

國立臺灣大學共同教育中心國際學院

生物多樣性國際碩士學位學程

碩士論文



Master's Program in Biodiversity (MPB)
International College, Center for General Education
National Taiwan University
Master's Thesis

台灣的戰略政策措施：解析歐盟的碳邊界調整機制並
透過比較台灣和日本的鋼鐵行業

**Strategic Policy Measures for Taiwan: Dissecting the
European Union's Carbon Border Adjustment
Mechanism and Proposing Recommendations through
Comparative Examination of Taiwan and Japan, with
Emphasis on the Steel Sector**

林佳恩 Trisha Lim Jia En

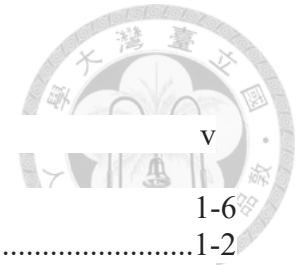
指導教授: 邱祈榮 Advisor: Chyi-Rong Chiou

中華民國 113 年 6 月 June 2024

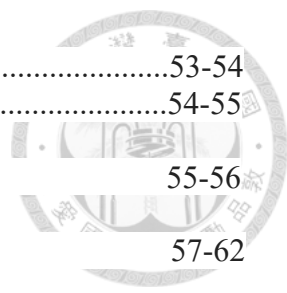
Table of Contents

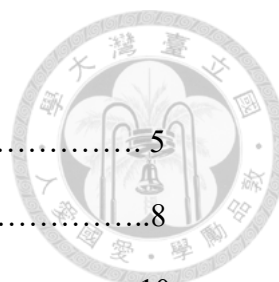
Abstract

1. Introduction	1-6
1.1 Taiwan's Role in the International Supply Chain.....	1-2
1.2 Background to CBAM.....	2
1.3 CBAM's Impact in Taiwan.....	2-5
1.4 Knowledge Gap.....	5
1.5 Research Objectives.....	5-6
2. Methodology	6-9
2.1 Research Approach.....	6-9
3 Literature Review	9-14
3.1 Europe's Global Influence in Policy Adoption.....	9-10
3.2 Understanding CBAM.....	10-14
4 Comparative Analysis of Taiwan and Japan	14-28
4.1 Discussion: Choice for Japan and Taiwan.....	14-16
4.2 Comparison of GHG Emissions.....	16-21
4.2.1. Taiwan's GHG Landscape (Target and Actual)	
4.2.2. Japan's GHG Landscape (Target and Actual)	
4.2.3. China Steel Corporation GHG Emissions	
4.2.4. Nippon Steel GHG Emissions	
4.3 Comparison of Decarbonisation Strategies.....	21-28
4.3.1. Government Plans and Policies in Taiwan and Japan	
4.3.2. Steel Industry in China Steel Corporation and Nippon Steel	
5 Results and Recommendations	28-44
5.1 Overarching Recommendations.....	29-31
5.1.1. 'Carrot and Stick' Approach	
5.1.2. Government R&D Subsidies towards Impacted Industries	
5.1.3. Proactive Engagement of SMEs and Reminder of Role in Supply Chain	
5.2 Specific Recommendations for Internal Pricing Mechanisms.....	31-37
5.2.1. Taiwan's Carbon Levy	
5.2.2. Carbon Trading Platform, Taiwan Carbon Solution Exchange (TCX)	
5.3 Specific Recommendations on Taiwan's Legislation.....	37-40
5.3.1 Incorporate mandatory third party verification on carbon reports and increasing verification capacity	
5.3.2 Expand Article 5 to include climate justice suits	
5.4 Specific Recommendations on Taiwan's SMEs.....	40-44
5.4.1. Proactive Approach	
5.4.2. Subsidies in Hydrogen-Based Steelmaking	
5.4.3. Utilise TAIEX	
6 Discussion	44-55
6.1. Summary Answers to Sub-Questions.....	44-50
6.2. Further Consideration on Taiwan's Progress.....	50-52



6.3. Relevance to Biodiversity.....	53-54
6.4 Limitations of the Research.....	54-55
7. Conclusion	55-56
References	57-62





List of Illustrations and Tables

1.1 Taiwan’s Indirect Contribution Trade with the EU (2022)	5
1.2 Taiwan’s Fastener Exports to the EU (2018-2022)	8
2.1 Table of research sub-questions	10
2.1 Overview of Research Method Approach.....	10
2.1 Overview of the Interviewees and their Role and Industry	12
4.2.1 Taiwan’s Total GHG Emissions (1990-2021)	20
4.2.2 Japan’s Total GHG Emissions (1990-2021)	22
4.2.3 CSC’s Carbon Emission Comparison	23
4.2.4 Japan’s Emissions from the Metal Industry	24
4.2.4 Nippon Steel’s Carbon Emission Comparison	25

Abstract

As part of the Fit for 55 package, the Carbon Border Adjustment Mechanism (CBAM) is one of many tools used by the European Union (EU) in its roadmap to establish itself as the first 'climate-neutral' continent by 2050. The EU's CBAM stands as a pioneering initiative aimed at addressing carbon leakage and promoting international carbon reduction initiatives in trading partner nations. This thesis aims to provide systematic recommendations for Taiwan's national and industrial preparation for CBAM, with an emphasis on regulations, national strategy, carbon trading platform, and with references to Japan's approach. This study will use a mixed method case study research approach to gather data from various sources. Firstly, a comprehensive review of literature on CBAM, national policies in Taiwan and Japan, and carbon market structure will be conducted. This will be supplemented with an instrumental case study into China Steel Corporation (CSC) and Nippon Steel's ESG Reports, as both countries export iron and steel to the EU and steel is one of the six industries covered in the transitional phase. Subsequently, interviews with key stakeholders from academia and carbon consultancy were conducted to gain insights on the current landscape and future trajectory of Taiwan. Interviews were conducted in-person, using a semi-structured approach. The final phase is conducting an inductive thematic analysis on the transcripts, with the aid of coding software AI Delve, to identify common codes and draw key recommendations from that.



Introduction

1.1 Taiwan's Role in the International Supply Chain

The foundation on the importance of preparation for CBAM is the preface that Taiwan holds an irreplaceable position in the global supply chain, and is a key manufacturer in the metal industry. Taiwan is the 21st largest economy with an average growth rate of 3.6% from 2018 to 2022, 1.2% higher than the global average.¹ According to the Import and Export Trade Statistics data from the International Trade Administration of Taiwan's Ministry of Economic Affairs, Taiwan exported consumer goods worth USD 3.2 million to the EU in 2022.² Furthermore, Taiwan's indirect trade with the EU was valued at USD 274.808 billion, a substantial 8.4% of total EU imports (see Table 1). This table encompasses our intermediate goods exports to developing countries, which are subsequently used in their consumer exports to the EU. Hence our total export contribution to the EU was valued at USD 282.466 billion, about 8.7% of the EU's total imports.

Taiwan's Indirect Contributions to Trade with the European Union (2022)

Unit: Million US dollars, Ratio (%)

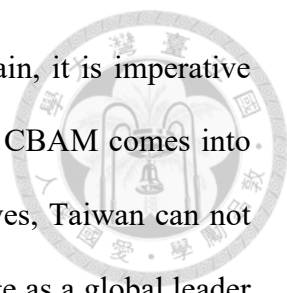
Category	Consumption Goods	Proportion of Intermediate Goods from Taiwan	Indirect Contributions of Taiwan	Value of Import of EU	Ratio
Vietnam	21,889	95.1	20,816	3,242,530	0.6
China	249,301	95.0	236,836		7.3
Indonesia	7,712	92.1	7,103		0.2
Thailand	11,282	87.4	9,860		0.3
Total	290,184	94.7	274,804		8.4

Note: The ratio represents the proportion of Taiwan's indirect contributions to the total import amount of the respective country.

Source: Compiled using data from the International Trade Administration, Ministry of Economic Affairs, R.O.C., "Import and Export Trade Statistics;" HIS Markit, "Global Trade Atlas"

¹ Wang, G.-C. (n.d.). *Economic Security: Taiwan's Role in New Global Supply Chains*. Chung-Hua Institution for Economic Research, p33

² International Trade Administration, Ministry of Economic Affairs, R.O.C., "Import and Export Trade Statistics," November 24, 2023, accessed, *International Trade Administration*, <<https://cuswebo.trade.gov.tw/>>



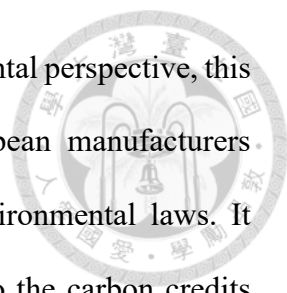
If Taiwan is to maintain its position in the international supply chain, it is imperative Taiwan established a robust internal pricing system in place before CBAM comes into full effect in January 2026. By embracing carbon reduction initiatives, Taiwan can not only mitigate potential disruptions in its supply chain but also emerge as a global leader in green innovation. Moreover, the US had recently implemented the Clean Competition Act (CCA) to commence in January 2024, and metal imports like steel and aluminium fall under its scope. The global trajectory shows the clear trend of carbon pricing and Taiwanese SMEs must be sufficiently prepared, otherwise replacement by foreign companies complicit with international standards and losing our position in the international supply chain.

1.1 Background to CBAM

The EU has been at the forefront leading global efforts to combat climate change. Its aim is to establish itself as a 'climate-neutral' continent by 2050 under the 2020 EU Green Deal and has enacted the European Climate Law in 2021, with the interim goal to reduce greenhouse gas (GHG) emissions from 55% from 1990 levels by 2030. To achieve this, a "Fit for 55" package was introduced comprising 14 initiatives aimed at facilitating progress towards the emission goal. Among the most controversial is the Carbon Border Adjustment Mechanism (CBAM), which is a carbon levy imposed on EU trading countries exporting certain products into the EU. A more detailed analysis of CBAM is provided in Section 3.2.

1.2 CBAM's Impact in Taiwan

Beginning January 2026, the EU will impose this carbon levy on imports entering Member States in six carbon-intensive sectors - iron and steel, cement, fertiliser,



aluminium, hydrogen, and electricity generation. From an environmental perspective, this initiative aims to reduce the risk of carbon leakage from European manufacturers outsourcing or migrating operations to countries with lenient environmental laws. It ensures imports entering the EU are priced at a value equivalent to the carbon credits auctioned at the European Emission Trading System (ETS), hence Taiwanese exporters must buy CBAM certificates equal to their liable emissions, less carbon price paid at home, to offset the direct emissions in their products. This would also act as an incentive for foreign trading partners to adopt carbon reduction measures to reduce the levy payable, or establish their domestic carbon tax to retain funds within their borders.

During CBAM's current transition phase from October 2023 to December 2025, exporting companies from the aforementioned six sectors are required to report the direct emissions of their products, i.e. emissions from manufacturing processes or direct use of fossil energy. As an export-oriented economy, Taiwan exports a wide range including microchips, various electrical machinery, mechanical appliances and metal compartments of iron and steel. Iron and steel made up 3% of Taiwan's total exports in 2022 at a value of USD12,109,103³, and the EU was the largest export destination at 18% of total sales. Taiwan's Ministry of Economic Affairs (MOEA) confirmed iron and steel will be the most impacted industry, considering exports in other impacted industries like aluminium, fertilisers and cement are a mere 0.46%, 0.05%, and 0.01% of total exports respectively.⁴

Logically, CBAM will hit Taiwanese steel monopoly China Steel Corporation (CSC) the hardest. In 2022, their exported sales were 41% of total sales, with 23% (810,037 tons)

³ International Trade Centre (ITC). (2023). *Trade Map - Trade Statistics for International Business Development*. Trademap.org. <https://www.trademap.org/Index.aspx>

⁴ *Policy measures to respond to carbon fee impacts on industry in Taiwan*. (2024). London School of Economics (LSE) Grantham Research Institute of Climate Change and the Environment.

sold to Europe (namely Italy, Germany, Spain, Belgium, and Portugal).⁵ They face mounting pressure to lead decarbonisation efforts internally and across their supply chain. However astoundingly, the European Parliament has expanded the sector of iron and steel under Product Code No. 7318 to include steel fasteners like screws, nuts, bolts, pins etc.⁶ Taiwan is the second-largest exporter of fasteners globally,⁷ with exports worth USD5.3 million in 2021, USD6.1 million in 2022, and USD4.6 million in 2023, and the EU27 receives approximately 25% of total exports. This is particularly significant as this figure represents approximately 3,565 SMEs exporting to the EU that stand to be affected.⁸

Table 1. Taiwan's Fastener Exports to the World and EU in 2018-2022

Unit: NT\$ 0.1 bn; %

	2018	2019	2020	2021	2022	CAGR
Value of Taiwan's Fastening Product Export to the World	1,504.8	1,401.3	1,290.2	1,726.7	1,895.5	5.9%
Value of Taiwan's Fastening Product Export to the EU	428.6	377.7	330.5	457.6	495.5	3.7%
% of EU in Taiwan's Global Fastening Product Export	28.5%	27.0%	25.6%	26.5%	26.1%	-2.1%
Value of Taiwan's Fastener (HS Code 7318) Export to the World	1397.0	1333.2	1171.5	1487.0	1810.6	6.7%
Value of Taiwan's Fastener (HS Code 7318) Export to the EU	408.0	368.1	305.7	399.9	485.5	4.4%
% of EU in Taiwan's Global Fastener (HS Code 7318) Export	29.2%	27.6%	26.1%	26.9%	26.8%	-2.1%

Source: Taiwan Customs / compiled by MIRDC

The table below indicates that Taiwan's fastener exports to the world have shown a consistent upward trend from 2018 to 2022, with an increase from NTD 1,504.8 billion to an estimated NTD 1,895.5 billion, reflecting a Compound Annual Growth Rate (CAGR) of 5.9%. Exports to the EU has already grown, albeit slower, with a CAGR of 3.7%, rising from NTD 428.6 billion in 2018 to an estimated NTD 495.5 billion in 2022. Notably, the proportion of exports to the EU as a percentage of Taiwan's total global fastening product

⁵ China Steel Corporation. (2022). China Steel Corporation Sustainability Report 2022.

⁶ Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023, Official Journal of the European Union, Annex 1, (2023).

⁷ Hsu, A. (2023). CBAM's Impact on Taiwan Fastener Industry, Fastener World 199/2023. Industry Focus.

⁸ Insight from interview conducted

exports has been declining, with a CAGR of -2.1%. Although CAGR of exports to the EU has been on a downwards trend in recent years, the overall share still shows the EU is an important export market for Taiwan.



