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**Decarbonizing Economies Balancing Growth and Green
in South Africa Mozambique the United Kingdom and
Sweden**

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WOS

Decarbonizing Economies: Balancing Growth and Green in South Africa, Mozambique, the United Kingdom and Sweden

This article critically examines climate change taxes, environmental pollution levies and related policies in South Africa, the United Kingdom and Sweden, assessing their design, implementation, economic impacts and efficacy in reducing carbon emissions and promoting green growth, while also analysing Mozambique's potential to adopt such strategies given its current absence of such taxes. Key performance indicators, including emission reductions and tax revenues, are analysed to gauge the effectiveness and limitations of each model. Sweden's pioneering carbon tax demonstrates the intricate balance between economic growth and environmental targets, providing a well-documented case of both successes and trade-offs. The United Kingdom's Carbon Price Floor, emissions trading system, Aggregates Levy and Climate Change Levy show a flexible yet complex approach that integrates various economic sectors. South Africa's carbon tax, implemented within a developing economy context, sheds light on the socio-economic challenges and potential benefits of carbon taxation in emerging markets. In contrast, Mozambique – a low-income, climate-vulnerable country – offers a unique perspective with its existing environmental policies but lack of specific climate change tax measures, highlighting an area for potential climate change mitigation policy innovation.

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1. Introduction

Climate change, characterized as a shift in global climate patterns attributable to activities by humans that alter the atmosphere’s composition, is among the biggest challenges confronting humanity today.¹ The Intergovernmental Panel on Climate Change (IPCC) reports that temperatures across the globe have been rising since the mid-20th century, with the

1. Pielke Jr, Roger A. “What is climate change?.” *Energy & Environment* 15, no. 3 (2004): 515-520, <https://doi.org/10.1260/0958305041494576>.

increase largely driven by human-induced greenhouse gas (GHG) emissions.² The evidence of a warming climate is unmistakable: the rising mean and median of ocean and air temperatures, widespread melting of ice and snow, and the escalating ocean levels.³ The Arctic, in particular, faces unprecedented warming, leading to glacier and permafrost retreat, with significant repercussions for global weather patterns and ecosystems.⁴

The impact of these changes is not uniform; it is intensified in regions like Africa, by the critical role that natural resources and agriculture play in both the economy and in driving environmental changes.⁵ Agriculture is both a victim and a contributor to climate change.⁶ Agricultural activities contribute to GHG emissions through various processes: deforestation to create farmland releases carbon dioxide (CO₂),⁷ livestock farming emits methane (CH₄),⁸ and the use of synthetic fertilizers releases nitrous oxide (N₂O) – all potent GHGs.⁹ Furthermore, practices such as tillage and overgrazing can degrade soil health, reducing its ability to sequester carbon.¹⁰ Thus, while agriculture is crucial for food security and economic stability, especially in regions like Africa, it also plays a role in accelerating climate change.¹¹

2. Allan, Richard P., Paola A. Arias, Sophie Berger, Josep G. Canadell, Christophe Cassou, Deliang Chen, Annalisa Cherchi, et al. "Intergovernmental Panel on Climate Change (IPCC). Summary for Policymakers." In *Climate Change 2021: The physical science basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, (Cambridge University Press, 2023): 3-32, https://pure.mpg.de/rest/items/item_3565224/component/file_3565229/content.
3. Mohammed, Zahraa Radi Harijah, Aban Talal Mohammed Saeed, Saja Abbas Burhi Hussein, Noor Rasim Yousif Jasim, and Hussein Abdul Hassan Talab Haleeb. "The Science of Global Warming." In *Global Warming and its Impact on the Climate in 2024*. (Bright Sky Publication, 2024), chap. 2, 23-25, <https://www.bspublications.com/book-pdf/1727696576-global-warming-and-its-impact-on-the-climate-in-2024.pdf>.
4. Vincent, Warwick F. "Arctic climate change: Local impacts, global consequences, and policy implications." In *The Palgrave Handbook of Arctic Policy and Politics* (2020): 507-526, https://doi.org/10.1007/978-3-030-20557-7_31.
5. Kotir, Julius H. "Climate change and variability in Sub-Saharan Africa: a review of current and future trends and impacts on agriculture and food security." In *Environment, Development and Sustainability* 13 (2011): 587-605, <https://doi.org/10.1007/s10668-010-9278-0>.
6. Rathore, Anoop Kumar, and M. K. Jhariya. "Agriculture Cause, Victim As Well As Mitigator of Climate Change." (2014), <http://gnanaganga.inflibnet.ac.in:8080/jspui/handle/123456789/10629>.
7. Tanveer, Arsalan, Huaming Song, Muhammad Faheem, and Abdul Daud. "Caring for the environment. How do deforestation, agricultural land, and urbanization degrade the environment? Fresh insight through the ARDL approach." *Environment, Development and Sustainability* (2024): 1-36, <https://doi.org/10.1080/02286203.2019.1707501>.
8. Bačėninaitė, Dovilė, Karina Džermeikaitė, and Ramūnas Antanaitis. "Global warming and dairy cattle: How to control and reduce methane emission." *Animals* 12, no. 19 (2022): 2687, <https://doi.org/10.3390/ani12192687>.
9. Xu, Wenyi, Dufeng Zhao, Yan Ma, Guiting Yang, Per Lennart Ambus, Xinhong Liu, and Jia Luo. "Effects of long-term organic fertilizer substitutions on soil nitrous oxide emissions and nitrogen cycling gene abundance in a greenhouse vegetable field." *Applied Soil Ecology* 188 (2023): 104877, <https://doi.org/10.1016/j.apsoil.2023.104877>.
10. Teague, Richard, and Urs Kreuter. "Managing grazing to restore soil health, ecosystem function, and ecosystem services." *Frontiers in Sustainable Food Systems* 4 (2020): 534187, <https://doi.org/10.3389/fsufs.2020.534187>.
11. Toromade, Adekunle Stephen, Deborah Aanuoluwa Soyombo, Eseoghene Kupa, and Tochukwu Ignatius Ijomah. "Reviewing the impact of climate change on global food security: Challenges and solutions." *International Journal of Applied Research in Social Sciences* 6, no. 7 (2024): 1403-1416, <https://doi.org/10.51594/ijarss.v6i7.1300>.

