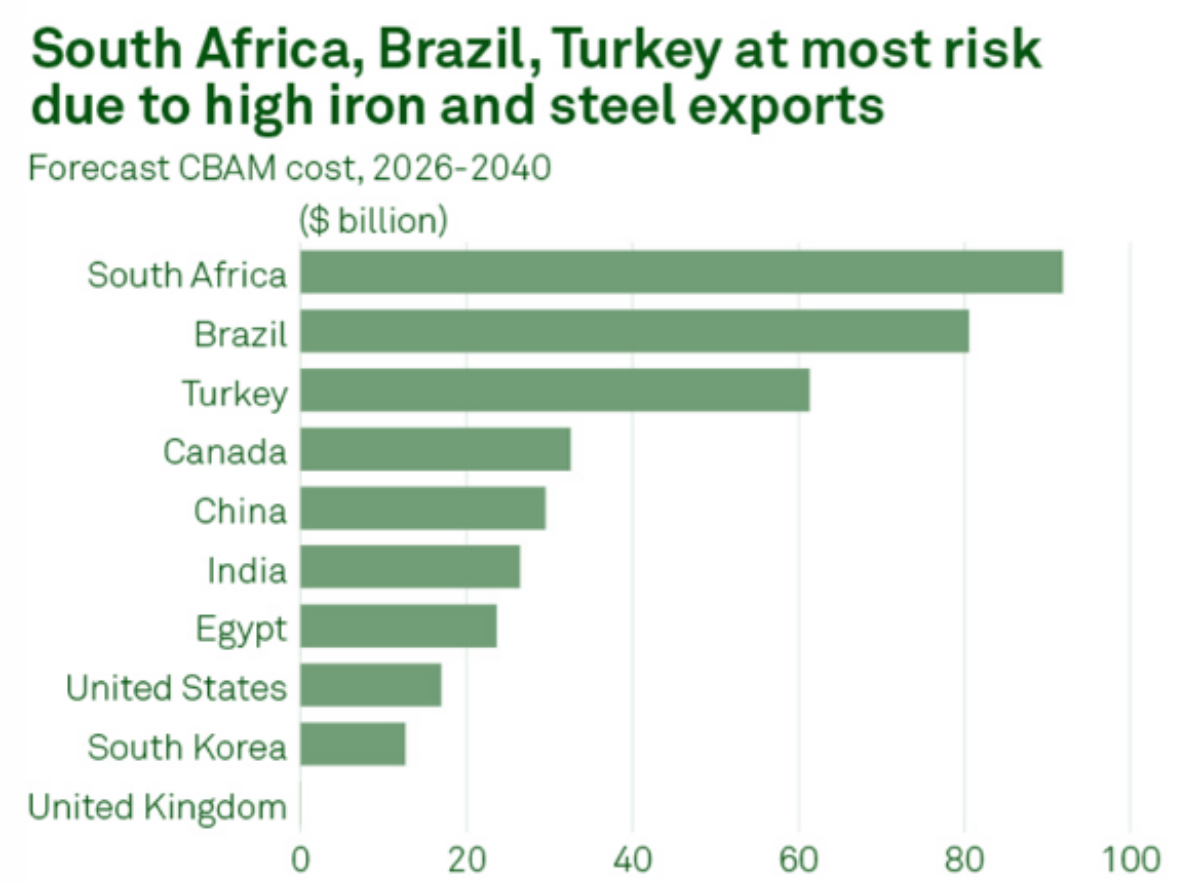

Figure 6- South Africa, Brazil, Turkey at most risk due to high iron and steel exports. Source: S&P Global Commodity Insights, Global Trade Atlas. Copyright (2023) by S&P Global Inc. (Developed by Eklavya Gupte & Nick Coles)

Considering facts in Fig 6, when we look at the expected costs of CBAM to these countries between 2026 and 2040; for instance, it is expected to cost South Africa $90 billion, China $25 billion and the United States about $18 billion.[46]

Three main interpretations can be made. Firstly, the CBAM's achievement of the 2030 (by 55%) and 2050 (carbon-neutral EU) targets for climate change as an emission reduction

[46] Gupte, E. (2023a, February 24). Infographic: Developing economies hit hardest by EU's Carbon Border Tax. S&P Global Commodity Insights. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/022423-infographic-cbam-countries-hit-hardest-eu-carbon-border-tax

mechanism is still far from concrete data. Secondly, the countries that are the subject of the CBAM and the EU-member companies that import from these countries will face a high cost and, as a result, drastic price increases in domestic market[47]. As a result, both domestic and foreign producers selling in the EU will face more pressure to invest in higher-cost, low-emission technologies. Thirdly, and most importantly, countries and sectors operating non-EU that will be exposed to CBAM will turn to countries with softer carbon mechanisms and higher profit-cost ratios, which in this scenario seems very likely to cause destruction in both the EU's input products and the domestic market.

In particular, the commodity exporting countries to the EU face various challenges in addition to the expected high cost of CBAM exposure. Although it is difficult to anticipate the long-term effects of these restrictions, CBAM adaptation phases for Developing and Low-Developing exporting countries can be summarized within four main challenges.

1. **Inadequate Resources:** One of the key challenges is the lack of accountable and transparent systems for tracking carbon emission metrics in non-EU countries especially in developing countries. Further, they tend to be constantly funded for integration into large-scale regulatory systems such as CBAM.[48]
2. **Lack of Skilled Experts and Conceptual Complexity:** The technical complexity of EU regulations requires an inclusive collaborative effort of highly skilled experts, especially in the interpretation and integration of these regulations[49]. In fact, the World Bank has published a special technical note to overcome the slippage in these technical issues.[50] Technical Note on the CBAM Exposure Index aims to clarify the confusion of technical concepts such as the mathematical measurement of CBAM

[47] Playing by new rules: How the CBAM will change the world. Wood Mackenzie. (2023, September 21). https://www.woodmac.com/horizons/how-the-cbam-will-change-the-world/
[48] Challenges faced by developing countries in competition and regulation in the maritime transport sector. UNCTAD. (n.d.). https://research.un.org/en/docs/unsystem/unctad
[49] Preston, C., Dias, M. F., Peña, J., Pombo, M. L., & Porrás, A. (2020). Addressing the challenges of regulatory systems strengthening in small states. *BMJ Global Health*, *5*(2), e001912.
[50] World Bank Group. (2023, June 15). Technical note for the CBAM exposure index. World Bank. https://www.worldbank.org/en/topic/trade/brief/technical-note-for-the-cbam-exposure-index

exposure, the Relative CBAM Exposure Index, and even the aggregate relative CBAM exposure index.

3. **Long-run Trade Sanctions in EU:** EU-SMEs operating such as in the fertiliser, iron and steel and especially green energy sectors might experience major impacts within the scope of necessary imported intermediate goods. Although some structural initiatives have been made by the EU on how these expected structural problems in imported minerals and commodities required to produce such as batteries, especially in the energy sector, will affect the production systems of SMEs operating in the EU, there is no concrete study on the long-term effects of CBAM on EU-SMEs.[51][52][53]

4. **Regulatory Differences:** Plausibly the most problematic challenge is the differentiating regulatory emission frameworks[54]. While countries such as Russia, China, South Africa, Brazil and Turkey are among the main exporters of CBAM's commodities to the EU, the EU is not the only market for those countries' businesses operating in these sectors. These SMEs export commodities, which is included in the CBAM, also to non-EU countries. In this regard, evidently, those SMEs are put in a single-preference strategy development position in the face of differing regulations. Because, supposedly, if a business running in non-EU country, binding to CBAM, exports commodities to the EU, and the non-EU counties with softer regulations have higher profit expectations and market share than EU, then the final decision become obvious.