1.3 Knowledge Gap

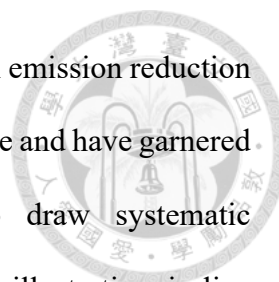
CBAM is a relatively new initiative, having only been announced less than three years ago and will only be implemented in 2026. Literature on CBAM at the EU level is growing quickly, but there remain many unexplored areas on how foreign trade partners, like Taiwan, are equipped to manage it and the best strategies going forward. As a player in the global steel supply chain and a significant emitter of carbon dioxide (details in Section 3), it is in Taiwan's best interest to leverage CBAM's transitional period before its effective date and expansion into other industries.

There is lacklustre engagement from Taiwan's small and medium-sized enterprises (SMEs) which make up 98% of all enterprises.⁹ It stands to question whether it is due to a lack of governmental guidance on how emissions should be tracked, verified and reported, or is it a matter of inherent attitude that sees this as an unnecessary administrative burden. Questions also rise on the national level of what to do with the collected data, what policies and projects would progress this.

1.4 Research Objectives

My research objectives are to assess the sufficiency of Taiwan's regulations and carbon trading platform in spite of its early age and draw comparisons to a more mature market

⁹ R.O.C, M. of E. A. (2022, October 28). *SMEs Serve as the Backbone of Taiwan's Stable Economic Development*. Ministry of Economic Affairs, R.O.C.
https://www.moea.gov.tw/MNS/english/news/News.aspx?kind=6&menu_id=176&news_id=103826



like Japan and see if their developments have led to a national carbon emission reduction over the years. I further want to gauge the future of Taiwan's landscape and have garnered expert opinion from international stakeholders in Taiwan to draw systematic recommendations on needed improvements. The case will be rather illustrative, in line with the exploratory character of this research.

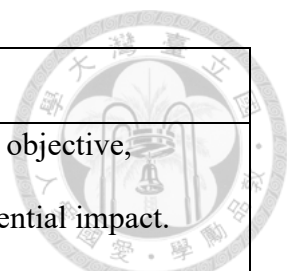
The main research purpose is to draw recommendations for Taiwan's benefit on how to improve its preparation for CBAM, with references to Japan's system and a case study into the steel industry. To be able to answer the main research question, some sub-questions are set up that need to be addressed.

<i>1. What is CBAM and its objectives?</i>
<i>2. A comparison of Taiwan and Japan on their regulations and policies relevant to CBAM.</i>
<i>3. An instrumental case study in Taiwan's CSC and Japan's Nippon Steel.</i>
<i>4. Key policy recommendations drawn from the abovementioned studies that Taiwan can adopt going forward?</i>

Methodology

2.1 Research Approach

With the research topic and sub-questions identified, this study will use a mixed method case study research (MMCSR) (Cook & Kamalodeen, 2019) approach to gather data from primary and secondary sources.

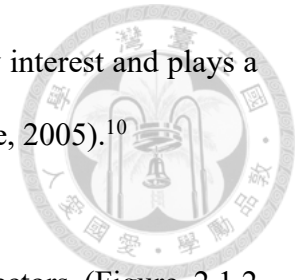


Question	Method	Explanation
1. What is CBAM in relation to Taiwan?	Literature study Interviews	Researching the objective, concept and potential impact.
2. A comparison of Taiwan and Japan on their regulations and policies relevant to CBAM.	Literature study Interviews	Understand the current situation and gain insights on the future trajectory of both countries, particularly Taiwan.
3. An instrumental case study in Taiwan's CSC and Japan's Nippon Steel.	Study of Sustainability Reports	Analyse the company's goals, strategy to reach these goals, and yearly CO2 emissions.
4. What are the recommendations drawn from the abovementioned studies that Taiwan can adopt going forward?	Interviews	Identifying common themes with the aid of coding software to draw key themes.

Figure 2.1.1

Firstly, a comprehensive review of literature on CBAM, Taiwan and Japan's national policies, and carbon market structure will be conducted. This desk research will provide a starting point and foundation to determine the knowledge gaps for research. This will be supplemented with an instrumental case study into CSC and Nippon Steel's ESG Reports, two monopolies in their respective countries with similarities in cultures, value

and governance. In short, instrumental case studies are of secondary interest and plays a supportive role in facilitating understanding in something else (Stake, 2005).¹⁰



Subsequently, interviews with key stakeholders from different sectors (Figure 2.1.2 below) will be conducted to gain insights on Taiwan's current landscape and future trajectory. Interviews are conducted in-person, using a semi-structured approach and in accordance to Babbie's (2005)¹¹ and Yin's guidelines (2018).¹² This entails establishing rapport between interviewer and interviewee to facilitate an open and honest discussion, clarify the purpose and objective of my study and the role of researcher in this capacity, using open-ended questions, actively listening, maintaining flexibility and adapt follow-up questions based on the context and dynamic of each interviewee, documenting the process and respecting confidentiality and privacy of participants.

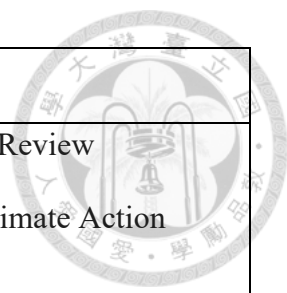
The final phase is conducting a 6-step inductive thematic analysis on the generated transcripts according to Braun & Clarke 2006 principles. The steps are as follows, to familiarise yourself with the data, generate the codes (i.e. categories), combine the codes into themes, review of the themes and determine the significance of each, before reporting your findings.¹³ The analysis will be conducted using AI coding software *Delve* to identify common codes and draw key themes and recommendations from that.

¹⁰ Stake, R. E. (2005). *Case Studies*. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 443-454, 3rd ed.). Thousand Oaks, CA: Sage Publications.

¹¹ Babbie, E 2005 *Survey Research The Basics of Social Research*, pp.251-255; 283-289

¹² Robert K. Yin, 2018 *Case study research and applications : design and methods* 3rd Edition

¹³ Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. ResearchGate; British Psychological Society, p120-123.



Sector	Interviewee	Position
Policymakers	Andy	Participant in Carbon Fee Review Committee and Taiwan Climate Action Network (TCAN)
	Bernard	Researcher at Taiwan Research Institute, involved in Net Zero Office of Taiwan's Ministry of Economic Affairs (MOEA)
Consultants	Candice	Consultant at RESET Carbon
Academics	Duncan	Professor of Atmospheric Sciences, NTU
	Egor	Professor at School of Forestry and Resource Conservation, NTU
NGOs	Finley	European Values Center for Security Policy, Taiwan Office
	Gerald	European Union Centre in Taiwan
Private Sector	Harlow	Sustainability Consultant and Head of Legal & Compliance at BlueOnion

Figure 2.1.2

Literature Review

3.1 Europe's global influence in policy adoption

Europe identifies itself as an international normative power, or civil power, whose influence is not based on military force, but rather its ability to influence international rules and norms. Unlike America's coercive power, normative power is growing in fundamental importance because it's a subtle yet powerful strategy to "trade-in military

uniform[s] for the more civilian garments of economics, law and technology.”¹⁴ The EU has had a successful run in setting international standards in environmental protection and climate change mitigation and enacted directives on greenhouse gas emission, management of electronic waste, protecting biodiversity etc,¹⁵ that has influenced international norms and served as a model for others. The Green Deal marks a new landmark in EU establishing itself as the leading power in the global green transition, and reiterated by various stakeholders in the European Values Centre for Security Policy and European Union Centre in Taiwan.

The EU has a de facto Brussels effect,¹⁶ i.e. the ability to regulate global markets peacefully by setting international standards on issues of contention, like environmental protection. Many countries do, or strive to, conduct trade with the EU, which means mandatory compliance with their stringent regulations to access their single market. This power stands to influence foreign governments to adopt EU-style regulations in their own country. The best example is Taiwan, which is now discussing implementing a cross-border carbon tariff to carbon-intensive imports entering Taiwan. EU rules are a good model for less experienced countries, particularly for their willingness to extend assistance and technical expertise through initiatives like Technical Assistance and Information Exchange (TAIEX).

¹⁴ Cohen-Tanugi, L. (n.d.). *Europe as an international normative power: state of play and perspectives - Groupe d'études géopolitiques*. <https://Geopolitique.eu/>. <https://geopolitique.eu/en/articles/europe-as-an-international-normative-power-state-of-play-and-perspectives/>

¹⁵ For a list of the European policies and legislations relating to environmental protection and the fight against climate change, see https://eur-lex.europa.eu/summary/chapter/20.html?expand=230807,2020#arrow_2020

¹⁶ Door Anu Bradford. (2021). *The Brussels effect: how the European Union rules the world*. Uitgever: New York, Ny Oxford University Press. p. 75.

3.2 Understanding CBAM

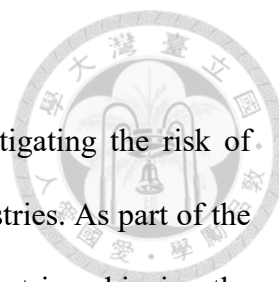
Chronological timeline

The formal introduction of CBAM occurred in July 2021, when the European Commission presented it as part of the “Fit for 55” package, designed to reduce net greenhouse gas emissions by at least 55% by 2030. The CBAM proposal was subjected to intense discussions and negotiations within the EU institutions, reflecting on its design, scope, and implementation strategies to ensure compatibility with World Trade Organization (WTO) rules and its effectiveness in preventing carbon leakage. On April 2021, the European Economic and Social Committee decided to adopt the opinion on CBAM, which was later formally adopted in December 2021. This marked a significant milestone in the CBAM timeline, setting the foundation for its phased implementation.

The European Economic and Social Committee announced the transitional phase of CBAM began on October 1, 2023, to initially focus on imports of carbon-intensive goods, such as cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen. During this phase, importers are required to report emissions embedded in their imports, to understand the reporting process and for the EU to collect data on their trading partners.

Commencing January 2026, exporters will need to start purchasing CBAM certificates to offset the carbon fee. This will see exporters in Taiwan registering with national authorities and purchasing CBAM certificates, which reflects the weekly average auction price of EU ETS allowances. This mechanism ensures that the carbon price of imports is equivalent to that of domestic production, thereby safeguarding the EU’s climate objectives and encouraging cleaner industrial production globally.





CBAM objectives

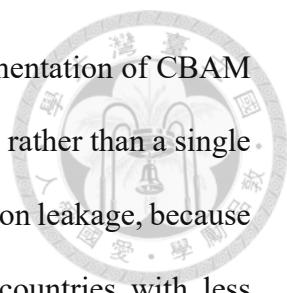
The objectives of CBAM are multifaceted, primarily aimed at mitigating the risk of carbon leakage and ensuring a level playing field for European industries. As part of the EU's broader climate strategy, CBAM serves as a critical component in achieving the ambitious target of reducing greenhouse gas emissions by 55% from 1990 levels by 2030, and transitioning to a climate-neutral continent by 2050¹. According to the European Commission, the mechanism is designed to impose a carbon cost on imports equivalent to what would have been paid if the goods were produced under the EU's carbon pricing rules, thereby preventing companies from shifting production to countries with less stringent environmental standards.

However, the underlying motive has been the subject of various disputes and concerns. One of the primary issues revolves around its compatibility with World Trade Organization (WTO) rules, as it introduces a new dimension to the intersection of trade and environmental policies.¹⁷ There are apprehensions about potential trade disputes and retaliatory measures from non-EU countries that may perceive CBAM as a protectionist tool rather than a genuine environmental measure. Additionally, the mechanism's impact on developing countries and their industrial competitiveness has raised questions about fairness and equity in global climate efforts.

Highlighting relevant articles

The literature on the impact of CBAM on Taiwan shows a nuanced perspective on the possible pathways for preparation. At a macro level, a study published by Perdana and

¹⁷ Benson, E., Majkut, J., Reinsch, W. A., & Steinberg, F. (2023). Analyzing the European Union's Carbon Border Adjustment Mechanism. *www.csis.org*. <https://www.csis.org/analysis/analyzing-european-unions-carbon-border-adjustment-mechanism>



Vielle¹⁸ suggests it is more advantageous to have a collective implementation of CBAM organised by a group of significant emitters (EU, the US, and China), rather than a single region (EU) in isolation. This collective action helps to minimize carbon leakage, because it reduces the incentive for businesses to relocate production to countries with less stringent carbon regulations. The study also suggested that when these major emitters work together, the overall economic well-being of the countries within the coalition can improve, because the aligned carbon pricing reduces market distortions and encourages cleaner production, leading to potential economic and environmental benefits. For Taiwan, this collective approach to carbon pricing could be particularly beneficial. As an economy with significant exports, including to the EU, Taiwan could face challenges if only the EU implements CBAM. However, if Taiwan aligns its carbon pricing with a coalition of major emitters, it could help Taiwanese industries remain competitive while contributing to global efforts to reduce emissions.

In their study, Zhong and Pei and provide a comprehensive review of the most recent economic studies CBAM. They analyzed 97 relevant studies on CBAM from 2004 to 2021, providing a thorough synthesis of the literature. Their analysis underscores the potential impacts of CBAM in terms of its effectiveness across three policy objectives: protecting fair competition, reducing carbon leakage, and limiting global welfare costs. Importantly, they highlight how policy design and the characteristics of an economy can lead to varying levels and types of CBAM effectiveness. This work offers valuable insights into the formulation of effective CBAM policies and presents a solid foundation for further research.

¹⁸ Perdana, S., & Vielle, M. (2023). Carbon border adjustment mechanism in the transition to net-zero emissions: collective implementation and distributional impacts. *Environmental Economics and Policy Studies*, 25(3), 299–329. <https://doi.org/10.1007/s10018-023-00361-5>



There has also been further studies conducted specifically on the potential impacts of CBAM on Taiwan-EU steel exports.¹⁹ This study offers guidance for Taiwan, suggesting a need for significant adjustments to Taiwan's steel manufacturing sector that are still heavily reliant on fossil fuels for power generation, and stresses the importance of Taiwan to comply with EU guidelines, rather than adopt a fight approach. A subsequent paper titled "*A review on low carbon emissions projects of steel industry in the World*" by Xinyu Zhang, Kexin Jiao, Jianliang Zhang, and Ziyu Guo provided a comprehensive review of low carbon emissions projects in the global steel industry. They selected projects like the COURSE50 project in Japan, the FINEX-CEM project in Korea, the hydrogen projects in China among others, and argued these are the future development trends of the metal industry, focusing on innovative approaches like coke substitution and treatment of by-product gases.

Comparative Analysis of Taiwan and Japan

4.1 Reason for choosing Japan and Taiwan

This study focuses on the case study of Taiwan and Japan and their steel sector. Japan and Taiwan are comparable in terms of political, economic, and societal models, with important functions in the international supply chain. Both are EU trade partners, exporting steel products over and subject to CBAM coverage. Both nations have established democratic systems with a strong adherence to the rule of law and an independent judiciary,²⁰ which ensures that legal frameworks are robust and reliable.