Furthermore, many African countries are positioned near the equator,¹² a region that naturally experiences higher baseline temperatures.¹³ With global warming, the impacts of even minor temperature increases can be amplified in equatorial regions, leading to more extreme heat events and putting additional stress on water resources, crop viability and overall health.¹⁴ The proximity to the equator means that Africa's climate is already warmer and more prone to droughts, and increased temperatures can worsen these issues.¹⁵ This geographic position, combined with factors like fragile ecosystems and limited resources for climate adaptation, makes African countries particularly vulnerable to climate variability and environmental stresses.

Tackling climate change demands immediate and unified global efforts to keep temperature rise below 2°C above pre-industrial levels.¹⁶ Achieving this goal requires carefully balancing economic growth with the need to lower carbon emissions and energy use across all sectors.¹⁷ The environmental challenges we face – climate change, pollution and resource depletion – arise when the environment's ability to absorb pollutants is overwhelmed.¹⁸ These issues are compounded by the fact that polluters are often not held responsible for the costs their actions impose on society, a phenomenon known in economic theory as a negative externality.¹⁹

Governments worldwide respond to these market failures through a blend of regulatory measures and market-based instruments,²⁰ though some of these approaches remain under discussion and are subject to criticism.²¹ Regulatory approaches, such as emissions standards and carbon taxes, and market-based tools, like cap-and-trade systems, face scrutiny

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12. While global warming affects regions worldwide, the severity and type of impact differ based on factors like topography, proximity to bodies of water, local ecosystems and infrastructure resilience. In Africa, for instance, coastal and arid regions may experience warming differently. Coastal areas might be more vulnerable to rising sea levels and increased flooding, while inland and desert areas face heightened drought risks.

13. Bedair, Heba, Mubarak S. Alghariani, Esraa Omar, Quadri Agbolade Anibaba, Michael Remon, Charné Bornman, Samuel Kuria Kiboi et al. “Global warming status in the African continent: sources, challenges, policies, and future direction.” *International Journal of Environmental Research* 17, no. 3 (2023): 45, <https://doi.org/10.1007/s41742-023-00534-w>.

14. Collins, Matthew, Jonathan D. Beverley, Thomas J. Bracegirdle, Jennifer Catto, Michelle McCrystall, Andrea Dittus, Nicolas Freychet et al. “Emerging signals of climate change from the equator to the poles: new insights into a warming world.” *Frontiers in Science* 2 (2024): 1340323, <https://doi.org/10.3389/fsci.2024.1340323>.

15. Ceola, Serena, Johanna Mård, and Giuliano Di Baldassarre. “Drought and human mobility in Africa.” *Earth's Future* 11, no. 12 (2023), <https://doi.org/10.1029/2023EF003510>.

16. Joshi, Manoj, Ed Hawkins, Rowan Sutton, Jason Lowe, and David Frame. “Projections of when temperature change will exceed 2 C above pre-industrial levels.” *Nature Climate Change* 1, no. 8 (2011): 407-412, <https://doi.org/10.1038/nclimate1261>.

17. Antonakakis, Nikolaos, Ioannis Chatziantoniou, and George Filis. “Energy consumption, CO2 emissions, and economic growth: An ethical dilemma.” *Renewable and Sustainable Energy Reviews* 68 (2017): 808-824, <https://doi.org/10.1016/j.rser.2016.09.105>.

18. Hussain, Shahid, and Murshid Reza. “Environmental damage and global health: understanding the impacts and proposing mitigation strategies.” *Journal of Big-Data Analytics and Cloud Computing* 8, no. 2 (2023): 1-21, <https://questsquare.org/index.php/JOURNALBACC/article/view/5>.

19. Harris, Jonathan M., and Brian Roach. “The Theory of Environmental Externalities.” In *Environmental and Natural Resource Economics*, (Routledge, 2021): 44-92.

20. Mazaheri, Maryam, Jaime Bonnin Roca, Arjan Markus, and Bob Walrave. “Market-based instruments and sustainable innovation: A systematic literature review and critique.” *Journal of Cleaner Production* 373 (2022): 133947, <https://doi.org/10.1016/j.jclepro.2022.133947>.

21. Chausson, Alexandre, E. A. Welden, Marina S. Melanidis, Erin Gray, Mark Hirons, and Nathalie Seddon. “Going beyond market-based mechanisms to finance nature-based solutions and foster sustainable futures.” *PLoS Climate* 2, no. 4 (2023): e0000169, <https://doi.org/10.1371/journal.pclm.0000169>.

regarding their effectiveness, fairness and economic impacts, with varying perspectives on their optimal application.²² Traditional regulatory approaches, such as emissions standards and bans, impose direct limits on pollution but often lack flexibility and economic efficiency.²³ In contrast, market-based instruments, such as carbon pricing, tradable permits, environmental pollution levies and subsidies leverage the price mechanism to internalize the costs to the environment of production and consumption.²⁴ By assigning a cost to pollution, these instruments encourage firms and individuals to cut emissions in a cost-effective approach, fostering the adoption of cleaner technologies and more sustainable practices.

This article seeks to deepen the global understanding of climate change mitigation by examining and comparing climate change taxation policies and environmental sustainability policies in three distinct economies – South Africa, the United Kingdom and Sweden – while exploring Mozambique’s potential to adopt such policies in the absence of an existing tax framework. Each of these countries faces unique economic and environmental challenges that shape its approach to climate change taxation and environmental sustainability policies, offering valuable insights into the complex relationship between economic growth and sustainable development. For example, South Africa, one of Africa’s largest carbon emitters, has implemented a carbon tax to address emissions.²⁵ However, it must balance these opportunities and policy with pressing socio-economic goals, including reducing poverty and inequality, creating employment opportunities and fostering economic growth.²⁶ This balancing act highlights the difficulty many developing countries face in aligning climate action with economic objectives, a challenge amplified by resource constraints and a strong dependence on energy-intensive industries.²⁷

Mozambique, another African country selected for this comparative analysis, experiences high vulnerability to climate change due to its tropical location, underdeveloped infrastructure and exposure to severe weather events such as cyclones and floods.²⁸ As a developing country, Mozambique’s agricultural sector and energy needs are especially sensitive to climate variations.²⁹ Despite its limited capacity to implement robust climate policies,