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[51] Preston, C., Dias, M. F., Peña, J., Pombo, M. L., & Porrás, A. (2020). Addressing the challenges of regulatory systems strengthening in small states. *BMJ Global Health*, *5*(2), e001912.

[52] Challenges faced by developing countries in competition and regulation in the maritime transport sector. UNCTAD. (n.d.). https://research.un.org/en/docs/unsystem/unctad

[53] EU actions to overcome challenges of small and medium-sidez enterprises (SMEs). European Parliament. (n.d.). https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/653630/EXPO_BRI(2021)653630_EN.pdf

[54] Challenges and concerns for small and medium-sized enterprises (SMEs). European Parliament. (n.d.-a). https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/653629/EXPO_BRI(2021)653629_EN.pdf

Impact on China and US

With the European Green Deal, the EU has included the CBAM mechanism in its regional climate targeting regulations within the framework of "Fit for 55" and has enabled almost all countries that have trade relations in the commodities included in the scope of CBAM to focus on carbon mechanisms. Designed to operate in accordance with World Trade Organization (WTO) rules, CBAM has also increased the risks of retaliation from other countries to the EU.[55]

Based on 2022 trade data, CBAM covers only about 3.5 billion euros with a rate of 1.1% of the total volume of approximately 340 billion euros that the USA exports to the EU, while China's CBAM-based exports reaches approximately 17 billion euros.[56][57] When we examine the expected emission values of the sectors that will be exposed to CBAM in the long term between 2024 and 2040, it is expected that total emission of China likely to be 224 million tons of CO2, whilst total emission is 105 million tons of CO2 for the US.[58] Reminding the Statista report[59], it is projected that by the end of the 2030 carbon allowances under EU ETS would be almost 150 euros/tCO_2e, before reaching nearly 200 euros/tCO_2e by 2035. Considering the low volume of CBAM-based exports of the United States[60], United States is a much larger producer of carbon-efficient CBAM comprehensive products than its Chinese

[55] World Bank Group. (2024, May 21). Global Carbon Pricing Revenues Top a Record $100 Billion. https://www.worldbank.org/en/news/press-release/2024/05/21/global-carbon-pricing-revenues-top-a-record-100-billion

[56] Potential CBAM impacts on U.S. industry. Climate Leadership Council. (2024, April 12). https://clcouncil.org/blog/potential-cbam-impacts-on-u-s-industry/

[57] (ITC), I. T. C. (n.d.). Trade Statistics for International Business Development. ITC. https://www.trademap.org/Index.aspx

[58] Gupte, E. (2023, February 24). Infographic: Developing economies hit hardest by EU's Carbon Border Tax. S&P Global Commodity Insights. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/022423-infographic-cbam-countries-hit-hardest-eu-carbon-border-tax

[59] Forecast EU-ETS Carbon Prices 2024-2035. Statista. https://www.statista.com/statistics/1401657/forecast-average-carbon-price-eu-emissions-trading-system/#:~:text=European%20Union%20Emissions%20Trading%20System,200%20euros%2FtCO%E2%82%82e%20by%202035

[60] Carbon dioxide emissions embodied in International Trade. OECD. (n.d.). https://www.oecd.org/sti/ind/carbondioxideemissionsembodiedininternationaltrade.htm

competitors[61]. Further there is an ambiguity of the verification and integrity of emission data under the China Certified Emission Reduction scheme (CCER) and China ETS mechanism and China's national ETS mechanism only covers electricity [62] and it is effective only in some regions[63]. Given these circumstances, while CBAM will impose heavy burdens, especially on China during importers start to pay, it seems that U.S. companies, which have the most integrated trade relations with EU[64], are already competitive in the CBAM-covered sectors in Europe and their market penetration will be increasing in the long term.

Section Summary

Evidently, by European Green Deal and CBAM, EU is leading climate policies and innovations for green transition, not only regionally, but also globally, with strict regulations on climate action, and especially in other countries in trade relations. CBAM, which will be effective in 2026, aims to bring radical changes in the sectors it covers. Nonetheless, pitfalls are being waited to be solved, especially long-term impacts on global trade and developing country economies.[656667]

Considering CBAM's expected cost of $90B on South African economy, countries exposed to CBAM and link partially their welfare growth to the export of some CBAM-covered products, are far from covering CBAM's liabilities. This fact is even subject to criticism such as Trap of

[61] Potential CBAM impacts on U.S. industry. Climate Leadership Council. (2024, April 12). https://clcouncil.org/blog/potential-cbam-impacts-on-u-s-industry/
[62] Zhang, C., & Lin, B. (2024). Impact of introducing Chinese certified emission reduction scheme to the carbon market: Promoting renewable energy. *Renewable Energy*, *222*, 119887.
[63] CBAM and its implications for companies in China. Deloitte China. (2022, October 10). https://www2.deloitte.com/cn/en/pages/risk/articles/esg-cbam-china-implications.html
[64] EU trade relations with United States. European Commission. (n.d.-a). https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/united-states_en
[65] Brandi, C. (1970, January 1). Priorities for a development-friendly EU Carbon Border Adjustment (CBAM). EconStor. https://www.econstor.eu/handle/10419/242609
[66] Magacho, G., Espagne, E., & Godin, A. (2024). Impacts of the CBAM on EU trade partners: consequences for developing countries. *Climate Policy*, *24*(2), 243-259.
[67] Lim, B., Hong, K., Yoon, J., Chang, J. I., & Cheong, I. (2021). Pitfalls of the eu's carbon border adjustment mechanism. *Energies*, *14*(21), 7303.

Green Colonialism[68]. Although the CBAM enables ETSs in origin countries be considered, the complexity of verifying and integrity of emissions embedded in imports brings challenges[69]. Particularly, the concerns expressed at COP28 (e.g., the CCER (Chinese ETS) is a simple tool for greenwashing, and China's openly saying "if you want to lead the world, you should stop your CBAM" and "China would set its climate targets based on the country's own pace of technological and economic development")[70]; or as UNTAD's 2021[71] report asserts "CBAM's impact on climate change would be limited – only a 0.1% drop in global CO2 emissions – with higher trade costs for developing countries", it can be claimed that CBAM is not only climate-focused, but also a *soft-power mechanism* of a carbon-tax-based new world system.

IV. United States' Climate Financing

As one of the world's largest economies and the second largest emitter of greenhouse gases, the US has an important role to play in addressing climate change and, in particular, green climate finance.[72] Although the US, which has set 2050 as a net-zero emission target like the European Union, is a party to the Paris Agreement today, the US's Paris Agreement commitments have witnessed ups and downs. The US, which was one of the first parties to the agreement, stated in 2017 that it would withdraw from the agreement during the President Trump Period, continue its fight against climate change by taking into account its own economic, financial and technological dynamics, and officially withdrew from the