¹⁹ Best, Frank (2023) : The EU Carbon Border Adjustment Mechanism and its Influence on Steel Imports from Taiwan, The 19th International Conference on Knowledge-based Economy and Global Management. Tainan, Taiwan, 2-3 November, 2023

²⁰ Fukuda, M. (2018). The Japan-Taiwan Relationship Under the Tsai Ing-wen Administration. *Springer Link*, 297–322. https://doi.org/10.1007/978-3-319-77125-0_12

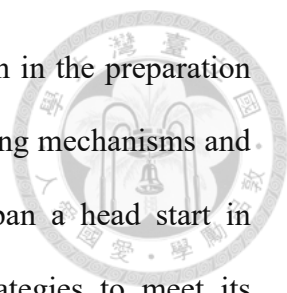
Politically, they are committed to participating in international agreements and conforming to EU standards, which is evident in their environmental policies and how both are actively taking steps to implement carbon levies and enhance their decarbonization strategies. They are considering the implementation of similar carbon pricing mechanisms to maintain their competitive edge in the EU market.

From an economic perspective, both Taiwan and Japan possess highly developed economies with a pronounced focus on the technology and manufacturing industries. Taiwan's economy is predominantly export-driven, with exports constituting 57.75% of its GDP in 2021, amounting to USD 447.693 billion. Conversely, Japan's economy leans towards services and manufacturing, with exports accounting for 15% of its GDP in 2021, totaling USD 756 billion. Taiwan's steel exports represent 2.5% of our manufacturing value, equating to USD 12,109,103 in 2022 out of a total export value of USD 478.252 billion²¹, and Japan's iron and steel exports reach 3% of total exports.²²

Societally, both Japan and Taiwan have similar cultural habits, given that Taiwan used to fall under Japanese occupation. Both have an ageing demographic, and values education, innovation, and research in work culture. These values not only drive their economic competitiveness but also demonstrate their societal resilience and adaptability, as seen during global challenges like the COVID-19 pandemic.

²¹ International Trade Centre (ITC). (2023). Trade Map - Trade Statistics for International Business Development. Trademap.org. <https://www.trademap.org/Index.aspx>

²² Yasuo, T. (2023, November 30). Japan Should Cooperate Constructively with the EU on CBAM. Research Institute of Economy, Trade and Industry (RIETI). https://www.rieti.go.jp/en/columns/a01_0739.html

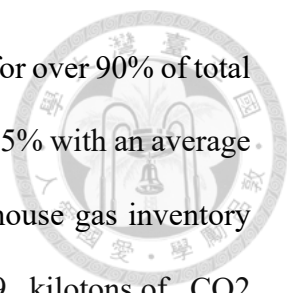


Most importantly, Japan serves as a valuable benchmark for Taiwan in the preparation for CBAM due to its earlier start. Japan had instigated internal pricing mechanisms and policy measures prior to CBAM announcement, and this gave Japan a head start in understanding the implications of CBAM and in developing strategies to meet its requirements. Taiwan can learn from Japan's experiences, particularly in sectors like steel and iron, and their progress can offer insights into best practices, challenges to anticipate, and strategies for effective compliance, making it an apt comparison for Taiwan as both nations navigate the complexities of CBAM preparation. Japan's journey could thus provide valuable lessons for Taiwan in its own path towards CBAM readiness and decarbonization efforts.

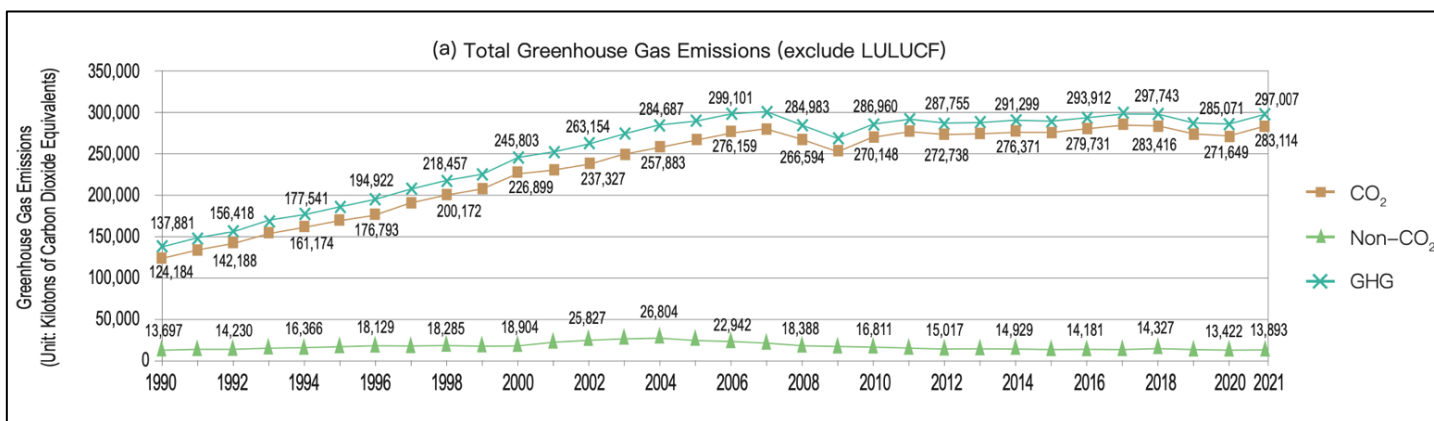
4.2 Comparison of GHG Emissions

4.2.1 Taiwan

In March 2022, Taiwan's government implemented a *2050 National Action Plan for Reaching Net Zero*, finalised in March 2023. Alongside the 2015 Greenhouse Gas Management Act, this set our GHG reduction goals for the next decade: 2% reduction from 2005 levels by 2020 (i.e. 261,131 kt in emissions), 10% reduction by 2025 (i.e. 239,814 kt in emission), and 24% reduction by 2030, through the four avenues of energy, industry, lifestyle and society.



However, actual GHG emissions remains high with CO₂ accounting for over 90% of total emissions. From our base year 2005 until 2021, CO₂ increased by 6.25% with an average annual growth rate of 0.38%.²³ According to Taiwan’s latest greenhouse gas inventory database below, 2005 had emissions at approximately 276,159 kilotons of CO₂ equivalents and rose to around 283,114 kilotons by 2021. This upward trajectory in emissions is particularly significant given the global efforts to reduce GHG emissions to mitigate the effects of climate change. The line graph indicates that while there have been fluctuations, the overall direction is an increase in both CO₂ and total GHG emissions, with a notable spike around the year 2006. Non-CO₂ emissions have remained relatively stable with minor variations. The data suggests that despite Taiwan setting GHG reduction goals, achieving these targets may require more aggressive strategies and policies focused on sustainability and environmental protection. Our 2020 emissions were 9% above target level, and currently we are not on track to achieve the 2025 goal either.

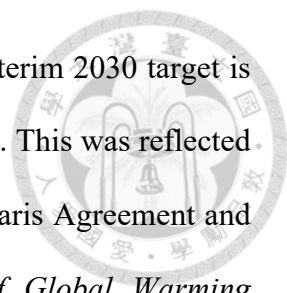


Source: 2023 Taiwan National Greenhouse Gas Inventory Report

4.2.2. Japan

According to Japan’s government roadmap *Green Growth Strategy for Carbon Neutral 2050* published in December 2020, their emission reduction milestones are to have a 46%

²³ 2023 Taiwan National Greenhouse Gas Inventory Report p1



reduction from 2013 levels by 2030, and net-zero by 2050. If the interim 2030 target is achieved, Japan's emissions in 2030 will be around 760,000 kilotons. This was reflected in their revised Nationally Determined Contribution (NDC) to the Paris Agreement and the later modification of the *Revised Act on the Promotion of Global Warming Countermeasures and its Practical Impact* in 2021.

In comparison to Taiwan, Japan has done better in reducing national CO2 levels from their base year. As shown in the bar graph below, total GHG emissions excluding LULUCF, was 1170 million tonnes (mt) in FY2021 which is a 17% decrease from 2013 levels of 1408 mt. Even better still was FY2023 which saw record low in GHG emissions since data collection began in 1990, with a 19.3% reduction from 2013 levels. The drop was due to a 5.3% decline in emissions from the industrial sector as steel production fell which reduced power demand, the ministry shared, “the emission continued a steady decline trend, on track toward a net-zero target in 2050,” an official representing the Ministry of Environment shared at a news conference.²⁴

²⁴ Umekawa, T., & Clark, A. (2024, April 12). *Japan's annual emissions drop as industrial pollution shrinks*. The Japan Times. <https://www.japantimes.co.jp/business/2024/04/12/japan-emissions-drop-fiscal-2023/>

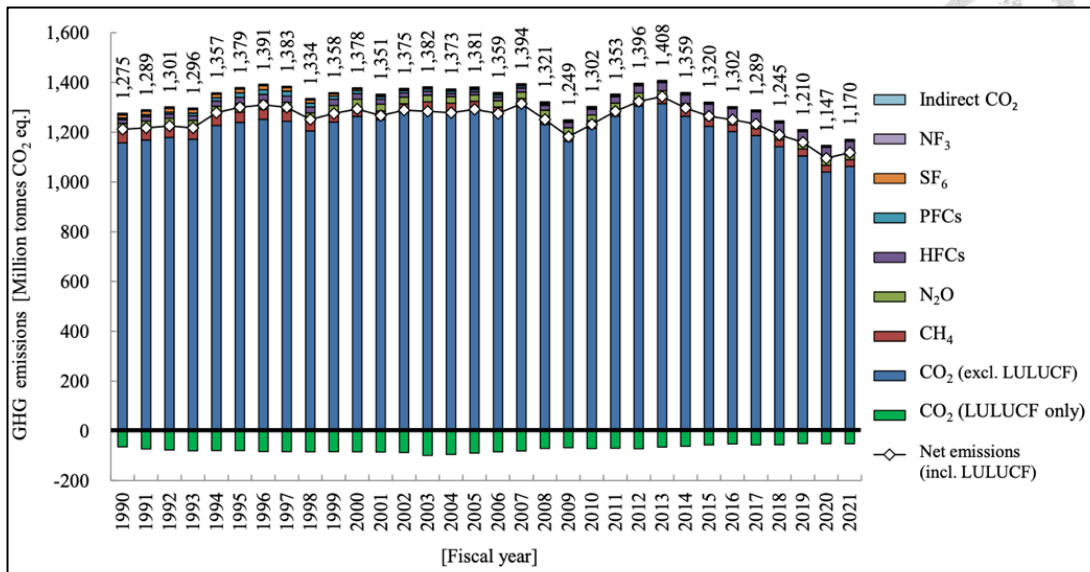


Figure 1 Trends in GHG emissions and removals in Japan

Source: National Greenhouse Gas Inventory Report of Japan 2023, Ministry of the Environment

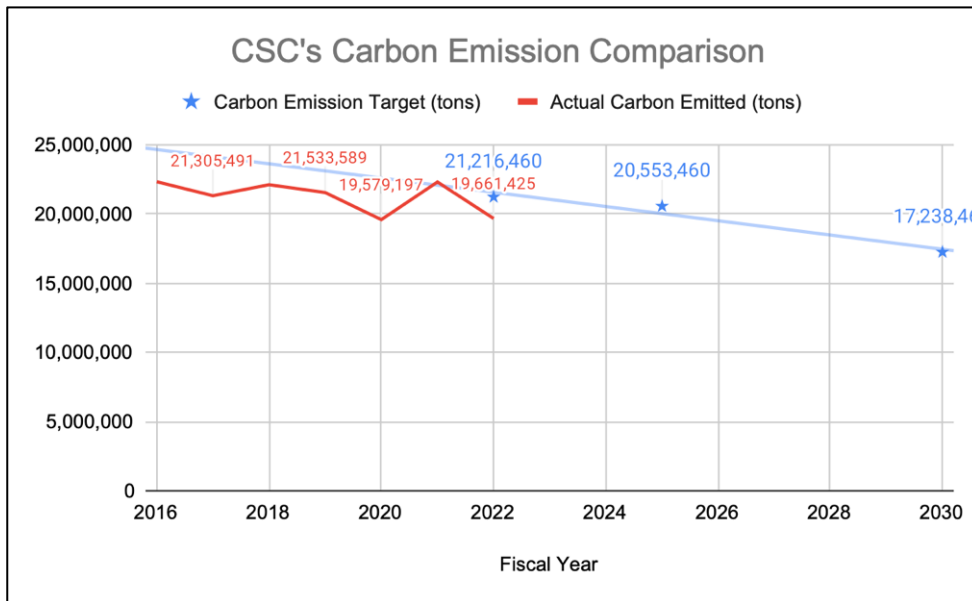
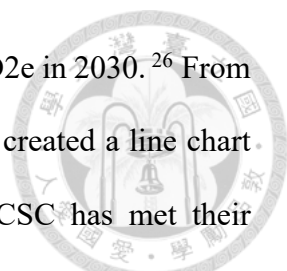
4.2.3 CSC

According to the 2023 National GHG Inventory Report Taiwan voluntarily submitted to the UNFCC Convention of the Parties, 5.51% of total emissions were caused by the industrial process and product use (IPPU) sector. IPPU metal processes, which includes iron and steel manufacturing, emit an annual average of 7000 kt CO₂ from 2012 to 2021.²⁵ Unfortunately Taiwan’s report was relatively general and did not include a section specific to iron and steel production, like Japan did (*elaborated in 4.2.4*).

According to CSC’s 2022 Sustainability Report, they aim to be carbon neutral by 2050. Their interim targets are a 7% reduction from base year 2018 by 2025, and a 22% reduction by 2030. If achieved this means a cumulative reduction of 1.547 million tonnes

²⁵ 2023 Taiwan National Greenhouse Gas Inventory Report. (2023), p5

CO₂e in 2025 and a subsequent reduction of 4.862 million tonnes CO₂e in 2030.²⁶ From the data reported on annual carbon emitted, Scope 1 and Scope 2, I created a line chart comparison to determine their success trend. It shows annually CSC has met their reduction goals, save for 2021 when it peaked slightly above target level, most likely due to trade opening up post-Covid.



However, their success rate is taken with a grain of salt because their goals are very modest and lack the ambition many international firms have. If they are to be carbon neutral by 2050, they need to increase their annual targets and chart an innovative decarbonisation strategy pathway.