22. Chakraborty, Debashis, and Oindrila Dey. “Trade Policy and Price-Based Barriers.” In *Influence of WTO and Global Dynamics on Trade Flows: A Machine-Generated Literature Overview*, (Singapore: Springer Nature Singapore, 2024): 183-244, https://doi.org/10.1007/978-981-99-7375-0_2.
23. Bruce, Neil, and Gregory Ellis. “Green taxes and policies for environmental protection.” In *Taxing Choices for Managing Natural Resources, the Environment, and Global Climate Change: Fiscal Systems Reform Perspectives*, Cham: Springer International Publishing, (Palgrave Macmillan, 2023): 83-119, https://doi.org/10.1007/978-3-031-22606-9_3.
24. Jia, Zhijie, and Shiyan Wen. “Interaction effects of market-based and incentive-driven low-carbon policies on carbon emissions.” *Energy Economics* 137 (2024): 107776, <https://doi.org/10.1016/j.eneco.2024.107776>.
25. Karsten, Advocate ASJ, and Ms M. van der Bank. “The role of carbon emissions taxes and carbon greenhouse gas emissions on the renewable energy output: evidence from South Africa.” *International Journal of Economics and Finance Studies* 14, no. 2 (2022): 156-174.
26. Adom, Richard Kwame, Mulala Danny Simatele, and Memory Reid. “Addressing the challenges of water-energy-food nexus programme in the context of sustainable development and climate change in South Africa.” *Journal of Water and Climate Change* 13, no. 7 (2022): 2761-2779, <https://doi.org/10.2166/wcc.2022.099>.
27. Barua, Suborna. “Financing sustainable development goals: A review of challenges and mitigation strategies.” *Business Strategy & Development* 3, no. 3 (2020): 277-293, <https://doi.org/10.1002/bsd2.94>.
28. Langa, José Maria do Rosário Chilaúle, Natacha Bruna, Boaventura Monjane, Giverage do Amaral, Elton Augusto da Amélia Fé, Bento Paulo Rafael, Patricia Figueiredo Walker, and Patricia E. Perkins. “Extreme Climatic Events and Climate Change Policies: A Call for Climate Justice Action in Mozambique.” In *Climate Justice in the Majority World*, (Routledge, 2023): 42-60, 9781003214021.
29. Manuel, Lourenço, Orcidia Chiziane, Gaby Mandhlate, Faaia Hartley, and Emílio Tostão. “Impact of climate change on the agriculture sector and household welfare in Mozambique: an analysis based on a dynamic computable general equilibrium model.” *Climatic Change* 167, no. 1 (2021): 6.

Mozambique is actively exploring tax policies and incentives to support sustainable practices and lower GHG emissions.³⁰ By studying Mozambique's approach, this article highlights the distinctive challenges that highly vulnerable, low-income countries face in decarbonizing while striving to enhance economic resilience, protect vital sectors like agriculture, and provide economic stability for its population.³¹

In contrast, developed countries like the United Kingdom and Sweden illustrate how high-income developed countries with stronger institutional frameworks can address climate change through comprehensive and advanced policy structures.³² The United Kingdom, for instance, has set ambitious climate targets, including achieving net-zero emissions by 2050.³³ Its policies, such as the Climate Change Act and the emissions trading system (ETS), demonstrate a proactive stance on emissions reduction, where climate change taxation and environmental sustainability policies serve not only as a deterrent but as a tool for fostering greener industries and reducing long-term environmental impact.³⁴ Sweden's experience provides additional context: as one of the first countries to implement a carbon tax, it has maintained economic growth while achieving significant reductions in GHG emissions.³⁵ This dual success in economic performance and environmental progress emphasizes the potential effectiveness of well-designed carbon taxes in driving sustainable development.³⁶ By examining these diverse national contexts, this article aims to identify adaptable policy elements and strategies that could serve as models for other countries, helping to forge a pathway towards global decarbonization that supports, rather than hinders, economic development.

This article employs a doctrinal research approach to analyse the critical link between climate change taxation, environmental sustainability policies and economic outcomes. The article integrates economic analysis of gross domestic product (GDP) and carbon emissions to assess the impact of these tax policies on economic growth and sustainability. This dual approach facilitates a comprehensive understanding of how legal and economic factors interact within climate change mitigation efforts. By synthesizing legal and economic perspectives, this article aims to provide actionable recommendations for developing countries, emphasizing the importance of integrating climate policies within broader economic strategies.

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30. Zachariassen, Henrikke Vikøren. "Factors influencing environmentally responsible investment in the forestry sector: A qualitative examination of Green Resources investment projects in Mozambique." Master's thesis, Norwegian University of Life Sciences, (2023), <https://nmbu.brage.unit.no/nmbu-xmlui/handle/11250/3077701>.
 31. Manuel, Lourenço, Emilio Tostão, Orcidia Vilanculos, Gaby Mandlhate, and Faaqiqa Hartley. "Economic implications of climate change in Mozambique." *SA-TIED Working Paper* 136 (2020).
 32. Ghazouani, Assaad, Wanjun Xia, Mehdi Ben Jebli, and Umer Shahzad. "Exploring the role of carbon taxation policies on CO2 emissions: contextual evidence from tax implementation and non-implementation European Countries." *Sustainability* 12, no. 20 (2020): 8680, <https://doi.org/10.3390/su12208680>.
 33. Shahzad, Sulman, Muhammad Faheem, Hafiz Abdul Muqet, and Muhammad Waseem. "Charting the UK's path to net zero emissions by 2050: Challenges, strategies, and future directions." *IET Smart Grid* (2024), <https://doi.org/10.1049/stg2.12185>.
 34. Averchenkova, Alina, Sam Fankhauser, and Jared J. Finnegan. "The impact of strategic climate legislation: evidence from expert interviews on the United Kingdom Climate Change Act." *Climate Policy* 21, no. 2 (2021): 251-263, <https://doi.org/10.1080/14693062.2020.1819190>.
 35. Jonsson, Samuel, Anders Ydstedt, and Elke Asen. "Looking back on 30 years of carbon taxes in Sweden." *Fiscal fact* 727 (Tax Foundation, 2020).
 36. Cheng, Ya, Avik Sinha, Vinit Ghosh, Tuhin Sengupta, and Huawei Luo. "Carbon tax and energy innovation at crossroads of carbon neutrality: Designing a sustainable decarbonization policy." *Journal of Environmental Management* 294 (2021): 112957, <https://doi.org/10.1016/j.jenvman.2021.112957>.