[68] Raul. (2023, October 5). CBAM: The path to sustainable trade or the trap of green colonialism?. REVOLVE. https://revolve.media/interviews/cbam-sustainable-trade-or-green-colonialism
[69] Perdana, S., & Vielle, M. (2022). Making the EU Carbon Border Adjustment Mechanism acceptable and climate friendly for least developed countries. *Energy Policy*, *170*, 113245.
[70] Yin, I., & Transition, M. S.-E. (2023, December 4). COP28: China, Eu face uphill battle to coordinate carbon policies. S&P Global Commodity Insights. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/120423-cop28-china-eu-face-uphill-battle-to-coordinate-carbon-policies
[71] EU should consider trade impacts of new climate change mechanism. UNCTAD. (2021a, July 14). https://unctad.org/news/eu-should-consider-trade-impacts-new-climate-change-mechanism
[72] Jaeger, J., & Saha, D. (2020b, July 28). 10 charts show the economic benefits of US Climate Action. World Resources Institute. https://www.wri.org/insights/10-charts-show-economic-benefits-us-climate-action

agreement on November 4, 2019.[73] With the decision of President Biden, the winner of the presidential elections in 2020, US decided to become a party to the Paris Agreement again on January 20, 2021, and continues the climate change combat with radical policy and financial reforms [74]

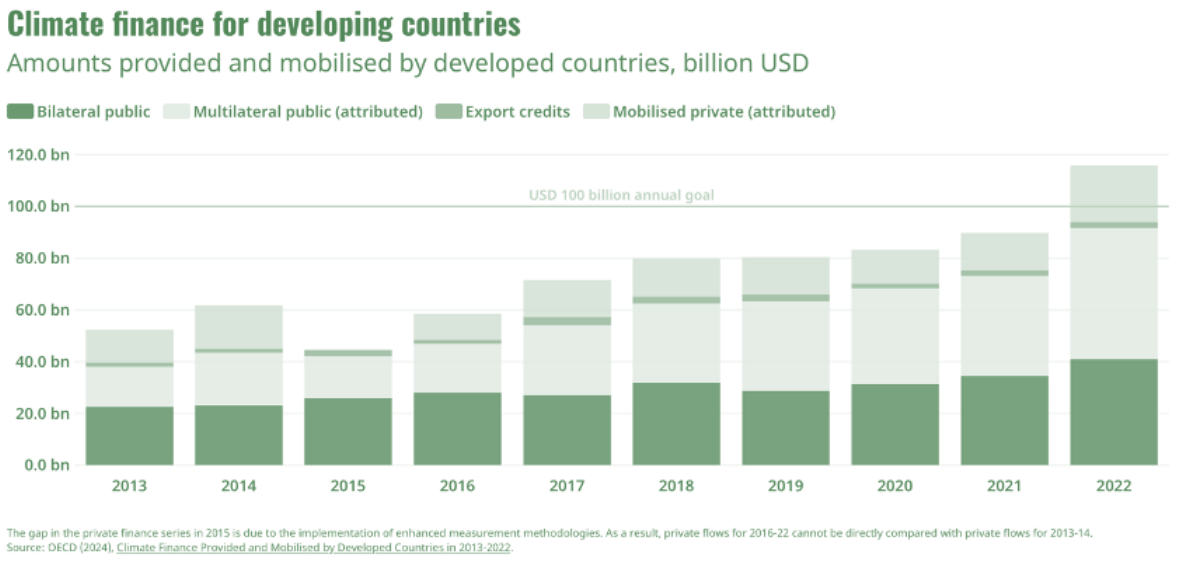

Figure 7- Climate Finance Provided and Mobilized by Developed Countries in 2013-2022. Source: OECD.

The U.S. government also attaches great importance to climate finance to developing countries. The climate finance mechanism of developed countries, which was first committed to the UNFCCC at the 2009 Copenhagen COP15, exceeded the $100Bn target for the first time in 2022 with $115.9Bn in 2022, according to the OECD's 2024 process report[75]. Considering China's contribution of $3.1Bn[76] and the EU's total contribution of €28.5Bn[77], the

[73] On the U.S. withdrawal from the Paris Agreement - United States Department of State. (n.d.-c). https://2017-2021.state.gov/on-the-u-s-withdrawal-from-the-paris-agreement/

[74] The United States officially rejoins the Paris Agreement. United States Department of State. (n.d.). https://www.state.gov/the-united-states-officially-rejoins-the-paris-agreement/

[75] Climate Finance and the USD 100 billion goal. OECD. (n.d.-b). https://www.oecd.org/climate-change/finance-usd-100-billion-goal/

[76] You, X. (2023, June 7). Confusion surrounds China's pledged climate finance towards the global south . Climate Home News. https://www.climatechangenews.com/2023/06/07/china-climate-finance-global-south-southsouth-xi-jinping/

[77] Financing the climate transition. European Council. (n.d.-a). https://www.consilium.europa.eu/en/policies/climate-finance/

US contribution to developing countries in global climate finance is approximately $11Bn[78], making the US the leader in global climate finance.[79]

Considering the damage of climate change-based catastrophes of over $100Bn to the US economy by according to 2020 data, the US economy and financial system are also at great risk. Recognizing this, in 2021 the US published A Roadmap for Safeguarding the U.S. Economy, which is based on a large-scale study of Climate-Related Financial Risk on US economy.[80] The roadmap defines these risks as physical risk to U.S. companies and publicly traded securities due to the effects of climate change and extreme climate-disasters, and transition risk as the global shift away from carbon-intensive economies put risk and create opportunity to US companies, communities, and workers.

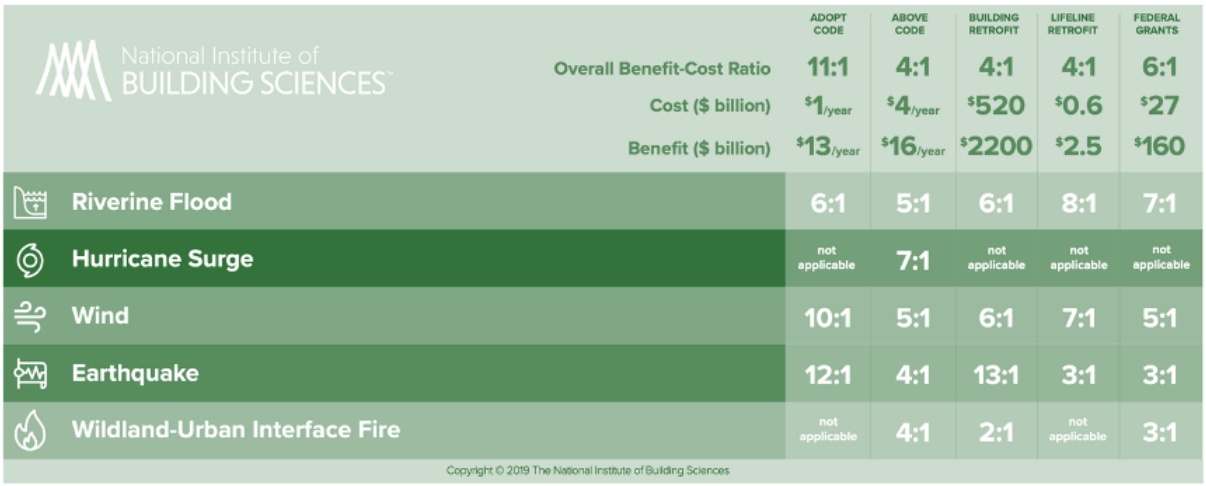

Figure8- Nationwide average benefit-cost ratio by hazard and mitigation measure. Source: NIBS.