4.2.4 Nippon Steel

²⁶ China Steel Corporation. (2022). China Steel Corporation Sustainability Report 2022, p23, 122

According to Japan's GHG Inventory Report²⁷ submitted to the UN, 8.8% of FY2021 emissions came from IPPU. Emissions from the metal industry were 5796 kt CO₂ equivalent, only a mere 0.5% of Japan's total GHG emissions (excluding LULUCF). This is slightly lower than Taiwan's, moreover Japan has done well in decreasing these emissions and FY2021 saw a 24.9% decrease compared to FY1990.

Table 4-42 Emissions from 2.C. Metal Industry

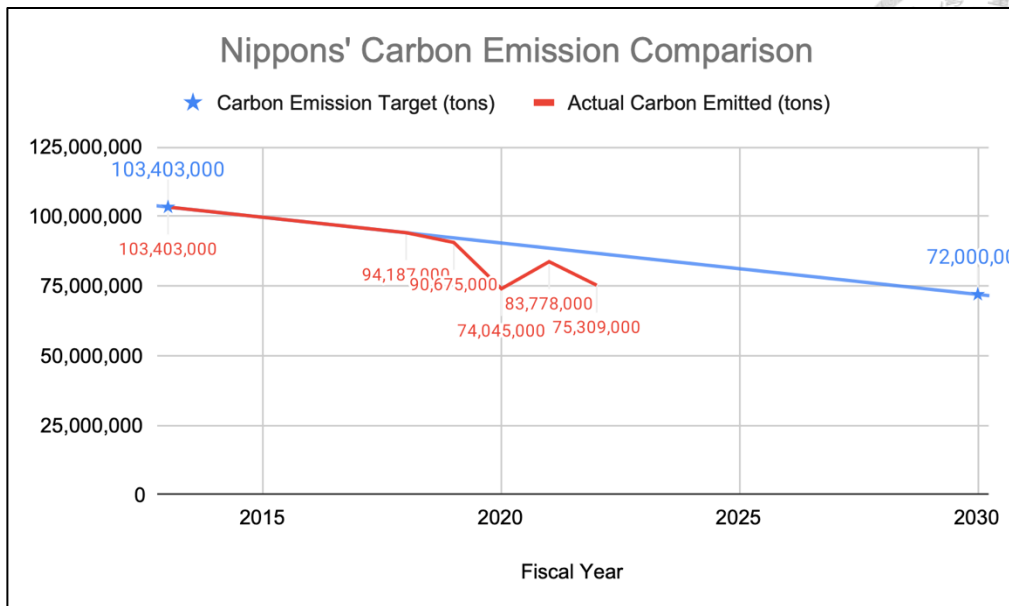
Gas			Units	1990	1995	2000	2005	2010	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
CO ₂	2.C.1	Iron and steel production	Use of electric arc furnaces in steel production	kt-CO ₂	298	328	190	231	152	167	140	160	132	143	170	175	139	91	189
			Limestone and dolomite use in iron and steel production	kt-CO ₂	6,884	6,492	6,537	6,222	5,919	5,844	5,950	5,861	5,705	5,634	5,542	5,420	5,143	4,799	5,120
			By-product gas flaring in iron and steel production	kt-CO ₂	25	56	102	174	243	212	256	245	223	213	192	181	168	133	149
	2.C.3	Aluminium production	kt-CO ₂	58	29	11	11	8	7	5	1	NO	NO	NO	NO	NO	NO	NO	
	Total		kt-CO ₂	7,266	6,905	6,841	6,637	6,322	6,230	6,351	6,267	6,059	5,990	5,904	5,776	5,450	5,023	5,459	

Source: National Greenhouse Gas Inventory Report of Japan 2023, p4-52

Nippon Steel, roughly four times larger than CSC, also aim to be carbon neutral by 2050. They have formulated a target of reducing total CO₂ emissions by 30% by 2030, compared to a 2013 baseline, which if achieved means emissions must be capped at 72 million tons in 2030.²⁸ The line graph below shows the trend of their actual emissions and if they are on track to meet their 2030 target. Their trend is identical to CSC – a decrease in both Scope 1 and Scope 2 emissions from 2013 to 2022, with the exception of 2021. This suggests the measures taken to reduce CO₂ emissions have been generally effective over this period. They are well on track to meet their 2030 goal.

²⁷ National Greenhouse Gas Inventory Report of Japan 2023, Ministry of the Environment. (2023). Center for Global Environmental Research ISSN 2434-5679, CGER-1164-2023.

²⁸ Nippon Steel. (2019). *Nippon Steel Sustainability Report 2019*.



4.3 Comparison of Decarbonisation Strategies

4.3.1 Government Plan and Policies

Taiwan

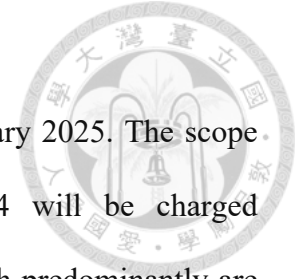
Before the announcement of CBAM, Taiwan’s progress in carbon reduction and green transition was relatively slow. Despite having the Greenhouse Gas Reduction and Management Act in place since 2015, the country faced significant barriers in its international diplomatic and economic relations that inhibited the adoption of more ambitious climate policies. Expert opinions in ‘*Taiwan and Climate Change*’²⁹ highlighted the impact of carbon reduction policies fell on industries and the general public via energy prices, which affected the cost of living and transportation. This, coupled with the public’s lack of awareness of the climate emergency, meant that customary elite political decision-making could not win in party politics. Also whilst the

²⁹ Fan, C.-T., Chien, K., Liu, J. C.-E., Yeh, T.-K., Shih, W.-Y., & Hsu, P.-J. (2023, May 19). *Taiwan and Climate Change: Six views on how it and climate community can work better together*. The Breakthrough Institute. <https://thebreakthrough.org/issues/energy/taiwan-and-climate-change>

government had also enacted policies to boost the development of the renewable energy industry, like Ma Ying-Jeou's Renewable Energy Development Act in 2009 and Tsai Ing-Wen's 2025 Nuclear Phase-Out Plan, there were problems with Taiwan's local grid system and lack of land that hindered its deployment. As a result, even after Taiwan voluntarily adopted the Paris Agreement in 2015, a more ambitious carbon reduction goal was needed.

However, the announcement of the CBAM marked a turning point for Taiwan's carbon reduction efforts. The government became increasingly proactive in establishing a carbon reduction environment. In March 2022, the government laid out their strategy in the 2050 National Action Plan for Reaching Net-Zero, and passed the Climate Change Response Act (CCRA)³⁰ in January 2023. The CCRA, a modification of the 2015 Greenhouse Gas Reduction Management Act, has two key landmarks: a legally binding goal to reach net-zero by 2050 (Art 3(10)), and the implementation of a domestic carbon fee (Art 5(4)). It also includes broader strategies for reducing GHG emissions, with a new chapter on climate change adaptation and just transition, ensuring the shift towards a low carbon economy is fair and inclusive. It encourages technological innovation, research and development and financial mechanisms to promote low-carbon green growth, and increases information transparency and citizen participation to rope the public into getting involved in national efforts. The CCRA represents a more comprehensive and integrated framework for addressing both the causes and effects of climate change, with a clear emphasis on sustainability, justice, and economic transformation and shows Taiwan's evolving approach to climate change.

³⁰ Climate Change Response Act, adapt.moenv.gov.tw (2023). https://adapt.moenv.gov.tw/eng/TCCIP-1-D/TCCIP-1-D-11_en.html



Furthermore, a domestic carbon levy will be implemented in January 2025. The scope covers companies emitting above 25,000 CO₂ tones in 2024 will be charged approximately NTD300 (USD10) per ton for their emissions, which predominantly are electricity and manufacturing installations sector.³¹ The first phase on this levy will cover 550 facilities, managed by 10 large companies, which represents 55% of total national emissions.³² This is a huge leap in the right direction because this carbon fee can be deducted from CBAM if exporters can prove a carbon price has already been paid in their own country.³³ It prevents double taxation and speaks to Europe's normative power in encouraging foreign partners to adopt emission reduction measures, and most importantly for Taiwan ensures monies stay within our borders.

Complementing the levy is a market-driven carbon trading platform, the Taiwan Carbon Solution Exchange (TCX), launched in August 2023. The legal basis was first presented in the GHG Reduction Management Act 2015, and reaffirmed in Article 8(13) of CCRA. There are currently seven listed carbon projects on water and energy, with 45 companies participating to trade 88,520 tons of CO₂ at USD 3.5-12 per ton.³⁴ In December 2023, TCX expanded and launched its international trading platform.

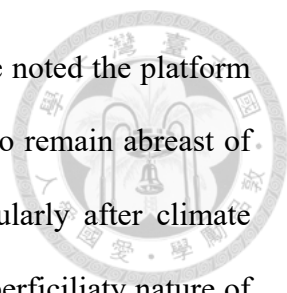
However it's worth emphasizing that the TCX was received with very mixed reviews. During my interviews, many stakeholders shared their suspicion on the effectiveness of

³¹ *Policy measures to respond to carbon fee impacts on industry in Taiwan*. (2024). London School of Economics (LSE) Grantham Research Institute of Climate Change and the Environment.

³² Insight from interview conducted

³³ European Commission. (2023). *Carbon Border Adjustment Mechanism*. European Commission. https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

³⁴ *Taiwan Carbon Solution Exchange*. (n.d.). <https://www.tcx.com.tw/en/index.html>



the platform and the underlying motives for its implementation. One noted the platform was only implemented for geopolitical reasons in a bid for Taiwan to remain abreast of international trends and remain relevant in diplomatic ties, particularly after climate change was included in Biden's agenda. Two commented on the superficial nature of the website with one saying "it's called the Taiwan Carbon Solution Exchange, so what solutions are they offering?", and the misinformation floating in the community pushing the idea carbon credit investments are a lucrative business. Desk research, confirmed by stakeholder interviews, notes there are many limitations in place on the current trading platform, i.e. credits cannot be used to offset the domestic carbon levy nor any carbon tariffs, like CBAM. Yet some stakeholders I met saw these limitations as positive because they force companies to focus on reducing their emissions rather than using credits as a scapegoat to continue carbon-intensive operations.

Japan

Japan had an earlier start in climate policies compared to Taiwan, due to the United Nation's recognition as an independent country. It gave them the platform and incentive to implement national measures to reduce carbon emissions even before CBAM was announced. They implemented the 1998 Act on the Promotion of Global Warming Countermeasures as their primary legislative framework guiding its climate policies, and as a commitment to the Kyoto Protocol. In 2015, they also committed NDC to the Paris Agreement to reduce GHG levels by 26% from 2013 levels by 2030 which was later increased to 46%. In 2020, Prime Minister Suga announced the net-zero by 2050 goal which became legally binding in the Revised Act on the Promotion of Global Warming Countermeasures & its Practical Impact in 2021.

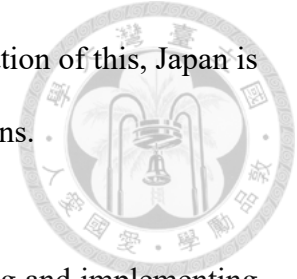
Furthermore, they were the first country in Asia to enact a carbon tax (known as the ‘tax for climate change mitigation’) in 2012. While the tax is meant to discourage businesses from using fossil fuels, the rate has stayed low ever since and currently at JPY289 (USD1.87) per CO2 ton. It generated JPY39.1 billion in government revenue in its first year, which was allegedly used to support energy-saving measures and renewable energy infrastructure.³⁵ But this shows Japan has been a long-time proponent of carbon pricing and has integrated international commitments into its national legislation.

After CBAM was announced, Japan worked to align domestic policies with international commitments with an emphasis on building their industrial capacity. Taiwan, on the other hand, focused on setting the foundation of internal carbon pricing mechanisms. Japan’s Ministry of Economy, Trade and Industry (METI) created the GX League in 2022, a cooperating platform between companies, government, academics and financial institutions to develop Japan’s emission trading platform, GX-ETS. A Net-Zero roadmap named the Basic Policy, later legislated on in the GX Promotion Act, charted a plan for the next 10 years to decarbonisation investment in power generation, industry, transport and residential sectors. It aims to mobilize JPY150 trillion (USD 1 trillion) in a Green Innovation Fund through GX Economic Transition Bonds to switch to renewables and other non-fossil fuel energy, and in R&D technology in resource-recycling, carbon storage for iron and steel, chemical and other manufacturing industries, with the goal to be marketable at a large scale by 2030.³⁶ Later the GX Promotion Act in May 2023,

³⁵ *Environmental Taxation*. (n.d.). Ministry of the Environment, Government of Japan. <https://www.env.go.jp/en/policy/tax/env-tax.html>

³⁶ Insight from interview conducted

provided legal authority for the Basic Policy.³⁷ With the implementation of this, Japan is in sound footing to continue seeing reductions in their GHG emissions.



Though Japan had a headstart, both countries are actively developing and implementing policies to address climate change and prepare for the economic and environmental impacts of CBAM. Japan continues to focus on strategic planning and industrial competitiveness to meet its long-term climate goals, while Taiwan are still in early stages in establishing our own system.

4.3.2 Steel Industry

CSC

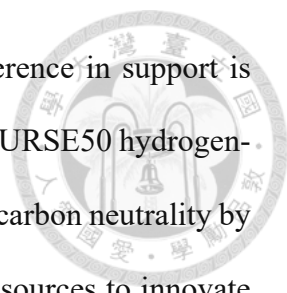
CSC sees opportunities in the global push for decarbonization. Steel production is so polluting because carbon serves a dual purpose in iron-making process, to convert iron oxide to iron as well as an energy source to provide heat when carbon and oxygen react exothermically. Just like Nippon, their strategy aims for carbon neutrality by 2050, but differs in their methods and support mechanisms. CSC's decarbonisation strategy focuses on 'green hydrogen' in direct reduction iron making, using 'carbon-free power' and developing carbon capture, utilisation and storage (CCUS) technology.³⁸

However they have acknowledged the many hurdles in terms of technology and finances. Unlike Nippon Steel, which has government support through the Green Innovation Fund and the backing of projects by the New Energy and Industrial Technology Development

³⁷ Anderson Mori & Tomotsune. (2023, July 6). *Enactment Of GX Promotion Act And Its Impact On Corporate Decarbonization - Renewables - Japan*.

<https://www.mondaq.com/renewables/1338324/enactment-of-gx-promotion-act-and-its-impact-on--corporate-decarbonization>

³⁸ China Steel Corporation. (2023). *China Steel Corporation Sustainability Report 2023*.