First, this article discusses the significance of climate change taxation and environmental sustainability policies for decarbonizing economies and establishes the economic rationale for climate change taxation, setting the foundation for a thorough analysis of its role in decarbonizing economies, reducing emissions and promoting green growth. Climate change taxation and environmental sustainability policies are introduced as key mechanisms for reducing GHG emissions, with a discussion of the theoretical principles that support their implementation to drive sustainable development.

When discussing climate change taxation and environmental sustainability policies, it is important to consider a broad range of fiscal tools designed to address environmental harm. According to Falcão,³⁷ based on the OECD's definition, environmental taxes are "compulsory payments to the government levied on tax bases with significant environmental relevance." These taxes target physical units or proxies that have a proven negative impact on the environment. Specifically, carbon taxes are described by Falcão as instruments intended to reduce carbon emissions and serve an environmental purpose. The African Tax Administration Forum (ATAF)³⁸ further defines carbon taxes as excise taxes imposed per ton of carbon, making them simple to administer with predictable revenue, based on fossil fuel consumption.

ATAF³⁹ distinguishes between "environmental taxes" and "environmentally related taxes." Environmental taxes, such as carbon taxes, directly aim to reduce environmental harm (e.g. carbon dioxide emissions). On the other hand, environmentally related taxes may not directly reduce environmental damage but can still influence behaviour with indirect environmental benefits. For example, transport taxes targeting vehicle ownership or usage may be levied to fund infrastructure maintenance, without a direct goal of reducing emissions or energy consumption. According to ATAF, environmental taxes can be divided into several categories, including carbon, energy, fossil fuel, pollution, transport and resource taxes. These categories address different environmental concerns, with tax rates generally aligned with the level of environmental harm caused.

In this article, the term "climate change taxation and environmental sustainability policies" is used to encompass both carbon pricing mechanisms such as market-based instruments (e.g. carbon taxes) aimed at internalizing the environmental costs of GHG emissions and ETS, as well as broader environmental taxes and environmental sustainability policies. Environmental taxes and environmental sustainability policies include a variety of fiscal measures, such as landfill taxes, designed to encourage sustainable behaviour and reduce environmental damage, as well as mitigation measures and climate change-related legislation.

This article conducts a comparative analysis of carbon emissions, climate change and environmental sustainability policy strategies across four diverse countries: South Africa, Mozambique, the United Kingdom and Sweden. Each country's environmental challenges and socio-economic contexts are examined to highlight how different national circumstances shape their climate change policies. South Africa's significant GHG contributions and its tax policies aimed at emissions reductions are analysed, illustrating how middle-in-

37. Falcão, Tatiana. "Policy note: highlights of the United Nations handbook on carbon taxation." *Intertax* 49, no. 11 (2021): 897-914.

38. African Tax Administration Forum (ATAF), *Environmental Taxes defined*, ATAF Policy Brief 2021.

39. African Tax Administration Forum (ATAF), *Carbon Taxation in Africa*, ATAF Policy Brief, May 2023.

come economies can leverage taxation to reduce reliance on carbon-intensive energy sources. Mozambique provides a contrasting perspective as a low-income, climate-vulnerable country, offering insights into the obstacles and opportunities for implementing climate change taxation and environmental sustainability policies within a developing context.⁴⁰

Further, the article examines the climate change taxation and environmental sustainability policies of advanced economies – the United Kingdom and Sweden. Known for their innovative and effective climate policies, these countries offer valuable lessons on designing tax frameworks that support low-carbon economic transitions. The United Kingdom’s comprehensive tax measures and Sweden’s pioneering carbon tax model are analysed to draw out key policy interventions that have proven successful in reducing emissions while promoting economic resilience.⁴¹ This comparative analysis aims to identify best practices and alternative approaches that could be adapted by other countries, particularly those in similar developmental contexts.

The article concludes with tailored recommendations for enhancing climate change tax policies, drawing on the successes and challenges observed internationally. These proposals emphasize actionable strategies that developing countries can adopt to balance economic growth with environmental goals. By integrating insights from both advanced and developing economies, the article offers a roadmap to strengthen climate mitigation efforts worldwide, supporting the transition to a low-carbon future and fostering global green growth.

2. Significance of Climate Change Taxation and Environmental Sustainability Policies for Decarbonization and Green Growth

The global community recognized the need for coordinated action through the Paris Agreement, established in 2015.⁴² This landmark accord set ambitious targets to reduce emissions and limit global warming, emphasizing the necessity for diverse policy tools, including environmental taxation.⁴³ Climate change taxes and environmental sustainability policies have emerged as essential instruments for regulating GHG emissions and fostering sustainable practices, particularly in developing countries where such policies can catalyze significant progress.⁴⁴

This article addresses the crucial role of climate change taxes and environmental sustainability policies in decarbonizing economies and promoting green growth – a key response to the global climate crisis.⁴⁵ By examining successful tax measures from four countries, the article offers actionable recommendations for tax authorities worldwide, aimed at design-

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40. Arndt, Channing, Kenneth Strzepeck, Finn Tarp, James Thurlow, Charles Fant, and Len Wright. “Adapting to climate change: an integrated biophysical and economic assessment for Mozambique.” *Sustainability Science* 6 (2011): 7-20, <https://doi.org/10.1007/s11625-010-0118-9>.

41. Nachtigall, Daniel, Jane Ellis, and Sofie Errendal. “Carbon pricing and COVID-19: Policy changes, challenges and design options in OECD and G20 countries.” (2022).

42. Savaresi, Annalisa. “The Paris Agreement: a new beginning?” *Journal of Energy & Natural Resources Law* 34, no. 1 (2016): 16-26, <https://doi.org/10.1080/02646811.2016.1133983>.

43. Dröge, Susanne. The Paris Agreement 2015: Turning point for the international climate regime. No. RP 4/2016. SWP Research Paper, (2016).

44. Bluffstone, Randall A. “Environmental taxes in developing and transition economies.” *Public Finance and Management* 3, no. 1 (2003): 143-175, <https://doi.org/10.1177/152397210300300107>.

45. Cheng, Ya, Avik Sinha, Vinit Ghosh, Tuhin Sengupta, and Huawei Luo. “Carbon tax and energy innovation at crossroads of carbon neutrality: Designing a sustainable decarbonization policy.” *Journal of Environmental Management* 294 (2021), <https://doi.org/10.1016/j.jenvman.2021.112957>.

ing effective climate change taxation and environmental sustainability policies that drive emissions reduction.