[78] Progress report on president Biden's climate finance pledge. U.S. Department of State. (n.d.). https://www.state.gov/progress-report-on-president-bidens-climate-finance-pledge/

[79] Gerretsen, I. (2021, September 21). US to double climate finance again, but gap remains to $100bn. Climate Home News. https://www.climatechangenews.com/2021/09/21/us-double-climate-finance-gap-remains-100bn/

[80] The White House. (n.d.). A roadmap to build a climate-resilient economy. U.S. Climate-Related Financial Risk Executive Order 14030. https://www.whitehouse.gov/wp-content/uploads/2021/10/Climate-Finance-Report.pdf

About 250 US financial firms have also set a net-zero target by 2050 and whose total asset values exceed $88 trillion, fall into this risk category.[81] Likewise, as mentioned in the same 2021 US roadmap strategy, based on 2019 data of NIBS, $1 invested by the public or the private sector in adopting more climate-resilient codes, $11 are saved in averted disaster costs,[82] thus, the US is conducting a very comprehensive mobilization effort on public and private climate finance mechanisms to support the transformation to a net-zero US economy to reduce its own financial risks (See Fig 8).

Climate Initiatives and Investments in US

The U.S. invests in renewable energy, low-carbon transportation, energy infrastructure and green transformation innovations, especially in sectors under climate-related financial risks, through various regulatory mechanisms and climate finance instruments.[83] In this sense, the most inclusive regulation is considered to be the US Inflation Reduction Act (IRA), which was passed in 2022[84], making the IRA the largest single climate finance investment vehicle in American history, as it allocates more than $370B in funds to more than 280 clean energy projects[85] to mitigate the possible risks of climate change.[86] These investments are expected to grow steadily and reach $9-12 trillion annually by 2030.[87] The IRA includes many units of economic incentives that can make a wide range of sector-based climate technologies

[81] Ibid.
[82] Mitigation saves up to $13 per $1 invested. National Institute of Building Services. (n.d.). https://www.nibs.org/files/pdfs/ms_v4_overview.pdf
[83] Atalla, G., Mills, M., & McQueen, J. (2022, May 13). Six ways that governments can drive the green transition. EY. https://www.ey.com/en_us/insights/government-public-sector/six-ways-that-governments-can-drive-the-green-transition
[84] Inflation reduction act of 2022. Internal Revenue Service. (n.d.-b). https://www.irs.gov/inflation-reduction-act-of-2022
[85] Nieuwenhuijzen, V., Willner, M., Reinders, S., & Utkarsh, A. (2023, October 31). The US inflation reduction act is driving clean-energy investment one year in. Goldman Sachs. https://www.gsam.com/content/gsam/uk/en/institutions/market-insights/gsam-insights/perspectives/2023/us-inflation-reduction-act-is-driving-clean-energy-investment-one-year-in.html
[86] Inflation reduction act of 2022. ENERGY.GOV. (n.d.). https://www.energy.gov/lpo/inflation-reduction-act-2022
[87] Dahlqvist, F., Kane, S., Leinert, L., Moosburger, M., & Rasmussen, A. (2023a, March 13). Climate investing: Continuing breakout growth through uncertain times. McKinsey & Company. https://www.mckinsey.com/capabilities/sustainability/our-insights/climate-investing-continuing-breakout-growth-through-uncertain-times

significantly more attractive than CBAM (ETS fluctuating between €90-100 per metric ton on green technologies). For example, the IRA's 45Z provision provides a production tax credit of up to $3 per kilogram to clean hydrogen producers. Similarly, the 45Q provision for CO2 storage can be as high as $180 per metric ton of stored CO2 in the case of direct air capture technology in tax credits.[88]

Not only U.S. public sources, but also financial and private firms such as Apple and Alphabet are leading various climate finance initiatives. Aware of climate-related financial risks and managing a total of $20 trillion in assets[89], leading financial firms such as BlackRock and Vanguard fund eco-friendly projects through Green Bond sales, sometimes reaching $75 billion[90]. Similarly, US firms such Alphabet and Apple, also issues Green Bonds to sustainable climate projects focused on green transformation. for Alphabet, this figure was $5.75 Bn in 2020, while[91] Apple issued a green bond of $4,7 Bn in 2022 to support innovative green technologies[92].

While green transition technologies (largely in battery, wind and solar $59.5Bn 81% of the US in total) and low carbon transport (LCT second largest sector mostly in EVs with $11.5 bn 16% of total US market) dominate US climate investments, 90% of these investments are provided by private financial sources, while US public finances are reported to account for the other

[88] Dahlqvist, F., Kane, S., Leinert, L., Moosburger, M., & Rasmussen, A. (2023a, March 13). Climate investing: Continuing breakout growth through uncertain times. McKinsey & Company. https://www.mckinsey.com/capabilities/sustainability/our-insights/climate-investing-continuing-breakout-growth-through-uncertain-times

[89] Evans, R., Willmer, S., Baker, N., & Kochkodin, B. (2017, December 4). With $20 trillion between them, Blackrock and Vanguard could own almost everything by 2028. Financial Post. https://financialpost.com/investing/a-20-trillion-blackrock-vanguard-duopoly-is-investings-future

[90] Mutua, C. (2021a, April 1). Record Green Bond Sales Greet BlackRock, Vanguard's Climate Push. Bloomberg. https://www.bloomberg.com/news/articles/2021-04-01/record-green-bond-sales-greet-blackrock-vanguard-s-climate-push?embedded-checkout=true

[91] Sustainability Bond Impact Report. Alphabet. (n.d.). https://www.gstatic.com/gumdrop/sustainability/alphabet-2022-sustainability-bond-impact-report.pdf

[92] Apple's $4.7B in Green Bonds Support Innovative Green Technology. Apple Newsroom. (2024, March 23). https://www.apple.com/newsroom/2022/03/apples-four-point-seven-billion-in-green-bonds-support-innovative-green-technology/

10% with $7.5Bn.[93] However, in the same report, it is emphasized that these climate-related financial investments can only meet one-third of the main need, and thus, it is asserted that more comprehensive climate finance tools and mechanisms should be operated.

As the EU's 'Fit for 55', i.e. the target of reducing emissions by 55% by 2030, the US is also developing similar initiatives for mid-term goals by 2030. For example, the U.S. Agency for International Development (USAID) published its new Climate Strategy[94] in 2022 with the goal of catalyse transformative shifts to net-zero and climate-resilient pathways to reduce emissions by up to 50% by 2030 with the vision of "resilient, prosperous, and equitable world with net-zero greenhouse gas emissions". It aims to mobilize $150Bn for climate finance in exchange for reducing emissions by about six billion metric tons.

In May 2024, New Principles for High-Integrity Voluntary Carbon Markets (VCMs)[95] [96] was announced to secure the IRA and reduce greenhouse gas emissions in every sector of the US economy in half by 2030 and reach net-zero by 2050. VCMs share some common values with CBAM, with criteria such as carbon credits and the activities that generate them meeting reliable atmospheric integrity standards and representing true decarbonization, avoiding simple greenwashing companies basing their own value chains when buying credits. In fact, the newly introduced VCMs in the US prove the assumption that CBAM, when it is announced, will encourage other countries to adopt similar frameworks and prevent carbon leakage.

[93] Tonkonogy, B., Solomon, M., & Wetherbee, C. (2021, March 18). The landscape of climate finance in the United States. CPI. https://www.climatepolicyinitiative.org/the-landscape-of-climate-finance-in-the-united-states/

[94] Climate strategy 2022-2030. USAID. (n.d.). https://www.usaid.gov/sites/default/files/2022-11/USAID-Climate-Strategy-2022-2030.pdf

[95] Fact sheet: Biden-Harris Administration announces new principles for high-integrity voluntary carbon markets. The White House. (2024, May 28). https://www.whitehouse.gov/briefing-room/statements-releases/2024/05/28/fact-sheet-biden-harris-administration-announces-new-principles-for-high-integrity-voluntary-carbon-markets/

[96] The White House, The Department of the Treasury, Department of Energy, Department of Agriculture. (2024, May). Voluntary Carbon Markets Joint Policy statement. https://www.whitehouse.gov/wp-content/uploads/2024/05/VCM-Joint-Policy-Statement-and-Principles.pdf

Influence on Global Climate Policy and Economics

US's IRAs and VCMs make an effective contribution to global climate policies, both in the US and with other countries. It is clear that the $370Bn climate finance provided by the IRA within the framework of clean energy and green transition, as well as its benefit to reducing greenhouse gas emissions, gives the US a stand and a voice in the activities carried out in the global climate policy agenda and diplomacy (e.g. COP).[97] On the other hand, since it has just been introduced, it is a matter of curiosity what long-term consequences VCMs will have, but in terms of its main scope, it stands out especially with its cost-reducing contribution while supporting efforts to reduce carbon emissions in the US.