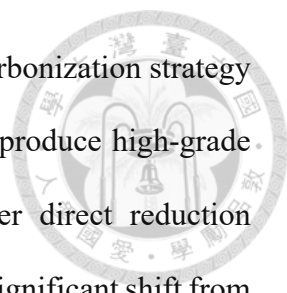
Organisation (NEDO), CSC lacks government assistance. The difference in support is most obvious as Nippon Steel embarks on ambitious projects like COURSE50 hydrogen-based blast furnaces³⁹ to reduce CO₂ emissions by 30% by 2030 and carbon neutrality by 2050. CSC, on the other hand, must rely more heavily on its own resources to innovate and invest in green technologies. However, CSC has only set aside USD10 million to invest in a hydrogen supply chain. In comparison, the German government subsidized steelmaker ThyssenKrupp earmarked 20 billion Euros for the development of hydrogen-based steelmaking, and the Japanese government invested USD 1.5 billion in the Green Innovation Fund, which includes subsidies to major steel manufacturers such as Nippon Steel, JFE Steel and Kobe Steel.⁴⁰ The Taiwanese government must drastically increase their support in CSC's green transition, along with other companies, otherwise risk Taiwan falling behind in decarbonisation.

Nippon Steel

Nippon Steel in comparison, has a decarbonization strategy with a multifaceted approach. According to their 2023 Sustainability Report, they articulated a strategic vision to achieve carbon neutrality by the year 2050, their “Carbon Neutral Vision 2050.” It sets an ambitious target to reduce total CO₂ emissions by 30% by the year 2030, using the year 2013 as a baseline for comparison. Central to their strategy is their priority to develop breakthrough technologies to revolutionize the steelmaking process. The COURSE50 project stands out as a significant initiative within this strategy, aiming to substantially reduce CO₂ emissions from the blast furnace (BF) and basic oxygen furnace (BOF) processes. This project positions Nippon Steel at the forefront of the industry's efforts to

³⁹ Nippon Steel. (2023). Nippon Steel Sustainability Report 2023. p23

⁴⁰ Liu, K., & Teng, K. (2024, April 9). Taiwan's Largest Steelmaker Faces Green Transition Challenge. Commonwealth Magazine.



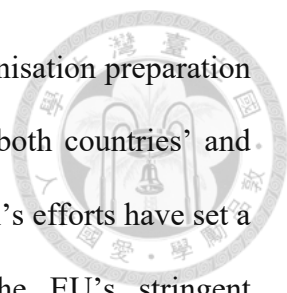
reduce its carbon footprint. Another innovative element of their decarbonization strategy is the focus on hydrogen steelmaking. The company plans to mass-produce high-grade steel in large-sized Electric Arc Furnaces (EAFs) and to pioneer direct reduction processes powered entirely by hydrogen. This approach represents a significant shift from traditional steelmaking methods and could set a new standard for the industry.

Unlike CSC, support from the Japanese government plays a crucial role in Nippon Steel's decarbonization efforts. The Green Innovation Fund and the New Energy and Industrial Technology Development Organization (NEDO) provide essential financial backing for the company's ambitious projects. This support enables Nippon Steel to pursue its technological ventures with greater confidence and resources.

In addition, Nippon Steel is also exploring a range of carbon offset measures. These include Carbon Capture, Utilization, and Storage (CCUS) among other strategies, which are integral to the company's comprehensive plan to offset its carbon emissions. Through these measures, Nippon Steel demonstrates its dedication to achieving a sustainable and environmentally responsible steel industry.

In summary, while both companies share the ultimate goal of carbon neutrality by 2050, their strategies reflect different focuses, challenges, and levels of government support. Nippon Steel's approach is characterized by a diverse set of technologies and strong government backing, whereas CSC's strategy is more focused on green hydrogen and self-reliance.

Results and Recommendations

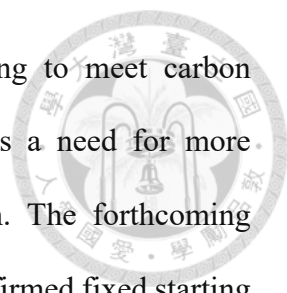


This section presents policy recommendations for Taiwan’s decarbonisation preparation in light of CBAM. This draws from a comprehensive analysis of both countries’ and discussions with stakeholders from various relevant industries. Japan’s efforts have set a precedent in reporting carbon footprints and aligning with the EU’s stringent environmental standards. Taiwan, following suit, has also initiated similar measures. The policy recommendations underscore the importance of governmental support, technological innovation, economic-environmental analysis, and international cooperation. The overarching recommendations section below are derived through an inductive thematic analysis (Virginia Braun and Victoria Clarke) on the transcripts, with the aid of coding software AI Delve, to identify common codes and key themes from stakeholder responses. Further tailored recommendations on Taiwan’s policies and internal pricing mechanisms will be elaborated on below as well. They advocate for the adoption of best practices from Japan’s experience, tailored to Taiwan’s unique economic and industrial landscape. These recommendations aim to facilitate a smooth transition for both nations towards a low-carbon economy, ensuring their continued competitiveness in the global market while adhering to the EU’s CBAM regulations.

5.1 Overarching Recommendations

1. More Emphasis on a ‘Stick’ Approach:

Based on the insights gathered from interviews, there is a common impression among foreign and local stakeholders that Taiwan’s current landscape is more skewed toward incentives, often referred to as ‘carrots’. There is an underlying culture of “情理法”, which prioritizes relationships above reason and law, and leaves too much room for lax results. However, there’s a pressing need to balance these with more stringent enforcement mechanisms, or ‘sticks’. To address this, a more assertive ‘stick approach’



should be implemented. This would ensure that companies failing to meet carbon reduction targets face tangible consequences. Additionally, there's a need for more accessible and legitimate platforms for carbon report verification. The forthcoming carbon levy, although a step in the right direction, still requires a confirmed fixed starting rate. This shift towards a more stringent approach is crucial for Taiwan to make significant strides in its carbon reduction efforts.

2. Government Subsidies towards Impacted Industries

A key strategy for Taiwan's green transition could be the implementation of government subsidies for industries impacted in the initial phase, like CSCs and downstream metal manufacturers. These subsidies will facilitate the larger companies to invest in research and development for decarbonisation, offsetting some of the costs associated with the transition and making it more financially feasible for them to explore and implement innovative carbon reduction solutions. This approach not only mitigates the short-term economic impacts of the transition but also fosters a long-term strategy for sustainable growth and development, thereby playing a pivotal role in Taiwan's green transition and global climate change mitigation efforts.

3. Proactive Engagement of SMEs and their Role in the Global Supply Chain

Another common theme reiterated by interviewees was for SMEs to adopt a more proactive response in preparing for CBAM, and use the guidance materials provided by the EU embassy and Taiwan government. Given that one of CBAM's objectives is to protect the EU's steel industry, Taiwanese SMEs, including the 3000+ metal compartment exporters, must be prepared to comply with stringent carbon reporting requirements. There should be a continuous effort to remind Taiwanese SMEs of their

critical role in the international supply chain. By doing so, the government can foster a sense of responsibility and urgency among SMEs to align with global environmental standards, thereby maintaining their competitive edge in the international market.



5.2 Specific recommendations for Taiwan's internal pricing mechanisms

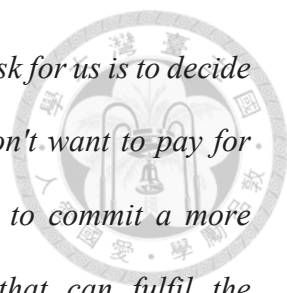
Taiwan's Carbon Levy

- **A higher starting rate is essential of minimum NTD500 (USD 15).**

The starting rate in 2025 will likely be NTD 300 (USD 10), which some have remarked as being too low. A recent research by the International Monetary Fund (IMF) in 2022 suggests the global average carbon price likely to achieve the 2°C target is around USD 80 per ton and USD 100 for the 1.8°C scenario,⁴¹ which admittedly is a high threshold for Asia. It was claimed by an interviewee that Singapore serves as a good reference for this region, and Taiwan should use their increased tax figure as 2025 benchmark. The Singaporean government will increase its national carbon tax from SGD 5 to SGD 25 (USD 18) by 2024 and subsequently to SGD 45 (USD 33) by 2026, to reach SGD 50-80 (USD 37-59) by 2030. To dispute any argument that Taiwan is justified in having a low starting rate as Singapore did, it is important to highlight Taiwan's late commencement date in 2025 and bear in mind the 2030 reduction goals. Taiwan lacks a buffer zone for a slow and incremental increase, and strict measures are necessary to take reduction goals seriously.

- **Provide discount carbon levy rates for companies with substantial GHG reduction.**

⁴¹ *Policy measures to respond to carbon fee impacts on industry in Taiwan.* (2024). London School of Economics (LSE) Grantham Research Institute of Climate Change and the Environment, p5



“But in our carbon levy community, there's another very important task for us is to decide the criteria to give the carbon levy discount. If you [companies] don't want to pay for those kind of \$6 billion, a choice you can make is that you have to commit a more aggressive reduction target for 2030. Reduction target target that can fulfil the requirement of science based target target so you can get more than 60% of the discount in your carbon living. So that's the thing we are talking about right now.”

This is to incentivise companies to lower their emissions and serves as a financial incentive for companies to invest in carbon reduction strategies and technologies. An interviewee commented this is a current topic under discussion with the committee. By offering a reduced carbon levy rate, the government can reward companies that make significant strides in reducing their carbon footprint. This not only lightens the financial burden of the carbon levy on these companies but also encourages other companies to follow suit. Over time, this could lead to a significant overall reduction in GHG emissions across various industries.

In Japan, their carbon tax system encourages businesses to reduce greenhouse gas emissions by offering tax incentives for investments in carbon neutrality. These incentives are part of the wider Industrial Competitiveness Enhancement Act, which provides tax credits for carbon neutral-related investments that meet specific decarbonization benchmarks.⁴²

⁴² *Japan's 2021 Tax Reform introduces tax incentives for carbon neutrality and digital transformation.* (2021, April 21). Ernst & Young Tax Co. https://www.ey.com/en_jp/ey-japan-tax-library/tax-alerts/2021/tax-alerts-04-20

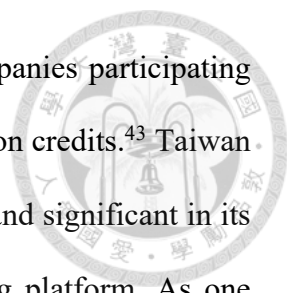
- **Revenue collected from carbon levy should be pooled in a decarbonisation fund and redistributed to impacted businesses.**

Taiwan can look to Japan's carbon tax system and its linkage with the Green Innovation Fund for inspiration. Japan's approach demonstrates the power of using tax revenues to drive innovation and support the transition to a low-carbon economy. The Green Innovation Fund, established by the Ministry of Economy, Trade and Industry (METI), is a 2 trillion yen initiative aimed at accelerating efforts toward structural changes in the energy and industrial sectors. It provides continuous support for up to ten years for R&D projects, demonstrations, and social implementation projects that align with Japan's goal of achieving carbon neutrality by 2050.

Taiwan could adopt a similar strategy by creating a dedicated fund that is directly financed by carbon levy revenues. This fund could focus on supporting ambitious green projects, particularly in areas essential to the circular economy such as renewable energy, energy efficiency, and carbon capture and utilization technologies. By ensuring that a portion of the carbon tax revenues is invested back into the economy through such a fund, Taiwan can foster a robust ecosystem for green innovation, driving both environmental sustainability and economic growth. This approach not only incentivizes emissions reductions but also aligns economic incentives with environmental goals, creating a win-win scenario for businesses and the environment alike.

Carbon Trading Platform, Taiwan Carbon Solution Exchange (TCX)

- **Encourage more players to participate to maintain demand for credits**



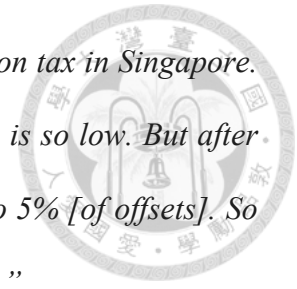
As TCX currently stands in 2024, there are 7 projects and 45 companies participating (including subsidiaries of financial holdings) in the purchase of carbon credits.⁴³ Taiwan should target key sectors such as semiconductors, carbon-intensive and significant in its economy, to increase the volume and impact of the carbon trading platform. As one interviewee remarked, *“the carbon exchange only really works if multiple industries are linked to it. Yep, the steel industry is not the dominant industry in Taiwan. It's not semiconductors. And it is I don't see how carbon pricing is really going to hold here.”*

Japan has taken a multifaceted approach to engage major industries in different sectors (e.g. energy, industry, forestry) in its carbon trading system. METI promotes green finance to support the development of new technologies. This financial backing makes it more attractive for industries to invest in carbon reduction technologies and participate in carbon trading as both a buyer and seller of credits. To fund the transition to carbon neutrality, Japan will issue GX Economic Transition Bonds to the amount of ¥20 trillion over the coming decade. This financial mechanism is designed to steer capital to where it's needed most, including industries that are part of the carbon trading system. Also, Japan's ETS is on a voluntary participation basis, where companies are encouraged to join by offering incentives for reducing emissions. Taiwan could adopt a similar approach by providing benefits such as tax credits or subsidies to companies that voluntarily participate in the carbon trading platform and meet certain emission reduction targets.

- **Permit participants to offset their domestic carbon levy by up to 5%**

⁴³ *The TCX International Carbon Credit Trading Platform Officially Launched.* (2023, December 26). Taiwan Carbon Solution Exchange. <https://www.tcx.com.tw/en/news.html?402890848c90dd26018ca395d88f000a>

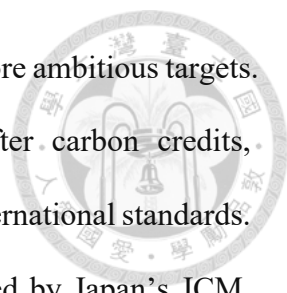
“We were using the example as a case in the first phase of the carbon tax in Singapore. You cannot use in the international offset project because the price is so low. But after the carbon price [jumped to] 35 Singapore dollars, they allow up to 5% [of offsets]. So that's the thing we want to see right now. Just like one classification.”



Based on that reference, once our carbon levy reaches a certain threshold, Article 24 of the CCRA should be amended to enable international carbon credits to be utilised to offset the domestic carbon levy by 5%. Singapore’s Ministry of Sustainability and the Environment has established an International Carbon Credit (ICC) Framework, allowing carbon tax-liable companies to offset up to 5% of their taxable emissions from 2024.⁴⁴ This alignment with international practices not only facilitates compliance with global carbon reduction commitments but also ensures the competitiveness of domestic industries in the international market. Moreover, it incentivizes the development of innovative carbon reduction technologies and promotes the transition towards a low-carbon economy, thereby contributing to the global effort to mitigate climate change.