Several studies⁴⁶ highlight the effectiveness of carbon taxes and other environmental levies as vital components in enhancing environmental well-being. Countries like the United Kingdom and Sweden have made notable strides in climate change mitigation through innovative taxation policies.⁴⁷ These examples provide valuable insights for developing economies like South Africa and Mozambique, which face distinct challenges yet can learn from the successes of more advanced countries.

Despite recent setbacks in global climate negotiations, the imperative for robust climate policies remains.⁴⁸ With substantial risks associated with rising global temperatures, all countries are affected by climate change, though low-income, climate-vulnerable developing countries often face heightened vulnerability due to limited resources, infrastructure challenges and dependence on climate-sensitive sectors like agriculture.⁴⁹ These countries frequently lack the financial and technological capacity to implement robust adaptation and mitigation measures, making it imperative to explore and implement effective climate strategies that account for these disparities.⁵⁰ Climate change taxation and environmental sustainability policies, while not a panacea, present a promising opportunity for countries to advance towards more sustainable economies and proactively address future climate challenges.⁵¹

This article fills a critical gap by comparing climate change taxation and environmental sustainability policies in the southern hemisphere (South Africa and Mozambique) with those in the northern hemisphere (Sweden and the United Kingdom). Such a comparative analysis is essential for understanding diverse approaches to climate change taxation in Africa and Europe and their potential to mitigate GHG emissions. The article contributes to the broader discourse on effective climate change mitigation strategies, offering insights that can help shape more inclusive and adaptive tax policies worldwide.

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46. Several studies have been conducted such as: Ali, Minhaj, and Dervis Kirikkaleli. "Carbon taxes, resources efficiency, and environmental sustainability in a developed country." *International Journal of Sustainable Development & World Ecology* 31, no. 4 (2024): 421-430, <https://doi.org/10.1080/13504509.2023.2296492>.
van Hulsten, M. J. "Environmental Taxation and Well-Being in the Context of Globalisation and Sustainability." (2024), <https://doi.org/10.5772/intechopen.1006675>.
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The vulnerability of many developing countries to climate change is exacerbated by their low levels of economic development and geographical disadvantages.⁵² Lower levels of economic development can limit a country's ability to invest in climate-resilient infrastructure, implement effective adaptation measures and reduce emissions. These countries often lack resources for robust disaster response systems, sustainable agricultural practices and technological innovations to mitigate climate impacts. Additionally, developing countries are frequently located in climate-sensitive regions, where geographic factors – like proximity to the equator, low-lying coastal areas or arid zones – heighten their exposure to climate extremes. These countries face heightened risks and challenges related to climate impacts.⁵³ These countries often struggle to invest in climate-resilient infrastructure, effective adaptation measures and GHG emission reductions. The pressing need for effective climate action is emphasized by the increasing commitments of major global actors such as the European Union, Australia and China, which, in turn, influence climate policies in developing countries.⁵⁴

Environmental taxation represents a promising pathway for advancing sustainable economies and addressing future climate challenges. By integrating these measures within a broader framework of climate strategies, developing countries can enhance their resilience and contribute meaningfully to global efforts in combating climate change.

3. Climate Change, Climate Change Taxation and Environmental Sustainability Policies

Climate change, characterized by significant shifts in temperature, precipitation and extreme weather events, poses substantial risks, particularly for vulnerable regions across the world.⁵⁵ These regions, facing unique developmental challenges and geographic vulnerabilities, highlight the urgency for targeted mitigation strategies. Human activities that emit GHG emissions significantly alter atmospheric conditions and contribute to these climatic changes.⁵⁶ This section critically explores the economic rationale and justification for climate change taxation, a key tool in addressing global environmental challenges. The discussion includes an examination of carbon dioxide emissions and GDP across the four selected countries: South Africa, Mozambique, the United Kingdom and Sweden

3.1. Rationale and economic justification for climate change taxation and environmental sustainability policies

The framework of climate change taxation and environmental sustainability policies, specifically carbon taxes, originates from early 20th-century economic theories, largely

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attributed to Arthur Pigou's work.⁵⁷ Pigou's theory argued for the internalization of external costs – such as those from environmental harm – by incorporating these costs into the pricing of goods and services.⁵⁸ This method seeks not only to correct market inefficiencies but also to foster environmentally responsible choices among consumers and producers.⁵⁹

Initially, climate policies in the 1970s and early 1980s primarily depended on regulatory mechanisms, often known as “command-and-control” methods.⁶⁰ These policies involved enforcing strict emission limits and environmental standards to control pollution.⁶¹ By the late 1980s and 1990s, there was a notable shift towards market-based instruments, including tradable permits, carbon taxes and deposit refund systems.⁶² This transition was driven by several factors:

- There was a move towards market-oriented public policies. As governments began to recognize the restrictive nature of traditional regulatory policies, there was an increasing preference for market-based solutions, which were seen as more adaptable and economically efficient.⁶³
- There was an increase in awareness in the limitations of purely regulatory measures. The inherent drawbacks of regulatory-only frameworks, such as high administrative costs and rigid implementation, became apparent, encouraging policymakers to explore alternative strategies for addressing complex environmental issues.⁶⁴
- There was an uptake of cross-sectoral integration. There was a growing emphasis on harmonizing environmental objectives with other sectors, including agriculture, transportation and industry, through flexible and cost-effective policies. This alignment aimed to foster holistic sustainability while reducing the economic burdens associated with traditional regulations.⁶⁵

This transition marked a significant evolution in environmental policy, highlighting the intricate and interdependent nature of environmental issues and the urgent need for innovative, economically feasible solutions. Furthermore, during the 1990s, several European countries emerged as pioneers in the implementation of carbon taxes. Finland was the first to introduce a carbon tax in 1990, followed closely by Sweden and Norway in 1991, Denmark

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in 1992 and the Netherlands in 1996.⁶⁶ These early adopters positioned themselves as front-runners in carbon taxation, setting a precedent for others. In subsequent years, countries like Italy and Germany followed suit in 1999, and the United Kingdom implemented its carbon tax in 2001.⁶⁷ Canada also took steps toward carbon taxation at the subnational level, with Quebec and British Columbia introducing their taxes in 2007 and 2008, respectively.⁶⁸ These initiatives, often designed to complement or supplant existing energy taxes, illustrate a range of strategies for embedding environmental costs into economic frameworks.⁶⁹