In the broad perspective of global climate policies, it is understood that the VCMs mechanism of the US and the CBAM of the EU and the CCER of China have significant differences. When comparing VCMs and CBAM, it is obvious that both aim to reduce carbon emissions, but they show significant differences in terms of design, implementation and impact. For example, CBAM imposes carbon tariffs on imports to encourage cleaner production in non-EU countries, while VCMs enable provable and verifiable emissions tracking based on global demand and supply, with the aim of decarbonizing more within the US. On the other hand, the main difference that distinguishes VCMs from China's CCER is that CCER is mostly energy-based and allows Chinese companies to offset their emissions, while VCMs have a sector-agnostic framework. The CBAM's mechanism of considering carbon credits of the origin country holds hesitation against China's CCER. The fact that VCMs have mechanisms that can meet the CBAM requirements in terms of the scope shows that the EU and the US can evolve into an environment that will develop and increase bilateral trade relations in the long term at the level of global climate policies. Nonetheless, given the current conditions for China and the EU, and if China does not take steps to meet the expectations of the EU, especially in terms of CBAM requirements, it shows that it may adversely affect trade relations between the EU and China.

[97] Voigts, S., & Paret, A.-C. (2024, April 1). Emissions reduction, fiscal costs, and macro effects: An assessment of IRA climate measures and complementary policies. VOXEU. https://cepr.org/voxeu/columns/emissions-reduction-fiscal-costs-and-macro-effects-assessment-ira-climate-measures

According to PWC's 2023 State of Climate Tech[98] report, in recent years, North America has seen more variability in climate technology investments than other regions. Although the verifiability of the correlation between global climate policies and climate finance flow is open to interpretation, according to this report, which contains significant data in terms of opening a window, it is seen that investment in climate technologies has decreased to the levels of $50-55Bn 5 years ago, according to the data based on the last quarter of 2023.

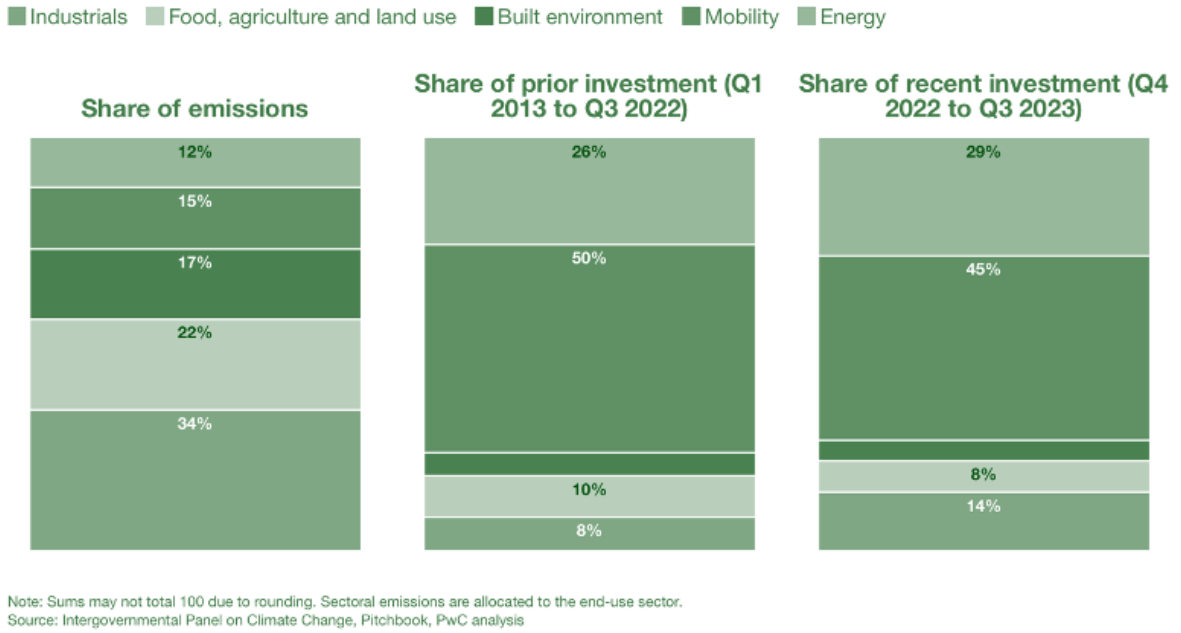

Figure 8- A Carbon Funding Gap. Source: PWC.

The most striking analysis provided in the same report is carbon funding gap (See Fig 9), the inverse correlation between emission source share, and climate technology investments related to their emission reduction potentials. In particular, the fact that climate finance in industrials is 14% while the share of its emissions is 34%, on the other hand, energy and mobility, which have emission shares of 12% and 15%, receive 29% and 45% of total investments. This reveals that VCs also should review their investment mechanisms on climate technologies (e.g., ESG reports).

[98] Dhawan, N., Jethani, M., Lawson, G., Leigh, J., Osmaston, R., Riley, L., Rirash, A., Stoeckel, T., & Taylor, A. (2023, October 17). State of Climate Tech 2023: Investment analysis. PwC. https://www.pwc.com/gx/en/issues/esg/state-of-climate-tech-2023-investment.html

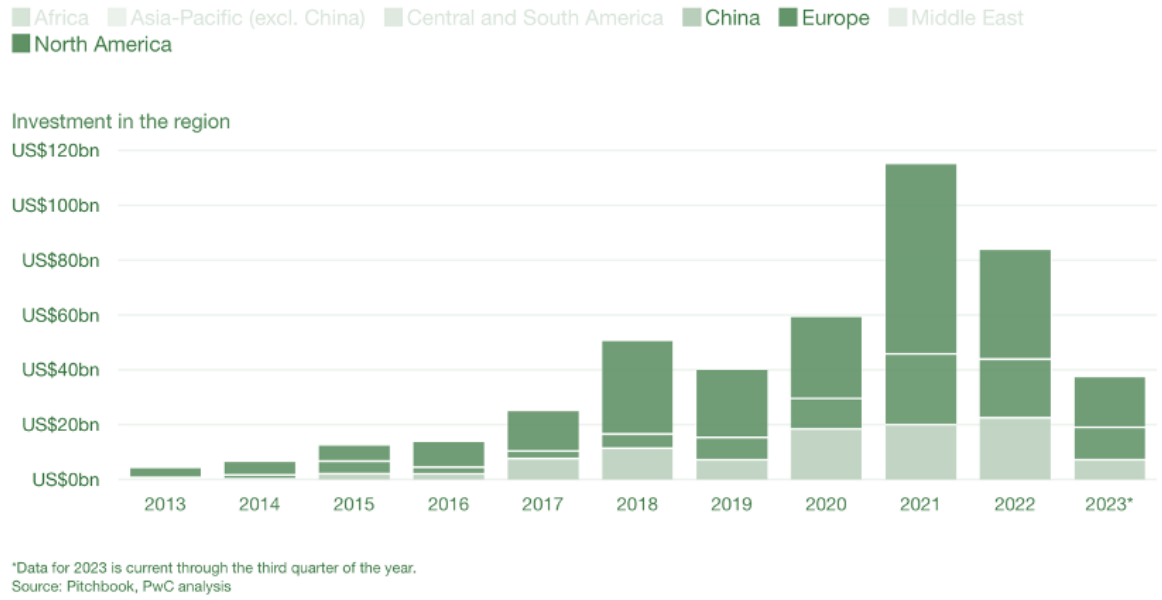

Figure 9- The changing North American market. Source: PWC.