Taiwan can also adopt the spirit of Japan’s Joint Crediting Mechanism (JCM), considering Article 6 limitation from the Paris Agreement. The JCM exemplifies how international cooperation can facilitate emission reductions, enhance ambitions for carbon reduction, and spur the development of innovative low-carbon technologies. By observing Tokyo’s strategy to offset 46% of its emissions-reduction target through international J-Credits, Taiwan can see the potential for leveraging high-quality voluntary carbon markets. This approach would not only lower the costs associated with carbon

⁴⁴ *Singapore Sets Out Eligibility Criteria For International Carbon Credits Under The Carbon Tax Regime.* (2023, October 4). Ministry of Sustainability and the Environment Singapore. <https://www.mse.gov.sg/resource-room/category/2023-10-04-eligibility-criteria-for-international%20carbon%20credits>



reduction for Taiwanese manufacturers but also enable them to set more ambitious targets. Simultaneously, it could transform into a supplier of sought-after carbon credits, enriching the TCX and aligning domestic carbon levy offsets with international standards. This strategic engagement with international carbon credits, inspired by Japan's JCM, could serve as a pragmatic reference for Taiwan to advance its climate objectives while enhancing its economic and environmental resilience.

- **Add a price floor for TCX adjusted for inflation annually**

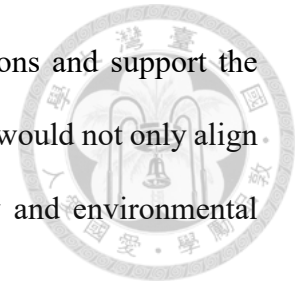
“One way that we've seen carbon pricing be more legitimised is when we put a carbon floor price. If you let the market with no carbon floor price control, people just they will lose essentially lose value in it, they know that these things can be traded away.”

It is recommended that TCX adopt a carbon price floor mechanism, akin to California's successful model, because a price floor is a safeguard against market volatility and ensures a consistent minimum value price for carbon allowances.⁴⁵ This not only guarantees a stable revenue stream to fund green initiatives but also provides a predictable cost trajectory for businesses, fostering long-term investment in low-carbon technologies. Learning from California's approach, TCX could initiate a quarterly auction system with a predetermined number of allowances, complemented by a cost-containment reserve to mitigate price spikes.⁴⁶ A price floor adjusted for inflation will ensure that credits cannot be sold for less at auctions, like California has a floor that increases by 5% per year, creating positive price momentum over time. Taiwan can integrate these features into its carbon pricing framework, aligning with the Climate

⁴⁵ Wood, P. J., & Jotzo, F. (2011). Price floors for emissions trading. *Energy Policy*, 39(3), 1746–1753. <https://doi.org/10.1016/j.enpol.2011.01.004>

⁴⁶ Gordon, K. (2023). An Advisor's Guide to Understanding California's Carbon Market [Review of *An Advisor's Guide to Understanding California's Carbon Market*]. *Climate Insights Channel*.

Change Response Act's objectives to incentivize emission reductions and support the transition to a net-zero economy. By establishing a price floor, TCX would not only align with global carbon pricing trends but also enhance the credibility and environmental integrity of Taiwan's carbon market.



5.3 Specific recommendations on Taiwan's legislation

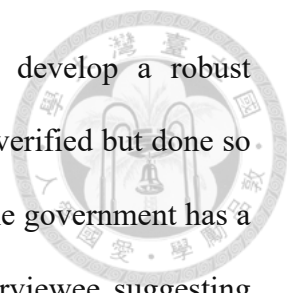
Climate Change Response Act (CCRA)

- **Incorporate mandatory third-party verification on carbon reports and increase verification capacity**

“Nowadays we don't have the ability to verify for [carbon reports]. Because nowadays the company, if we set out a mandatory response, we need to verify. But the verified capacity in Taiwan is quite [limited].”

It is imperative for Taiwan to bolster its verification capacity to ensure the integrity of environmental reporting. There is a very limited verification capacity and a lack enforcement capacity. Currently there are only 4 major verification bodies: SGS, BSI, TUV RH and BV. Furthermore, Article 7 and 21 of the CCRA are vague in determining what exactly requires verification, and who can establish themselves as a verification body.

To address this, Taiwan's government should consider implementing a more stringent legal framework that mandates comprehensive and standardized verification for all carbon reduction reports. This has to be done in conjunction with the European Commission guidelines to ensure they are complicit to their requirements as well. For example, in the case of CBAM reports, verifiers must obtain approval from the CBAM Committee in Europe to ensure they are qualified to do so. Drawing inspiration from



international standards such as ISO 14065:2020, Taiwan could develop a robust accreditation system for verifiers, ensuring that reports are not only verified but done so to a high standard that aligns with global best practices. Moreover the government has a role to ensuring verification is accessible to SMEs, with one interviewee suggesting providing subsidies to alleviate the financial burden on these companies and facilitate compliance. This would necessitate a clear legal framework for enforcement and penalties for non-compliance, thereby increasing the seriousness with which companies approach their carbon footprint.

- **Expand Art 5 on climate justice to provide legal standing for affected groups to sue organisations that fail to reach their reduction targets.**

This policy recommendation is derived from international case studies, rather than interviewee responses. Based on the CCRA's own 'Just Transition' rationale, Article 5 of the CCRA must go further and allow vulnerable populations, like indigenous communities and the youth, to hold multinational corporations (MNCs) accountable for failing to meet emission reduction targets. The youth represents the inheritors of our planet's future and including a right to climate justice within the CCRA would ensure that they have a legal avenue to safeguard their inheritance and demand accountability from entities whose actions jeopardize their prospects. Moreover, indigenous peoples often have a symbiotic relationship with their environment, and the degradation of natural resources can erode their way of life.

This builds upon the environmental accountability served in the Basic Environment Act of 2003, which mandates entities responsible for pollution or environmental destruction to be held accountable for the resulting harm or risk. There is even precedent - it afforded

Greenpeace East Asia's Taipei office, the Environmental Jurists Association (EJA), and four private citizens filed the first climate lawsuit in Taiwan. This lawsuit targeted corporate exemptions that allowed large corporations to evade their legal duty to transition to renewable energy and meet Taiwan's 2025 renewable energy goals.⁴⁷ Such cases demonstrate the ability of Taiwanese citizens to hold MNCs accountable for failing to meet environmental standards and commitments.

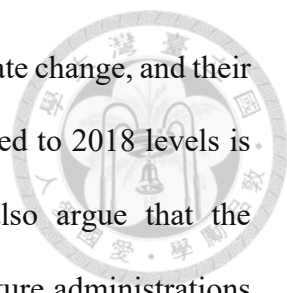
Very recently in April 2024, a landmark climate justice case Swiss group KlimaSeniorinnen v. Switzerland was made in the European Court of Human Rights (ECtHR).⁴⁸ The ECtHR ruled that Switzerland's government violated the European Convention on Human Rights by failing to reduce emissions and adequately address climate change. They had failed their positive obligations under the Convention concerning climate change, with critical gaps in establishing a relevant domestic regulatory framework, including through a carbon budget or national greenhouse gas emissions limitations. This was the first climate change litigation in which an international court ruled that state inaction violates human rights.

Following this, South Korea had its first public hearing case on climate justice against the government.⁴⁹ The case, Woodpecker v. South Korea, argues the South Korean

⁴⁷ *Taiwan: Greenpeace joins private citizens to file Taiwan's first climate lawsuit, targeting corporate exemptions.* (2021, February 3). Business & Human Rights Resource Centre. <https://www.business-humanrights.org/en/latest-news/taiwan-greenpeace-joins-private-citizens-to-file-taiwans-first-climate-lawsuit-targeting-corporate-exemptions/>

⁴⁸ *KlimaSeniorinnen v. Switzerland (ECtHR)*, Climate Change Litigation Database ___ (European Court of Human Rights 2024). <https://climatecasechart.com/non-us-case/union-of-swiss-senior-women-for-climate-protection-v-swiss-federal-council-and-others/>

⁴⁹ *South Koreans sue government over climate change, saying policy violates human rights, KSUT* ___. <https://www.ksut.org/2024-04-24/south-koreans-sue-government-over-climate-change-saying-policy-violates-human-rights>



government is violating human rights by not effectively tackling climate change, and their lacklustre goal to reduce carbon emissions by 40% by 2030 compared to 2018 levels is insufficient and will lead to disastrous climate change. They also argue that the government is deferring the task of reducing carbon emissions to future administrations and younger generations. This case represents a growing trend of climate litigation where citizens are holding their governments accountable for failing to adequately address climate change. The outcome of this case could set a precedent for future climate litigation in Asia.

The expansion of Article 5 of the CCRA to include a right for climate justice is not only a moral imperative but also a strategic move to reinforce Taiwan's position as a leader in climate action. It would empower the youth and indigenous peoples, ensuring their voices are heard in the quest for environmental stewardship and corporate accountability. Such a policy would resonate with global efforts to combat climate change and serve as a model for other nations to follow.

5.4 Specific recommendations on Taiwan's Small Medium Enterprises (SMEs)

- **The most fundamental shift is for Taiwanese SMEs to be more proactive in their preparation.**

"CBAM is probably a kind of last kick to the system. Understand you have to move, otherwise this is a deadline where everyone. So you have to be ready by the end of the 2025. So I think the CBAMs sped up the preparation of the private sectors, not the government."

From my observations in the in Taiwanese SMEs, there is definitely this very myopic focus on profit, and little consideration of value added. So, I don't think that Taiwanese SMEs are really excelling in areas such as, corporate social responsibility and I think that,

CBAM or in general environmental sustainability may be perceived as another the cherry on top.”

This was another common theme identified from the interviews. There is a diffused misconception that there is ample time for compliance and a tendency to remain inactive and wait for external assistance and guidance. This is a risky strategy that could lead to non-compliance, financial fees and decreased international competitiveness. It overlooks the ample resources online provided by the European Commission, to aid in reporting and tracking carbon emissions. SMEs must shift to a proactive mindset, and recognize CBAM deadline is non-negotiable and that two years is a short timeframe for the necessary adjustments.

To effectively prepare, SMEs should promptly commence a self-assessment of their carbon footprints to pinpoint potential areas for emission reductions. Concurrently, it is essential to invest in training and capacity building to thoroughly understand the requirements of the CBAM and formulate robust compliance strategies. Furthermore, collaboration is vital, so engaging with industry associations is crucial to share knowledge, pool resources, and adopt best practices, ensuring a cohesive and informed approach to carbon levy preparation. In the long term, it is imperative for SMEs to develop a long-term strategic plan. This plan should include clear milestones to achieve CBAM readiness well in advance of the 2025 deadline. Viewing the CBAM as an opportunity rather than a challenge can spur innovation and establish SMEs as leaders in sustainability within their sector. By embracing these strategies, Taiwan’s SMEs can not only comply with international carbon regulations but most importantly, maintain their position in the international supply chain.

- **Pressure government to provide subsidies for Hydrogen-Based Steelmaking in Taiwan.**

The Taiwanese government should provide targeted subsidies to incentivize the adoption of hydrogen-based steelmaking by companies like CSC and other SMEs in the supply chain. The transition to hydrogen-based steelmaking is critical for achieving Taiwan's climate goals. By replacing coal with hydrogen, the steel industry can significantly reduce its carbon emissions. However, CSC face financial constraints in this transition: research and development, infrastructure upgrades, and equipment modifications require substantial investment.⁵⁰ To accelerate progress, direct subsidies for R&D costs and collaboration with research institutes are essential.

With reference to Japan's establishment of a Green Innovation Fund as part of its ambitious Green Growth Strategy. This fund, with a staggering JPY 2 trillion (approximately USD 16 billion), provides continuous support for a series of efforts over the next 10 years—from ambitious R&D to social implementation. capital investment in decarbonization initiatives. Japan's strategy identifies 14 promising fields where future growth is expected, from fields span various sectors, including energy, manufacturing, transportation, and housing. The fund targets these priority areas, aligning with the reduction of greenhouse gas emissions.⁵¹ The fund operates in collaboration with the New Energy and Industrial Technology Development Organization (NEDO). It bridges the gap between public and private sectors, fostering innovation and driving technological advancements. In Taiwan, a similar approach—leveraging government-backed funds and

⁵⁰ Liu, K., & Teng, K. (2024, April 9). Taiwan's Largest Steelmaker Faces Green Transition Challenge. *Commonwealth Magazine*.

⁵¹ *Overview of the Green Innovation Fund Projects*. (2021, March 12). NEDO Green Innovation Fund Projects. <https://green-innovation.nedo.go.jp/en/about/>

private-sector commitment—can accelerate the adoption of hydrogen-based steelmaking. By learning from Japan’s success, Taiwan can overcome funding challenges and create a virtuous cycle of economic growth and environmental stewardship.



- **Utilise Technical Assistance and Information Exchange (TAIEX) in a peer-to-peer exchange.**

A key recommendation referred to in an interview was to utilise the EU’s TAIEX program to seek assistance to fill any knowledge gaps and bolster our preparedness for CBAM. This program is available to partner countries, including Taiwan, since 2020. It mobilizes public sector expertise from EU Member States to support reform processes around the world. It offers short-term technical support to public institutions in partner countries through workshops, expert missions, and study visits,⁵² which can provide Taiwanese officials and industry stakeholders with the necessary insights into the intricacies of CBAM.

This engagement would also facilitate the sharing of best practices and lessons learned from EU member states that have already begun implementing similar carbon pricing mechanisms. It can assist Taiwan in developing the institutional and administrative capacities required for effective CBAM compliance. This includes setting up robust systems for monitoring, reporting, and verifying carbon emissions, which are essential for meeting the CBAM’s stringent standards. Additionally, TAIEX’s role in fostering public-private partnerships can be instrumental in aligning the efforts of Taiwanese businesses with the government’s regulatory strategies. Engaging with TAIEX is a

⁵² TAIEX (*Technical Assistance and Information Exchange*) - European Commission. (n.d.). International-Partnerships.ec.europa.eu. https://international-partnerships.ec.europa.eu/funding-and-technical-assistance/technical-assistance/taix-technical-assistance-and-information-exchange_en

strategic step towards ensuring that Taiwan's industries remain competitive in the international market while advancing the country's green initiatives.



Discussion

6.1 Summary answers to the sub-questions

1. What is CBAM and its objectives?

The objectives of CBAM are multifaceted. One of the primary goals of CBAM is to mitigate carbon leakage. This mechanism aims to prevent companies from shifting their production to countries with less stringent environmental standards, thereby mitigating the risk of carbon leakage. Another objective of CBAM is to ensure fair competition. It seeks to level the playing field for European industries by imposing a carbon cost on imports. This cost is equivalent to what would have been paid if the goods were produced under the EU's carbon pricing rules. Thirdly, CBAM also supports the EU's broader climate goals. As part of the EU's comprehensive climate strategy, CBAM serves as a critical component in achieving the ambitious target of reducing greenhouse gas emissions by 55% from 1990 levels by 2030. Furthermore, it aids in the transition to a climate-neutral continent by 2050.