In the European context, the implementation of carbon taxes has frequently been accompanied by exemptions, rebates and reduced rates for energy-intensive industries to mitigate competitiveness concerns.⁷⁰ Similar considerations apply to low-income households, which could otherwise face a disproportionate financial burden from such taxes.⁷¹ Despite the influence of European carbon tax policies, they often diverge from the ideal Pigouvian model, in which tax rates are calibrated to align with the marginal damage costs of pollution.⁷² Various practical limitations, including challenges in accurately quantifying damage functions and apprehensions regarding industry competitiveness, have resulted in lower tax rates and differentiated approaches.⁷³ For instance, excessively high uniform tax rates could incentivize industries to relocate to jurisdictions with more lenient regulations, potentially exacerbating global pollution rather than mitigating it.⁷⁴ This situation emphasizes the ongoing tension between effective environmental regulation and economic competitiveness, highlighting the complexities that policymakers must navigate in designing effective carbon tax systems.

The rationale for climate change taxation and environmental sustainability policies encompasses a range of critical objectives that aim to integrate ecological considerations into economic systems.⁷⁵ At its core, climate change taxation seeks to internalize externalities by incorporating the costs associated with climate change into the prices of goods and

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services.⁷⁶ This implementation of the “polluter pays principle” serves to align economic and environmental policies, fostering a more sustainable marketplace.⁷⁷ The “polluter pays principle” states that unaccounted pollution, whether through economic or fiscal means, is ultimately borne by society. There are three other key principles guiding carbon tax policies: the “precautionary principle”, the “principle of prevention” and the “principle of common but differentiated responsibilities”.⁷⁸ The “precautionary principle” asserts that preventive measures should be taken when there is a risk of future environmental harm, even if the exact nature or certainty of the harm is not fully known at the time of decision-making.⁷⁹ This principle, introduced in Principle 15 of the UN Rio Declaration on Environment and Development (1992), encourages action in the face of uncertainty. The “principle of prevention” emphasizes that countries have the right to use their resources in accordance with their development policies but must also ensure that their activities do not cause environmental harm to other countries or beyond national borders.⁸⁰ The “principle of common but differentiated responsibilities” acknowledges that all countries share the responsibility for environmental degradation but should act according to their economic and developmental capabilities.⁸¹ In the context of carbon taxes, this translates into a variable tax rate that accounts for each country’s level of development and capacity to address climate change.

Moreover, carbon taxes offer behavioural incentives that encourage consumers and producers to adopt more sustainable practices.⁸² By driving innovation and enhancing compliance with environmental regulations, these taxes play a pivotal role in promoting a shift towards greener alternatives.⁸³ In addition to their regulatory function, carbon taxes also serve as a significant revenue source.⁸⁴ The funds generated are often earmarked for environmental projects, which in turn support further decarbonization efforts.⁸⁵ Some countries have even adopted a “green tax shift”, utilizing carbon tax revenues to offset other taxes, such as those levied on labour or capital. This approach aims to alleviate the economic burden of carbon taxes on households and businesses while simultaneously fostering employment and investment. For example, the Canadian province of British Columbia employs a portion of

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its carbon tax revenue to reduce personal and corporate income taxes, effectively aligning economic growth with environmental goals.⁸⁶ Furthermore, carbon taxes are particularly adept at addressing diffuse pollution sources – such as those stemming from transportation, waste and agricultural chemicals – that are often difficult to regulate through traditional command and control methods.⁸⁷

The fundamental economic justification for climate change taxation lies in its capacity to incorporate the external costs of GHG emissions and other environmental impacts into the pricing of goods and services.⁸⁸ Externalities – unintended consequences of economic activities that remain unaccounted for in market prices – distort economic signals and contribute to inefficiencies.⁸⁹ For instance, emissions from coal-fired power stations contribute to acid rain, causing damage to ecosystems and infrastructure that is not factored in to the cost of electricity production.⁹⁰ This discrepancy results in excessive energy generation beyond what would be socially optimal. Similarly, the full societal costs associated with car use – including land consumption, air pollution and traffic congestion – are inadequately captured in vehicle or fuel prices, creating market distortions that favour environmentally detrimental practices despite their substantial private benefits.⁹¹ Thus, the implementation of climate change taxes becomes essential for rectifying these inefficiencies and steering economic activities towards more sustainability.

Climate change taxation addresses these distortions by internalizing these external costs, thereby aligning private costs with social costs and enhancing market efficiency.⁹² By incorporating the true costs of GHG emissions into prices, carbon taxes promote the “polluter pays principle”, which ensures that those responsible for environmental damage bear the financial burden, thereby incentivizing more sustainable practices.⁹³ However, to make these incentives effective – particularly in developing countries where industries may lack the necessary resources or access to greener alternatives – governmental support policies are crucial.⁹⁴ Such policies could include subsidies for renewable energy, investments in green infrastructure and technological assistance to help industries transition toward lower emissions.

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Environmental taxes, as a component of climate change taxation, are strategically designed to fulfil multiple objectives within environmental governance. These taxes can be classified into three primary categories: cost-covering charges, which finance essential environmental services such as water treatment; incentive taxes, which aim to modify behaviours in favour of more sustainable practices; and fiscal climate change taxation, which predominantly focuses on generating revenue.⁹⁵ For instance, carbon taxes not only provide financial incentives for both consumers and producers to minimize their emissions but also generate significant funds that can be reinvested in environmental projects or utilized to offset other taxes.⁹⁶

Apart from carbon taxes there is the option of an ETS. Concerns surrounding ETS are not exclusive to countries considering its implementation. A notable example is the European Union ETS, which has faced considerable price volatility.⁹⁷ This volatility is partly attributed to a fixed supply of carbon allowances that struggles to adapt to fluctuating industrial activities. Since mid-2008, a decline in industrial output and energy consumption across Europe has resulted in decreasing carbon prices.⁹⁸ Additionally, the substantial allocation of free allowances to industrial users has further distorted the market, creating imbalances in incentives for emissions reduction. Such challenges highlight the complexities and potential pitfalls of emissions trading as a mechanism for addressing climate change, suggesting that a careful re-evaluation of these systems may be necessary to enhance their effectiveness and equity.⁹⁹