However, when we look at the investment distribution of climate technologies on the basis of the EU, China and the US, which are the subject of this report, decreases are observed in all three (See Fig 10). While the share of Chinese climate technology companies, which received investments in the band of $18-22Bn in 2020, 2021 and 2022, was only $7.24Bn according to the data of the last quarter of 2023. Based on the data here, it can be assumed that global climate policies and initiatives might have an impact on the flow of climate finance to the regions. Of course, whether this correlation exists or not requires a comprehensive data-based study.

National and global climate policies have a profound impact on bilateral and multilateral trade relations. Tariffs, the effects of which we have felt more recently in mobility and LCT technologies, also play an active role in these dynamics. For example, on May 14 2024, President Biden introduced new tariffs on import products from China (See Table 1). It can be claimed that one of the reasons was as a result of the increasing competition in the EVs market between the US-based Tesla and China-based BYD since for the first time in history, BYD surpassed Tesla's vehicle sales dominance in the EVs market with 526,409 unit in the 4Q of

2023[99]. It is stated that, the new tariffs to be applied to China was result of failed trade agreement of Trump era. Thus, new tariffs is to protect America's economic future and national security, to create jobs and to encourage investment against China's artificially low-priced exports and unfair trade practices resulting financial lasting damages to US economy. New tariff increases in strategic sectors (some are similar under the CBAM) such as steel and aluminum, semiconductors, electric vehicles, batteries, critical minerals, solar cells, ship-to-shore cranes and medical products, leaving China, or BYD, in a difficult position, especially in the context of EV imports. While very harsh voices are being raised from China, the US expects this new stance against China to be supported by the EU.[100] The EU now charges a 10% tariff on imported electric vehicles (EVs), but from July 4th, 2024, those rates will be temporarily increased for Chinese EVs. The tariff rate may be "hiked to 25-30% from 10% currently, while our risk scenario (40% probability) envisages a hike in the tariff rate to 30-50%," according to Citi analysts (According to CNBC reporter article on 11th Tuesday 2024).[101]

[99] Top all-electric car oems by sales in Q4 and 2023: Tesla vs. Byd. Inside EVs. (n.d.). https://insideevs.com/news/704678/top-electric-car-oems-sales-2023q4-tesla-byd/

[100] Duehren, A., & Mackrael, K. (2024, May 21). The U.S. raised tariffs on China. now it wants Europe's ... The Wall Street Journal. https://www.wsj.com/economy/trade/the-u-s-raised-tariffs-on-china-now-it-wants-europes-support-32c0fd3a

[101] Chiang, S. (2024, June 11). Eu is expected to unveil tariff plans for Chinese evs this week. CNBC. https://www.cnbc.com/2024/06/11/eu-is-expected-to-unveil-tariff-plans-for-chinese-evs-this-week.html#:~:text=The%20EU%20has%20a%20standard,to%2030%2D50%25

Import	Current rate	New rate	Implementation year (current rate)	Implementation year (new rate)
Electric vehicles (EVs)	25%	100%	2018	2024
Semiconductors	25%	50%	2018	2025
Solar cells	25%	50%	2018	2024
Syringes and needles	0%	50%	N/A	2024
Some steel and aluminum products	7.5%	25%	2019	2024
Lithium-ion EV batteries	7.5%	25%	2019	2024
Lithium-ion non-EV batteries	7.5%	25%	2019	2026
Battery parts	7.5%	25%	2019	2024
Some personal protective equipment (PPE)	7.5%	25%	2019	2024
Rubber medical and surgical gloves	7.5%	25%	2019	2026

Import	Current rate	New rate	Implementation year (current rate)	Implementation year (new rate)
Natural graphite and permanent magnets	0%	25%	N/A	2026
Other critical minerals	0%	25%	N/A	2024
Ship-to-shore cranes	0%	25%	N/A	2024

Table 1- New Tariff Rates. Source: WhiteHouse.Gov.

This new tariff application might bring long-term restrictive dynamics for the EV market, green energy and battery technologies, which are very important for the green transition. The announcement just before the 2024 presidential elections, is actually not new in the US. Trump's withdrawal from the Paris Agreement, US entered during Obama era (2016), was based on similar reasons.

If the aim is to provide global climate policies, climate technology innovations and green transition with affordable products, the fact that these sudden policy changes should be taken from the individual and given to permanent higher authorities. Because, in the case of the EU, although CBAM is subject to criticism, it provides solid roadmap on the long-term strategy, expectations and goals of companies by providing regulations and mechanisms. In this context, it emerges that withdrawing from periodic commitments and commitments made with a presidential decree without sanctions creates unpredictability to global climate change targets and strategies, and hinders the main cause, that is, the fight against climate change.

Planet as a Service (PaaS) Conceptual Framework

As a global threat climate change shapes the climate policies and financing instruments of countries. It is observed that these policies, which aim to strengthen the goals of becoming carbon neutral in 2050 or 2060, have led to the emergence of carbon emission-based taxation mechanisms, especially in developed countries. However, the research of the three case countries that are the subject of this report show that each country shaped its policies in accordance with its own socio-technical dynamics. This, in turn, puts pressure on countries with very different levels of green technology readiness and development phases on a global scale.

Although US, China and regionally the EU, tries to shape the global sustainability transition with various carbon trading policies and financial mechanisms, it seems that they are also on their way for power and to influence on developing countries. For example, given South Africa's expected investment of $90Bn in compliance with CBAM, there is no guarantee to stop China from offering softer climate policy, given the EU-US-China trade disputes. The main objective should be a new framework that addresses the *multi-level perspective* with a *global vision against climate change* and promotes *sustainable transition with green technology innovations*.

We introduce the Planet-as-a-Service (PaaS) framework. This framework, which facilitates global decarbonization, harmonizes various carbon policies and financing systems, and addresses the inequalities faced by developing countries. It is built on the principles of sociotechnical transitions, futures studies, and systemic innovations.
The Multi-level Perspective provides an analytical framework for sociotechnical transitions operating at three analytical levels: niche innovations, socio-technical regimes, and socio-technical landscapes (Geels, 2002)[102].

[102] Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research policy*, *31*(8-9), 1257-1274.