However, CBAM has also raised concerns about its compatibility with WTO rules and potential trade disputes. Some non-EU countries may perceive CBAM as a protectionist tool rather than a genuine environmental measure. Additionally, questions about fairness and equity in global climate efforts have been raised due to the mechanism's potential impact on developing countries and their industrial competitiveness. These concerns highlight the complexity and challenges of implementing such a mechanism on a global scale. Despite these challenges, CBAM represents a significant step forward in the global effort to combat climate change.

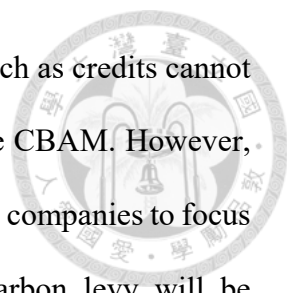


2. A comparison of Taiwan and Japan on their regulations and policies relevant to CBAM.

Before the announcement of CBAM, Taiwan's progress in carbon reduction and green transition was relatively slow. This was due to significant barriers in international diplomatic and economic relations. The impact of carbon reduction policies was felt by industries and the general public through energy prices, which affected the cost of living and transportation. Despite having policies to boost the development of the renewable energy industry, problems with Taiwan's local grid system and lack of land hindered its deployment.

The announcement of the CBAM marked a turning point for Taiwan's carbon reduction efforts. The government laid out their strategy in the 2050 National Action Plan for Reaching Net-Zero and passed the CCRA in January 2023. The CCRA includes a legally binding goal to reach net-zero by 2050 and the implementation of a domestic carbon fee. It also includes broader strategies for reducing GHG emissions, with a new chapter on climate change adaptation and just transition. This ensures that the shift towards a low carbon economy is fair and inclusive.

Then came the market-driven carbon trading platform, TCX, in August 2023. There are currently seven listed carbon projects on water and energy, with 45 companies participating to trade 88,520 tons of CO₂. TCX received mixed reviews. Some stakeholders viewed it as a geopolitical move to keep Taiwan abreast of international trends, especially after climate change became a key issue in global politics. Others criticized the platform for its superficiality and misinformation about carbon credit

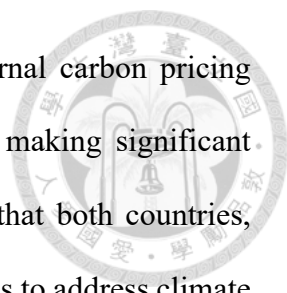


investments. There are limitations on the current trading platform, such as credits cannot be used to offset the domestic carbon levy or any carbon tariffs, like CBAM. However, some stakeholders saw these limitations as a positive because it forces companies to focus on actually reducing their emissions. Furthermore, a domestic carbon levy will be implemented in Taiwan in January 2025. This will cover companies emitting above 25,000 CO₂ tones in 2024. The first phase of this levy will cover 550 facilities, managed by 10 large companies, which represents 55% of total national emissions.

On the other hand, Japan had started implementing climate policies earlier than Taiwan, due to the United Nation's recognition as an independent country. They implemented the 1998 Act on the Promotion of Global Warming Countermeasures and committed to the Kyoto Protocol and the Paris Agreement. Japan was the first country in Asia to enact a carbon tax in 2012. However this tax, meant to discourage businesses from using fossil fuels, has remained low and is currently at JPY289 (USD1.87) per CO₂ ton.

After CBAM was announced, Japan worked to align domestic policies with international commitments with an emphasis on building their industrial capacity. Japan's METI created the GX League, a cooperating platform to develop Japan's emission trading platform, GX-ETS. A Net-Zero roadmap named the Basic Policy, later legislated on in the GX Promotion Act, charted a plan for the next 10 years to decarbonise investment in power generation, industry, transport and residential sectors.

Though Japan had a head start, both countries are actively developing and implementing policies to address climate change and prepare for the economic and environmental impacts of CBAM. Japan continues to focus on strategic planning and building their



industrial capacity, while Taiwan is setting the foundation of internal carbon pricing mechanisms. Despite the different approaches, both countries are making significant strides towards decarbonisation. This comparative analysis shows that both countries, despite their different contexts and challenges, are taking serious steps to address climate change and transition to a low-carbon economy. Their strategies offer valuable insights for other countries navigating their own decarbonisation journeys.

3. An instrumental case study comparison between Taiwan's CSC and Japan's Nippon Steel.

CSC sees opportunities in the global push for decarbonization and aims for carbon neutrality by 2050. Their strategy focuses on 'green hydrogen' in direct reduction iron making, using 'carbon-free power', and developing Carbon Capture, Utilisation and Storage (CCUS) technology. However, CSC acknowledges many hurdles in terms of technology and finances. Unlike Nippon Steel, which has government support, CSC lacks government assistance and must rely more heavily on its own resources to innovate and invest in green technologies. CSC has only set aside USD10 million to invest in a hydrogen supply chain.

Nippon Steel has a multifaceted decarbonization strategy with a strategic vision to achieve carbon neutrality by 2050, their "Carbon Neutral Vision 2050". It sets an ambitious target to reduce total CO₂ emissions by 30% by the year 2030, using the year 2013 as a baseline for comparison. Central to their strategy is their priority to develop breakthrough technologies to revolutionize the steelmaking process. The COURSE50 project stands out as a significant initiative within this strategy, aiming to substantially

reduce CO₂ emissions from the blast furnace (BF) and basic oxygen furnace (BOF) processes.



Another innovative element of their decarbonization strategy is the focus on hydrogen steelmaking. The company plans to mass-produce high-grade steel in large-sized Electric Arc Furnaces (EAFs) and to pioneer direct reduction processes that are powered entirely by hydrogen. Unlike CSC, support from the Japanese government plays a crucial role in Nippon Steel's decarbonization efforts. The Green Innovation Fund and the New Energy and Industrial Technology Development Organization (NEDO) provide essential financial backing for the company's ambitious projects.

While both companies share the ultimate goal of carbon neutrality by 2050, their strategies reflect different methods and support mechanisms. CSC's strategy is hindered by a lack of government support and financial resources, forcing them to rely on their own resources for innovation and investment in green technologies. On the other hand, Nippon Steel benefits from substantial government support, enabling them to pursue ambitious projects and technological ventures with greater confidence and resources. This support positions Nippon Steel at the forefront of the industry's efforts to reduce its carbon footprint.

In conclusion, both companies are making significant strides towards decarbonisation, but the level of government support they receive could be a determining factor in their success. The Taiwanese government must drastically increase their support in CSC's green transition, along with other companies, otherwise risk Taiwan falling behind in decarbonisation.



4. Key policy recommendations that Taiwan can adopt going forward?

Overarching Recommendations:

- There should be more emphasis on a ‘stick’ approach to encourage compliance with environmental regulations.
- Government subsidies should be directed towards industries that are impacted by these regulations to help them transition smoothly.
- Small and Medium Enterprises (SMEs) should be proactively engaged due to their significant role in the global supply chain.

Specific Recommendations for Taiwan’s Internal Pricing Mechanisms:

- For Taiwan’s Carbon Levy, a higher starting rate of a minimum NTD500 (USD 15) is essential. Companies with substantial GHG reduction should be provided with discount carbon levy rates. The revenue collected from the carbon levy should be pooled in a decarbonisation fund and redistributed to impacted businesses.
- For the Carbon Trading Platform, Taiwan Carbon Solution Exchange (TCX), it is recommended to encourage more players to participate to maintain demand for credits. Participants should be permitted to offset their domestic carbon levy by up to 5%. A price floor for TCX should be added and adjusted for inflation annually.

Specific Recommendations on Taiwan’s Legislation:

- The Climate Change Response Act (CCRA) should incorporate mandatory third-party verification for companies reporting emission reduction plans.
- Article 5 on climate justice should be expanded to provide legal standing for affected groups to sue organisations that fail to reach their reduction targets.

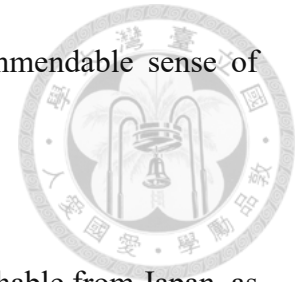
Specific Recommendations on Taiwan's Small Medium Enterprises (SMEs):

- The most fundamental shift is for Taiwanese SMEs to be more proactive in their preparation for these changes.
- The government should be pressured to provide subsidies for Hydrogen-Based Steelmaking in Taiwan.
- SMEs should utilise the Technical Assistance and Information Exchange (TAIEX) in a peer-to-peer exchange to learn from best practices and experiences.
- In conclusion, these recommendations aim to enhance Taiwan's decarbonisation strategy by addressing key areas such as internal pricing mechanisms, legislation, and the role of SMEs. By implementing these recommendations, Taiwan can make significant strides towards achieving its environmental goals and preparing for the impacts of the Carbon Border Adjustment Mechanism (CBAM).

6.2 Further Considerations on Taiwan's Progress

The first and most important consideration is whilst the purpose of the study is to provide recommendations to improve, Taiwan has made commendable progress in recent years. Despite the UN not recognising Taiwan as an independent country, Taiwan has remained a loyal participant in Conference of the Parties (COP) meetings and voluntarily contributed annual NDCs to the Paris Agreement. Since the announcement of CBAM in July 2021, Taiwan's government has been complicit in implementing national measures to establish an internal pricing mechanism (e.g. a carbon trading platform and carbon levy). It serves as an example for other EU trading partners navigating the complexities of international environmental policy of how much progress can be made within a few years with the government's backing. While there is still much room for improvement,

hence the purpose of this study, Taiwan has demonstrated a commendable sense of urgency in transitioning into the new era of carbon pricing.



Next, we consider Taiwan’s success in renewable energy, distinguishable from Japan, as one of four key government strategies in achieving Net-Zero.⁵³ This is not directly related to CBAM so was omitted from earlier discussions, but it still worth mentioning because it holds key implications in the broader sense of reaching carbon neutral, a goal shared by the EU. Taiwan’s commitment to wind power positions it as a leader in the Asia-Pacific region’s green transition. The “Pathway to Net-Zero Emissions in 2050” initiative underscores Taiwan’s ambitious goals, including a target of 60% total energy from renewable sources by 2050, with a significant milestone of 40GW wind-power capacity by 2035.⁵⁴ This strategic move not only aligns with environmental sustainability but also propels Taiwan towards becoming the green energy hub of Asia. The nation’s proactive approach is further evidenced by the substantial increase in cumulative installed renewable energy capacity, reaching 12.3 GW by May 2022, marking a 60% increase from 2016.⁵⁵

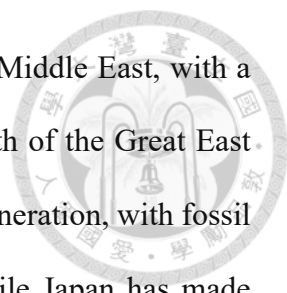
In contrast, Japan’s energy situation presents a different narrative. According to METI’s report on ‘Understanding the current energy situation in Japan’ published in 2022,⁵⁶ Japan

⁵³National Development Council. (2022). Taiwan’s Pathway to Net-Zero Emissions in 2050. In *國發會全球資訊網(英文網)*.

⁵⁴ *How Taiwan is powering a brighter tomorrow with wind energy*. (2022, August 10). The Guardian. <https://www.theguardian.com/power-of-green/2022/aug/10/taiwan-wind-power-renewable-energy-transition>

⁵⁵ Chang, T. (2022, November 2). *Taiwan Injects Momentum Into Global Transition to Net-Zero Emissions*. TheDiplomat.com. <https://thediplomat.com/2022/11/taiwan-injects-momentum-into-global-transition-to-net-zero-emissions/>

⁵⁶ *2021 – Understanding the current energy situation in Japan (Part 1)*. (2022, August 12). Agency for Natural Resources and Energy, METI. https://www.enecho.meti.go.jp/en/category/special/article/detail_171.html



remains heavily reliant on fossil fuel imports, particularly from the Middle East, with a low energy self-sufficiency ratio of 12.1% in FY2019. The aftermath of the Great East Japan Earthquake saw an increased dependency on thermal power generation, with fossil fuels accounting for 84.8% of Japan's energy mix in FY2019. While Japan has made strides towards incorporating renewable energy, the reliance on imports for essential minerals like rare metals for storage batteries highlights a vulnerability in Japan's energy security and a potential bottleneck in its transition to renewable energy. Taiwan's example offers valuable lessons in the importance of domestic resource development and the strategic implementation of renewable energy projects, a strength Japan can learn from.

Lastly, let's bear in mind the critical question on the use of the revenues generated from CBAM, which are estimated to be around EUR 1 billion per year on average over 2026-2030.⁵⁷ Nations subject to the CBAM fee should advocate for transparency in revenue allocation, and a portion of that be allocated to trading countries to support their transition towards carbon neutrality.⁵⁸ The call for transparency is grounded in the principle of mutual trust and cooperation. The EU has proposed that 75% of CBAM revenue go to the EU's budget, while 25% goes to the Member States.⁵⁹ However, there is a growing consensus that a portion of these revenues should be earmarked for supporting the green transition in trading countries, especially those that are economically dependent on EU trade and may lack the resources to rapidly decarbonize.

⁵⁷ *Revenues EU ETS and CBAM for the EU?* | Meijburg & Co Tax & Legal. (2022, January 25). KPMG. <https://meijburg.com/news/revenues-eu-ets-and-cbam-eu>

⁵⁸ Steenbrink, F. (2022). *Impact of the Carbon Border Adjustment Mechanism: An economic and geopolitical assessment of the German- Chinese aluminium trade flows* p64

⁵⁹ *Press corner*. (2021, December 22). European Commission - European Commission. https://ec.europa.eu/commission/presscorner/detail/en/ip_21_7025

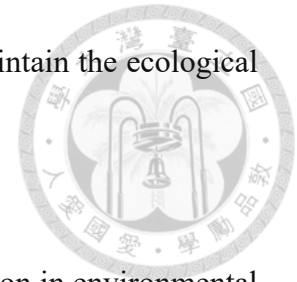
6.3 Relevance to Biodiversity

Taiwan is a biodiversity hotspot, boasting a vast array of species and ecosystems due to its subtropical location and significant altitudinal range. However, this rich biodiversity is under constant threat from development, habitat destruction, and climate change. The introduction of CBAM has prompted Taiwan to consider adjustments in its environmental policies, including the development of renewable energy sources and carbon pricing mechanisms. It is a powerful motivator for Taiwan to enhance its environmental regulations, which could include stronger biodiversity protection measures. By potentially imposing a carbon cost on imports, CBAM encourages countries like Taiwan to adopt greener policies to avoid trade disadvantages. This could lead to the creation of incentives for businesses to engage in practices that are not only carbon-neutral but also biodiversity-friendly, such as habitat conservation and sustainable land use.