In contrast, a carbon tax system offers several administrative advantages, primarily due to its simplicity and ease of implementation compared to other regulatory methods.¹⁰⁰ As it applies uniformly based on emissions, it promotes transparency and predictability for businesses and consumers, embodying the “polluter pays principle” by linking costs directly to pollution levels.¹⁰¹ Oversight by existing tax authorities reduces complexity and costs, and fewer stakeholders mean reduced lobbying efforts and influence. Additionally, carbon taxes require no new accounting systems, which minimizes administrative risks and simplifies oversight.¹⁰² This combination of transparency, fairness and administrative efficiency makes carbon taxes an appealing approach for addressing environmental costs across

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society. Additionally, carbon taxes are often viewed as more equitable because they apply uniformly based on emissions, making them transparent and predictable for businesses and consumers alike.¹⁰³ By directly tying the cost to the amount of pollution generated, carbon taxes embody the “polluter pays principle”, which ensures that those responsible for higher emissions bear a proportionally higher share of the financial burden.¹⁰⁴ This approach not only reduces administrative complexity but also allocates environmental costs more fairly across society.

The effectiveness of climate change taxation and environmental sustainability policies in driving behavioural change is intricately linked to prevailing market conditions and the availability of alternative options.¹⁰⁵ High taxes alone may prove insufficient in fostering the desired shifts if viable substitutes are lacking or if the taxed activity exhibits inelastic demand.¹⁰⁶ In such scenarios, additional measures – such as enhancing energy efficiency or expanding public transport infrastructure – become essential to facilitate the intended behavioural transformations.¹⁰⁷

Furthermore, political barriers significantly impede the successful implementation of climate change taxation.¹⁰⁸ These barriers encompass concerns regarding competitiveness, the potential regressive effects on low-income households, conflicts with international trade regulations, and the presence of existing subsidies that may undermine environmental objectives.¹⁰⁹ To navigate these complexities, it is crucial that climate change taxation is integrated within a comprehensive policy framework that addresses various market dynamics and includes supportive initiatives, such as public awareness campaigns and complementary regulations.¹¹⁰ This holistic approach is vital to ensure that climate change taxation not only promotes sustainable practices but also mitigates any adverse economic impacts while achieving its environmental goals.

Regulations and tradable permits can also offer efficient solutions for specific problems, as seen with air and water pollution controls in the United States and fisheries management in New Zealand.¹¹¹ Climate change taxation fosters innovation by making fossil fuels and

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other carbon-intensive resources more expensive, thereby encouraging the development of new technologies and sustainable practices.¹¹² For instance, higher fossil fuel costs drive investment in renewable energy sources like solar, wind and bioenergy, as well as advancements in energy storage solutions. Additionally, industries are incentivized to adopt energy-efficient technologies, such as electric vehicles, carbon capture and storage (CCS) systems and sustainable manufacturing processes.¹¹³ This shift not only promotes greener alternatives but also accelerates the transition to a low-carbon economy. Historical examples, such as the United States' tax on chlorofluorocarbons¹¹⁴ and Sweden's tax on sulphurous diesel, demonstrate how such taxes can drive significant environmental improvements and enhance competitiveness through innovation.¹¹⁵

Despite its advantages, climate change taxation has certain limitations.¹¹⁶ For instance, it may disproportionately impact low-income households and small businesses that are less able to absorb increased costs, potentially leading to economic inequality.¹¹⁷ Additionally, in industries where alternatives to carbon-intensive processes are limited or costly, such taxes may place undue financial strain without significantly reducing emissions.¹¹⁸ There is also the risk of "carbon leakage", where companies relocate operations to countries with less stringent climate policies, undermining efforts at global emissions reduction. However, with appropriate design and supporting policies, climate taxes can still serve as a powerful tool for promoting sustainable practices and generating revenue for environmental initiatives.

Overall, climate change taxation and environmental sustainability policies provide a dual benefit: they address environmental challenges while also offering potential revenue streams that can support further environmental initiatives or other government priorities. For example, some governments allocate a portion of climate tax revenues to social welfare programmes or healthcare, thereby easing the financial impact on vulnerable communities affected by higher energy prices.¹¹⁹ Revenue can also be used to reduce taxes in other areas, such as payroll or corporate taxes, to stimulate job creation and economic growth. Additionally, funds from carbon taxes may be directed toward infrastructure projects, like public transit improvements, which reduce emissions while also enhancing mobility and

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 115. Johansson, Magnus, Inge Vierth, Kristina Holmgren, and Kevin Cullinane. "The climate and environmental effects of policies for moving freight transport from road to other modes: The case of Sweden." *Case Studies on Transport Policy* 15 (2024), <https://doi.org/10.1016/j.cstp.2024.101151>.
 116. Gaulin, Nicolas, and Philippe Le Billon. "Climate change and fossil fuel production cuts: assessing global supply-side constraints and policy implications." *Climate Policy* 20, no. 8 (2020): 888-901, <https://doi.org/10.1080/14693062.2020.1725409>.
 117. Greenstein, Robert, Sharon Parrott, and Arloc Sherman. "Designing Climate-Change Legislation That Shields Low-Income Households from Increased Poverty and Hardship." *Washington, DC: Center on Budget and Policy Priorities* (2008), <https://www.jstor.org/stable/resrep41360>
 118. Fischer, Carolyn, Richard Morgenstern, and Nathan Richardson. "Carbon taxes and energy-intensive trade-exposed industries: impacts and options." In *Implementing A US Carbon Tax*, (Routledge, 2015).
 119. Khastar, Mojtaba, Alireza Aslani, and Mehdi Nejati. "How does carbon tax affect social welfare and emission reduction in Finland?." *Energy Reports* 6 (2020): 736-744, <https://doi.org/10.1016/j.egy.2020.03.001>.

economic development. This flexible allocation allows climate tax revenue to serve multiple public interests, balancing environmental goals with broader social and economic benefits. This approach not only helps mitigate climate change but also promotes sustainable economic development.¹²⁰

3.2. Evaluating the impact of climate change taxation and environmental policies on carbon dioxide (CO₂) emissions and gross domestic product

The undeniable scientific consensus highlights the direct correlation between rising atmospheric concentrations of GHGs and the alarming increase in global temperatures.¹²¹ Over the last half century, global temperatures have risen by approximately 0.2°C per decade, primarily due to human activities.¹²² Even if GHG emissions were maintained at their 2006 levels, projections suggest that atmospheric concentrations could still climb to 550 parts per million (ppm) of carbon dioxide equivalent (CO₂e), doubling pre-industrial levels by 2035.¹²³ This situation could lead to a global temperature increase of 2 to 5°C, with even the lower end of this range presenting substantial risks to both the environment and to humans.