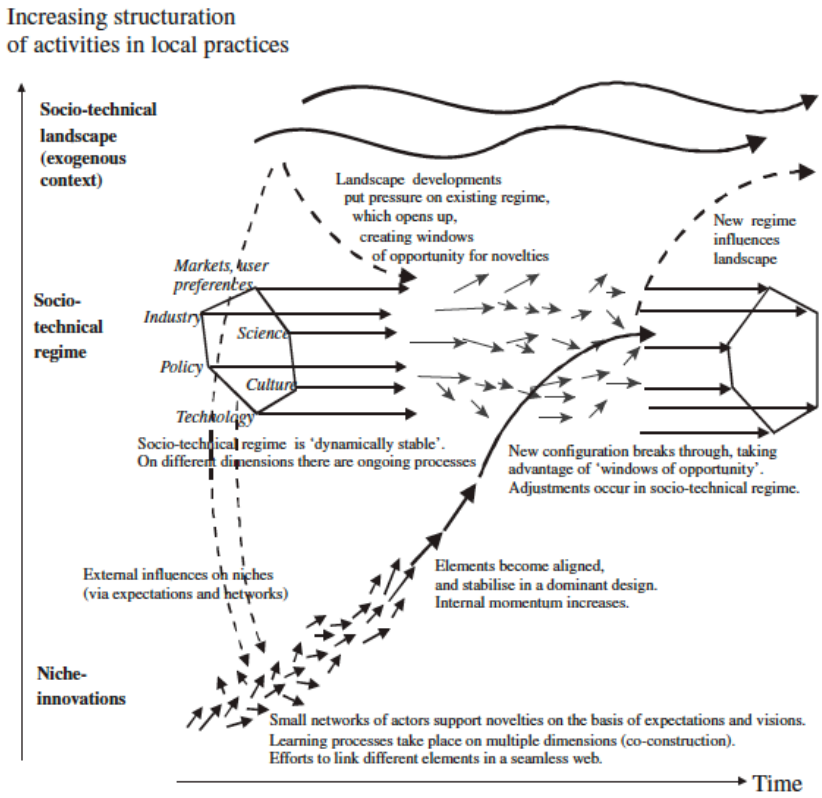

Figure 101- Multi-level perspective on transitions (Geels 2002, 1262)

The rationale of this report is that while climate change, global carbon-based economy trends and the dispersed carbon policies and financing instruments of the three countries represent landscape developments. These landscape developments necessitate changes in the socio-technical regimes of developing countries and niche green technology innovations in the production of carbon-weighted commercial commodities. The MLP helps to understand and manage the shared evolution of technology, policy, markets, culture and infrastructure necessary for low-carbon transitions, and helps us understand the pressures stemming from climate policies of US, China and the EU on the changing mainstream regimes of developing countries as they begin to shape the global economy with carbon-based policies.

Futures studies research change and recognizes the existence of not a single future but potential alternative futures (possible, plausible, probable, preferable, business as usual)[103] and that the future cannot be predicted[104] [105]. Futures Studies uses a variety of methods to study how the drivers of change can transform society socially and technologically, and what alternative ways there may be. Future studies methods such as scenario planning can be used as examples to create alternative, inclusive and empowering future scenarios to make adaptability of decarbonization pathways in developing countries in the development of global carbon policies and leveraging financial instruments in niche innovation.

Evidently, with current diverse climate policies exposing developing countries putting pressure to change their socio-technical regimes. Worst case scenario for Africa, expected to accelerate their green tech innovations due to CBAM and that will cost almost $90Bn to them, they might turn their economic activities to other countries considering heavy burden of their system changes. This brings a great attention of a dilemma: While EU aims to leverage other countries to achieve carbon-neutral goals, since every country has their socio-technical regimes and it is hard to transform them due costs, CBAM-exposed countries would choose carrying on their status quo and keeping their regimes business as usual and carry on trading with other countries which has softer regulations.

[103] Voros, J. (2017, February 24). The Futures Cone, use and history. The Voroscope. https://thevoroscope.com/2017/02/24/the-futures-cone-use-and-history/
[104] Bell, W. (2017). *Foundations of futures studies: Volume 2: Values, objectivity, and the good society*. Routledge.
[105] Dator, J. (2019). *Jim Dator: A noticer in time*. Springer Nature.

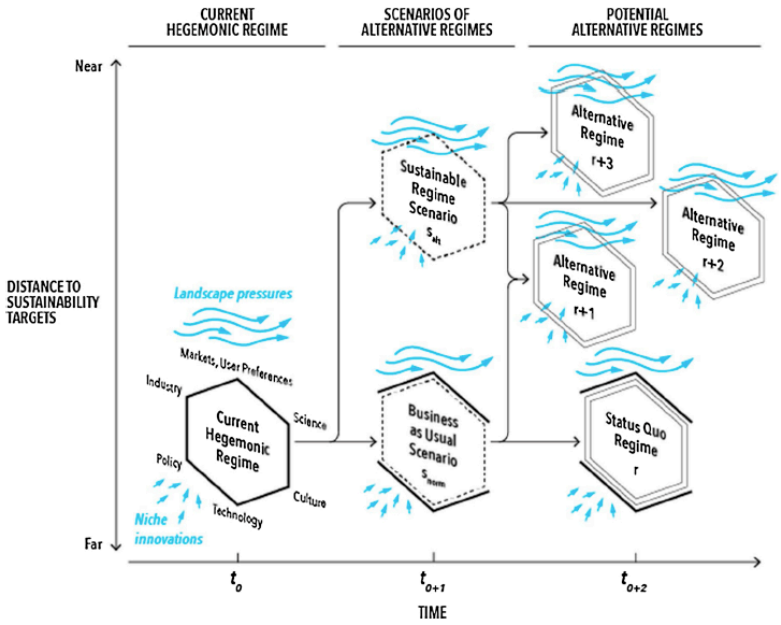

Figure 11- Constructing a potential framework on how to link elements from both futures studies (scenarios) and MLP (regime) in a development pattern of alternative sustainable futures. Vähäkari et al., (2020)[106]

PaaS is based on possible synergy between the Multi-Level Perspective (MLP) and the Future Studies[107]. A lot of empirical research has been presented on the sustainable transitions of MLP (e.g., Sociotechnical transitions for deep decarbonization[108], Socio-technical transitions to sustainability: a review of criticisms and elaborations of the Multi-Level Perspective[109]). In the same vein, efforts of Vähäkari et al. (2020) in "The future in sustainability transitions - Interlinkages between the multi-level perspective and futures studies"[110] provides essential linking foundations to this PaaS framework.

[106] Vähäkari, N., Lauttamäki, V., Tapio, P., Ahvenainen, M., Assmuth, T., Lyytimäki, J., & Vehmas, J. (2020). The future in sustainability transitions-Interlinkages between the multi-level perspective and futures studies. *Futures*, *123*, 102597.
[107] Ibid.
[108] Geels, F., Sovacool, B., Schwanen, T., & Sorrell, S. (2017, September 22). Sociotechnical transitions for deep decarbonization. Science. https://www.science.org/doi/10.1126/science.aao3760
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[110] Vähäkari, N., Lauttamäki, V., Tapio, P., Ahvenainen, M., Assmuth, T., Lyytimäki, J., & Vehmas, J. (2020). The future in sustainability transitions-Interlinkages between the multi-level perspective and futures studies. *Futures*, *123*, 102597.