Moreover, the revenues from carbon pricing, influenced by CBAM, could provide a significant source of funding for biodiversity conservation projects in Taiwan. This financial support could be directed towards the preservation of natural habitats, the protection of endangered species, and the restoration of ecosystems that have been degraded by industrial activities. Such funding could also support research and monitoring programs essential for maintaining biodiversity.⁶⁰ CBAM's emphasis on reducing carbon emissions can indirectly benefit biodiversity by encouraging the adoption of sustainable practices. For Taiwan, this could mean investing in renewable energy, promoting eco-friendly agriculture, and developing green infrastructure. These

⁶⁰ 農業部林業及自然保育署. (2020, November 27). Aichi Biodiversity Targets: 10-Years of Efforts in Biodiversity Showing Outstanding Results in Taiwan, Interdepartmental Cooperation to Link Road Network and Green Network. Forest and Nature Conservation Agency. <https://conservation.forest.gov.tw/EN/latest/0066734>

practices help to reduce pollution, preserve natural habitats, and maintain the ecological balance, which is crucial for the survival of diverse species.



The CBAM initiative may lead to increased international collaboration in environmental protection, which is vital for biodiversity conservation. Taiwan could engage in partnerships and knowledge-sharing with other nations to develop strategies for preserving biodiversity. This collaboration could extend to areas such as joint research projects, shared conservation programs, and the exchange of best practices in environmental governance. These suggestions highlight the multifaceted ways in which the CBAM study can be connected to biodiversity protection, demonstrating the potential for economic policies to have a positive impact on environmental conservation efforts.

6.4 Limitations of the research

There are a number of limitations to this research that can be identified, particularly with the interviewees selected. It was a huge emphasis of mine to collate stakeholders representing various impacted industries to showcase a holistic overview and draw common themes. However, there was insufficient interviewees originating from Japan familiar with CBAM implications. My main mode of reaching out was through my university connections, via LinkedIn or emailing relevant experts found through google search. Possible due to the language barrier, I was limited in connecting with actual Japanese experts with knowledge in the field. Hence that portion of data is predominantly secondary and conducted through desk research, though it was verified by interviewees with general knowledge of Japan.

Moreover, many interviewees came with a diverse background that may not be aligned with their current position. It is likely this has tainted their perspective when sharing their

viewpoints that were used as data in generating common codes. Therefore, a substantial portion of time allocated to literature review was spent reading through key policy themes identified to ensure validity.



Conclusion

In conclusion, the advent of CBAM has significantly influenced the decarbonisation strategies of both Taiwan and Japan. Despite facing unique challenges, both countries have demonstrated a strong commitment to reducing carbon emissions and transitioning to a low-carbon economy. Taiwan, despite its initial slow progress, has made significant strides following the announcement of CBAM. The government's proactive approach, as evidenced by the 2050 National Action Plan for Reaching Net-Zero and the Climate Change Response Act (CCRA), demonstrates a clear commitment to achieving net-zero emissions by 2050. The introduction of a domestic carbon levy and the establishment of the Taiwan Carbon Solution Exchange (TCX) further underscore Taiwan's efforts to create a robust internal carbon pricing mechanism. However there are still significant improvements that can be made, all elaborated under the 'Results' section.

Japan, on the other hand, has leveraged its early start in implementing climate policies to align its domestic policies with international commitments. The country's focus on strategic planning and building industrial capacity, coupled with the enactment of a carbon tax and the creation of the GX League, reflect Japan's comprehensive approach to decarbonisation.

Despite their different approaches, both Taiwan and Japan offer valuable insights into the complexities of navigating the transition to a low-carbon economy in the face of global mechanisms like CBAM. Their experiences underscore the importance of a multifaceted

approach that includes robust legislation, effective internal pricing mechanisms, and the active engagement of all sectors, including Small and Medium Enterprises (SMEs).

This thesis has highlighted the need for countries to be proactive, adaptable, and innovative in their decarbonisation strategies. As the world continues to grapple with the challenges of climate change, the experiences of Taiwan and Japan serve as valuable case studies for other countries embarking on their own decarbonisation journeys. The lessons learned from these two countries underscore the importance of international cooperation, policy innovation, and the active engagement of all stakeholders in the global effort to combat climate change. As we move forward, it is clear that a collective, concerted effort is required to achieve our global climate goals and ensure a sustainable future for all.

Recommendations for future research

Following the conclusions as explained above, several directions for further research can be identified. The first recommendation is to conduct an impact analysis of the CBAM on different sectors within Taiwan. Another direction is to assess the economic impacts to EU-Taiwan trade flows. Furthermore, another idea is to study scenario analysis if Taiwan were to implement our own carbon tariff on imports entering the country, what the impacts are on trading countries.



References

2021 – *Understanding the current energy situation in Japan (Part 1)*. (2022, August 12). Agency for Natural Resources and Energy, METI. https://www.enecho.meti.go.jp/en/category/special/article/detail_171.html

2023 *Taiwan National Greenhouse Gas Inventory Report*. (2023).

Anderson Mori & Tomotsune. (2023, July 6). *Enactment Of GX Promotion Act And Its Impact On Corporate Decarbonization - Renewables - Japan*. <https://www.mondaq.com/renewables/1338324/enactment-of-gx-promotion-act-and-its-impact-on--corporate-decarbonization>

Babbie, E. R. (2005). *The Basics of Social Research*. Wadsworth Publishing Company.

Benson, E., Majkut, J., Reinsch, W. A., & Steinberg, F. (2023). *Analyzing the European Union's Carbon Border Adjustment Mechanism*. *Www.csis.org*. <https://www.csis.org/analysis/analyzing-european-unions-carbon-border-adjustment-mechanism>

Carbon pricing outline open for input. (2023, December 31). Taipei Times. <https://www.taipeitimes.com/News/taiwan/archives/2023/12/31/2003811409>

Chang, T. (2022, November 2). *Taiwan Injects Momentum Into Global Transition to Net-Zero Emissions*. *TheDiplomat.com*. <https://thediplomat.com/2022/11/taiwan-injects-momentum-into-global-transition-to-net-zero-emissions/>

China Steel Corporation. (2022). *China Steel Corporation Sustainability Report 2022*.

China Steel Corporation. (2023). *China Steel Corporation Sustainability Report 2023*.

Clarke, V., & Braun, V. (2013). *Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning*. ResearchGate; British Psychological Society.

Climate Change Response Act, adapt.moenv.gov.tw (2023). https://adapt.moenv.gov.tw/eng/TCCIP-1-D/TCCIP-1-D-11_en.html

Cohen-Tanugi, L. (n.d.). *Europe as an international normative power: state of play and perspectives - Groupe d'études géopolitiques*. <https://geopolitique.eu/>. <https://geopolitique.eu/en/articles/europe-as-an-international-normative-power-state-of-play-and-perspectives/>

Door Anu Bradford. (2021). *The Brussels effect: how the European Union rules the world*. Uitgever: New York, Ny Oxford University Press.

Environmental Taxation. (n.d.). Ministry of the Environment, Government of Japan. <https://www.env.go.jp/en/policy/tax/env-tax.html>

European Commission. (2023). *Carbon Border Adjustment Mechanism*. European Commission. https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

Fan, C.-T., Chien, K., Liu, J. C.-E., Yeh, T.-K., Shih, W.-Y., & Hsu, P.-J. (2023, May 19). *Taiwan and Climate Change: Six views on how it and climate community can work better together*. The Breakthrough Institute. <https://thebreakthrough.org/issues/energy/taiwan-and-climate-change>

Fukuda, M. (2018). The Japan-Taiwan Relationship Under the Tsai Ing-wen Administration. *Springer Link*, 297–322. https://doi.org/10.1007/978-3-319-77125-0_12

Gordon, K. (2023). An Advisor's Guide to Understanding California's Carbon Market [Review of *An Advisor's Guide to Understanding California's Carbon Market*]. *Climate Insights Channel*.

Greenhouse Gas Reduction and Management Act, law.moj.gov.tw (2015). <https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=O0020098>

國際貿易局貿易統計系統. (2020). Trade.gov.tw. <https://cuswebo.trade.gov.tw/>

How Taiwan is powering a brighter tomorrow with wind energy. (2022, August 10). The Guardian. <https://www.theguardian.com/power-of-green/2022/aug/10/taiwan-wind-power-renewable-energy-transition>

Hsu, A. (2023). CBAM's Impact on Taiwan Fastener Industry, *Fastener World* 199/2023. *Industry Focus*.

International carbon credits to be available next month: TCX - Focus Taiwan. (2023, November 29). *Focus Taiwan - CNA English News*. <https://focustaiwan.tw/business/202311290022>

International Trade Centre (ITC). (2023). *Trade Map - Trade Statistics for International Business Development*. Trademap.org. <https://www.trademap.org/Index.aspx>

Japan's 2021 Tax Reform introduces tax incentives for carbon neutrality and digital transformation. (2021, April 21). Ernst & Young Tax Co. https://www.ey.com/en_jp/ey-japan-tax-library/tax-alerts/2021/tax-alerts-04-20

KlimaSeniorinnen v. Switzerland (ECtHR), Climate Change Litigation Database ____ (European Court of Human Rights 2024). <https://climatecasechart.com/non-us-case/union-of-swiss-senior-women-for-climate-protection-v-swiss-federal-council-and-others/>

Korpar, N., Larch, M., & Stöllinger, R. (2022). The European carbon border adjustment mechanism: a small step in the right direction. *International Economics and Economic Policy*, 20(1), 95–138. <https://doi.org/10.1007/s10368-022-00550-9>

South Koreans sue government over climate change, saying policy violates human rights, KSUT _____. <https://www.ksut.org/2024-04-24/south-koreans-sue-government-over-climate-change-saying-policy-violates-human-rights>

Liu, K., & Teng, K. (2024, April 9). Taiwan's Largest Steelmaker Faces Green Transition Challenge. *Commonwealth Magazine*.

National Development Council. (2022). Taiwan's Pathway to Net-Zero Emissions in 2050. In 國發會全球資訊網(英文網).

National Greenhouse Gas Inventory Report of Japan 2023, Ministry of the Environment. (2023). Center for Global Environmental Research ISSN 2434-5679, CGER-1164-2023.

Nippon Steel. (2019). *Nippon Steel Sustainability Report 2019*.

Nippon Steel. (2023). *Nippon Steel Sustainability Report 2023*.

Nippon Steel Carbon Neutral Vision 2050. (2021).

農業部林業及自然保育署. (2020, November 27). *Aichi Biodiversity Targets: 10-Years of Efforts in Biodiversity Showing Outstanding Results in Taiwan, Interdepartmental Cooperation to Link Road Network and Green Network*. Forest and Nature Conservation Agency. <https://conservation.forest.gov.tw/EN/latest/0066734>

Overview of the Green Innovation Fund Projects. (2021, March 12). NEDO Green Innovation Fund Projects. <https://green-innovation.nedo.go.jp/en/about/>

Perdana, S., & Vielle, M. (2023). Carbon border adjustment mechanism in the transition to net-zero emissions: collective implementation and distributional impacts. *Environmental Economics and Policy Studies*, 25(3), 299–329. <https://doi.org/10.1007/s10018-023-00361-5>

Policy measures to respond to carbon fee impacts on industry in Taiwan. (2024). London School of Economics (LSE) Grantham Research Institute of Climate Change and the Environment.

Press corner. (2021, December 22). European Commission - European Commission. https://ec.europa.eu/commission/presscorner/detail/en/ip_21_7025

R.O.C, M. of E. A. (2022, October 28). *SMEs Serve as the Backbone of Taiwan's Stable Economic Development*. Ministry of Economic Affairs, R.O.C.

https://www.moea.gov.tw/MNS/english/news/News.aspx?kind=6&menu_id=176&news_id=103826

Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023, Official Journal of the European Union, Annex 1, (2023).

Revenues EU ETS and CBAM for the EU? | Meijburg & Co Tax & Legal. (2022, January 25). KPMG. <https://meijburg.com/news/revenues-eu-ets-and-cbam-eu>

Singapore Sets Out Eligibility Criteria For International Carbon Credits Under The Carbon Tax Regime. (2023, October 4). Ministry of Sustainability and the Environment Singapore. <https://www.mse.gov.sg/resource-room/category/2023-10-04-eligibility-criteria-for-international%20carbon%20credits>

Stake, R. E. (2013). *Multiple Case Study Analysis*. Guilford Press.

Steenbrink, F. (2022). *Impact of the Carbon Border Adjustment Mechanism: An economic and geopolitical assessment of the German- Chinese aluminium trade flows.*

TAIEX (Technical Assistance and Information Exchange) - European Commission. (n.d.). International-Partnerships.ec.europa.eu. https://international-partnerships.ec.europa.eu/funding-and-technical-assistance/technical-assistance/taix-technical-assistance-and-information-exchange_en

Taiwan Carbon Solution Exchange. (n.d.). <https://www.tcx.com.tw/en/index.html>

Taiwan: Greenpeace joins private citizens to file Taiwan's first climate lawsuit, targeting corporate exemptions. (2021, February 3). Business & Human Rights Resource Centre. <https://www.business-humanrights.org/en/latest-news/taiwan-greenpeace-joins-private-citizens-to-file-taiwans-first-climate-lawsuit-targeting-corporate-exemptions/>

The TCX International Carbon Credit Trading Platform Officially Launched. (2023, December 26). Taiwan Carbon Solution Exchange. <https://www.tcx.com.tw/en/news.html?402890848c90dd26018ca395d88f000a>

Umekawa, T., & Clark, A. (2024, April 12). *Japan's annual emissions drop as industrial pollution shrinks.* The Japan Times. <https://www.japantimes.co.jp/business/2024/04/12/japan-emissions-drop-fiscal-2023/>

Wang, G.-C. (n.d.). *Economic Security: Taiwan's Role in New Global Supply Chains.* Chung-Hua Institution for Economic Research.

Wood, P. J., & Jotzo, F. (2011). Price floors for emissions trading. *Energy Policy*, 39(3), 1746–1753. <https://doi.org/10.1016/j.enpol.2011.01.004>

Yasuo, T. (2023, November 30). *Japan Should Cooperate Constructively with the EU on CBAM*. Research Institute of Economy, Trade and Industry (RIETI).
https://www.rieti.go.jp/en/columns/a01_0739.html

Yin, R. K. (2018). *Case study research and applications: design and methods* (3rd ed.). Sage.

Zhong, J., & Pei, J. (2023). Carbon border adjustment mechanism: a systematic literature review of the latest developments. *Climate Policy*, 24(2), 228–242.
<https://doi.org/10.1080/14693062.2023.2190074>