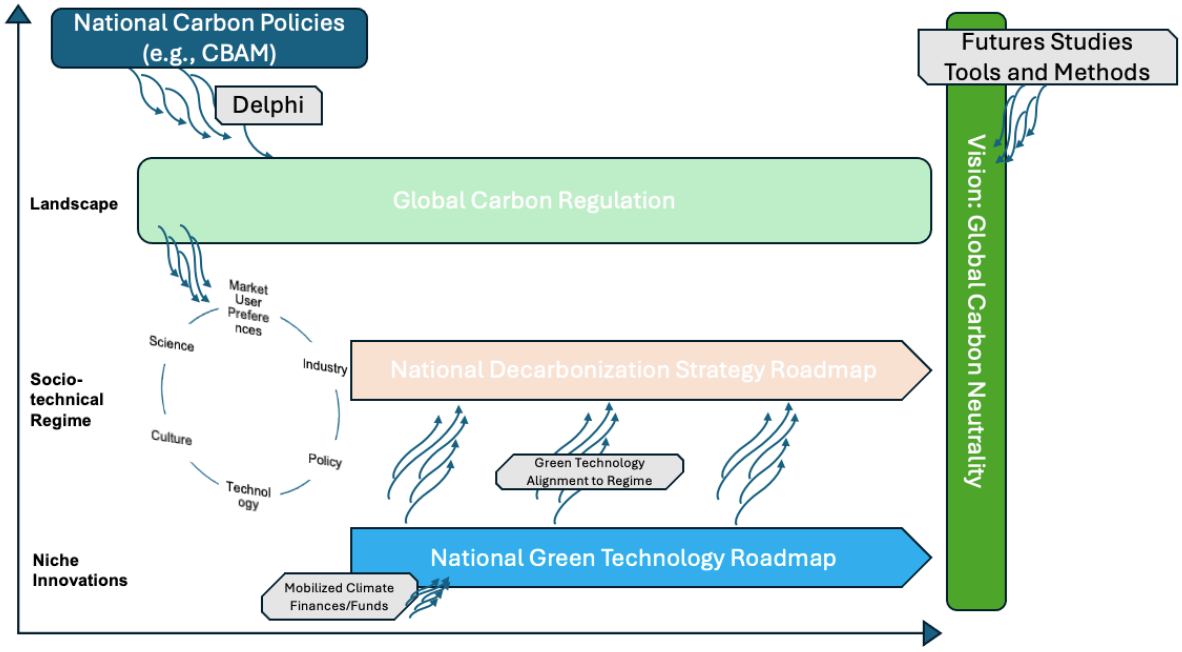

Figure 13 - Conceptual Framework Planet-as-a-Service (PaaS).

Inspiring from those works, the conceptual framework we propose with PaaS is an alternative future path to transform diverse climate policies in a single global climate regulation expose and binding for all to achieve a joint vision: Global Carbon-Neutral World. First, diverse climate policies and emission trading systems/mechanism (like CBAM) should be turned to a Global Emission Regulation (GER) binding every single country and their regime actors. GER should not be regulated by elected politicians nor their designated directors, but a constant supra-national department combines regime actors. This aspect is vital since in US case it is observable that presidents are effective on withdrawing from clime policies or applying shocking tariff amendments in global trade (e.g., Paris Agreement and heavy tariffs on Chinese EVs). For example, Delphi method can be used for building Global Emission Regulation[111]. The Delphi method involves a series of iterative (rounded) surveys or questionnaires in a structured way to gather expert opinions and achieve consensus on complex issues. Those experts for Delphi rounds could be regime actors with expertise in politics, innovations, citizens, markets, and cultural change.

[111] Gordon, T. J. (1994). The delphi method. https://eumed-agpol.iamm.fr/private/priv_docum/wp5_files/5-delphi.pdf

Then, for the joint vision, there need to be simultaneous global foresight studies (e.g., utilizing futures studies tools and methods) for each country based on determined Global Emission Regulation to define a future path for vision and build nation-specific strategy roadmaps considering their current challenges, near and future technology and socio-technical transition needs. This should be considered because every country has their own regimes stemming from their internal socio-technical systems and capabilities to green transitions. Lastly, when national strategy is determined, then national green technology roadmap can be defined to create windows of opportunities and mobilize climate finances for niche innovations to change the mainstream regimes into greener way. Continuing with the example of Africa which will be exposed to CBAM with estimated cost of $90Bn, EU has an initiative named Global Gateway which has the **Africa-Europe Investment Package** with approximately €150Bn of investment dedicated to bolstering cooperation with African partners.[112] This initiative is to tackle the global challenge of climate change and planned for accelerating innovations in green transition (e.g., Clean Hydrogen Production, biodiversity, agri-food and climate resilience and job creating) and increasing well-being in Africa.

Similarly, The **U.S. African Development Foundation** (**USADF**) is an independent U.S. government agency established by Congress in 1980 to invest directly in African grassroots enterprises and social entrepreneurs. U.S. spent an average of more than $10 billion per year on bilateral aid disbursements to Africa[113]. China Africa Development Fund[114] with a capital amount of 10 billion US dollars aims to leverage green industrialization process and enhancing Africa's sustainable development capacity through investments. While there are different requirements and sanctions of those large funding mechanisms, and each country's (i.e., US, EU and China) emission capture/trade policies and green technology innovations and emission regime regulations are different, in the context of niche innovations, PaaS

[112] Global gateway. European Commission. (n.d.-c). https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/global-gateway_en
[113] Investing in resilience from the ground up. FP Analytics, United States African Development Foundation. (n.d.). https://investinginafricanresilience.com/
[114] Introduction to CADF. China-Africa Development Fund. (n.d.). http://en.cadfund.com/Column/25/0.htm

synergizing MLP and Futures Studies might provide an alternative sustainable regime scenario for a vision of global carbon-neutral world.

PaaS is based on an alternative sustainable decarbonisation scenario in the holistic perspective of reaching a global carbon-neutral vision. It aims to integrate the socio-technical transition of combating climate change into roadmaps by blending climate policies and mobilizing climate financing into green technology innovations. It still needs development and empirical research. This entry-level conceptual framework is presented to show possible opportunities that MLP and strategic foresight via futures studies tools can offer broader perspectives for global climate change studies.

VI. Conclusive Remarks and Policy Suggestions

The climate crisis necessitates a unified, global response, yet the competitive approaches of major economies often lead to inefficiencies and inequalities. This report has examined how China, the EU, and the US leverage climate initiatives to enhance their geopolitical influence, often at the expense of global cooperation. A shift towards more collaborative, network-based models is essential for addressing climate change effectively and equitably.

Key Findings and Policy Suggestions

Findings	Policy Suggestions
Major economies use climate policies to enhance their geopolitical influence.	Strengten international organizations to manage global climate policies and enforce compliance across all nations.
Climate policies disproportionately impact developing countries.	Implement financial support mechanisms to assist develoing countries in adapting to stringent climate regulations.
National-centric approaches create inefficiencies and slow global responses.	Promote global frameworks for climate action that prioritize cooperative, rather than competitive.
Younger generations are more climate-motivated, but decision-making roles often favor older individuals.	Encourage youth participation in climate policy-making to ensure long-term, sustainable strategies.
Need to empover and adapt international institutions to manage increased flows of data, human capital, and trade.	Modernize and enhance the capacity of international institutions like the UN and World Bank to address global climate challenges effectively.
Existing global frameworks are inadequate for the scale of the climate crisis and socio-economic disparities.	Introduce a New Global Social Contract that redefines key performance indicators (KPIs) for businesses and countries, focusing on metrics beyond economic growth such as innovativeness.

Planet-as-a-Service (PaaS)

PaaS model emphasizes the necessity of a networked approach to climate action, where no individual, business, or country can reach its full potential without being part of a global network. PaaS integrates the principles of sociotechnical transitions, futures studies, and systemic innovations to create a cohesive global framework for decarbonization. This model advocates for a unified Global Emission Regulation (GER) that is binding for all countries, enforced by a supra-national entity, and supported by global foresight studies to develop nation-specific strategies. Expected outcomes include enhanced global cooperation, reduced inequalities, and more efficient use of resources, leading to a sustainable and equitable future. Long-term planning within this framework is crucial for achieving these outcomes and ensuring that all countries can contribute to and benefit from global climate initiatives.

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