African countries, alongside many other developing countries, are particularly vulnerable to the adverse effects of climate change due to their economic reliance on primary industries, such as fisheries, mining and agriculture.¹²⁴ While these industries are not necessarily the main drivers of climate change, they are highly climate sensitive. For instance, agriculture and fisheries depend on stable weather patterns, which climate change disrupts through extreme weather events, droughts and ocean warming. Additionally, reliance on mining and resource extraction can limit economic diversification, making it harder for these countries to adapt to changing environmental conditions. As a result, disruptions in these sectors due to climate impacts can have widespread socio-economic consequences

In southern Africa, where approximately 64% of the population is employed in these sectors, the impacts of climate change could be devastating.¹²⁵ For instance, a 3-4°C temperature increase is projected to reduce African crop yields by up to 15%.¹²⁶ This is especially alarming in sub-Saharan Africa, where just 4% of arable land is irrigated, making the region highly vulnerable to food insecurity.¹²⁷ Furthermore, a global temperature increase of 3°C

120. Bizikova, Livia, John Robinson, and Stewart Cohen. "Linking climate change and sustainable development at the local level." *Climate policy* 7, no. 4 (2007): 271-277.

121. Kabir, Muhammad, Um E. Habiba, Wali Khan, Amin Shah, Sarvat Rahim, R. Patricio, Liaqat Ali, and Muhammad Shafiq. "Climate change due to increasing concentration of carbon dioxide and its impacts on environment in 21st century; a mini review." *Journal of King Saud University-Science* 35, no. 5 (2023): 102693.

122. Jogdand, Onkar K. "Study on the effect of global warming and greenhouse gases on environmental system." In *Green chemistry and sustainable technology*, (Apple Academic Press, 2020): 275-306.

123. Meinshausen, Malte. "On the risk of overshooting 2 C." In *Scientific Symposium "Avoiding Dangerous Climate Change"* Exeter, Met Office, UK, vol. 2. 2005.

124. Opoku, Samuel Kwasi, Walter Leal Filho, Fudjumdjum Hubert, and Oluwabunmi Adejumo. "Climate change and health preparedness in Africa: analysing trends in six African countries." *International Journal of Environmental Research and Public Health* 18, no. 9 (2021): 4672.

125. Adenuga, Kayode I., Abubakar Sadiq Mahmoud, Yakubu Aminu Dodo, Moutlen Albert, Said Alkali Kori, and Nusa Jibril Danlami. "Climate change adaptation and mitigation in sub-Saharan African countries." *Energy and Environmental Security in Developing Countries* (2021): 393-409.

126. Baarsch, Florent, Jessie R. Granadillos, William Hare, Maria Knaus, Mario Krapp, Michiel Schaeffer, and Hermann Lotze-Campen. "The impact of climate change on incomes and convergence in Africa." *World Development* 126 (2020): 104699.

127. Coulibaly, Thierry, Moinul Islam, and Shunsuke Managi. "The impacts of climate change and natural disasters on agriculture in African countries." *Economics of Disasters and Climate Change* 4 (2020): 347-364.

could lead to food shortages for as many as 550 million individuals, with the majority of those impacted living in Africa.¹²⁸

The health implications are equally dire. Warming temperatures are expected to expand the prevalence of mosquitoes, leading to an increase in malaria cases.¹²⁹ Additionally, extreme weather patterns exacerbated by climate change are anticipated to hinder economic growth in many developing countries.¹³⁰

Given these severe consequences, one of the central objectives of climate change taxation is to mitigate GHG emissions.¹³¹ Compared to traditional regulations, taxes offer a more cost-effective mechanism for reducing emissions by providing continuous incentives for polluters to innovate and find new ways to cut pollution.¹³² Unlike regulations, which set fixed standards and offer no further incentives once those standards are met, taxation creates dynamic incentives that encourage ongoing improvements in pollution control and foster innovation.¹³³

To assess the effectiveness of climate change taxation, data on carbon emissions since the introduction of carbon taxes or similar policies were analysed. The results of this analysis are presented in Figures 1. through 4., illustrating the impact of these policies on reducing emissions.

3.2.1. *Assessing the relationship between taxation, CO₂ emissions and economic growth in South Africa*

South Africa's economy ranks among the most carbon-intensive globally, primarily driven by energy-hungry mining operations and heavy industries.¹³⁴ This carbon intensity is largely sustained by the country's vast coal reserves and its reliance on coal-generated electricity.¹³⁵ Sasol, a prominent energy and chemical company, exemplifies the country's carbon-intensive industrial base, but it is only one of many significant emitters.¹³⁶

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128. Nhemachena, Charles, Luxon Nhamo, Greenwell Matchaya, Charity R. Nhemachena, Binganidzo Muchara, Selma T. Karuaihe, and Sylvester Mpandeli. "Climate change impacts on water and agriculture sectors in Southern Africa: Threats and opportunities for sustainable development." *Water* 12, no. 10 (2020): 2673.
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 133. Goulder, Lawrence H. "Climate change policy's interactions with the tax system." *Energy Economics* 40 (2013): S3-S11.
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 135. de Kock, Lorren, Valentina Russo, and Harro von Blottnitz. "Carbon intensive but decarbonising quickly? Retrospective and prospective Life Cycle Assessments of South African pome fruit." *Journal of Cleaner Production* 212 (2019): 139-150.
 136. Winkler, Harald, Meagan Jooste, and Andrew Marquard. "Structuring approaches to pricing carbon energy-and trade-intensive sectors in South Africa." In *Putting a Price on Carbon in South Africa and Other Developing Countries*, (Routledge, 2020): 527-542.

Between 1990 and 2019, South Africa’s total GHG emissions increased by over 67%, with the energy sector alone contributing nearly 86% of emissions in 2019.¹³⁷ This heavy reliance on coal-fired power plants stresses the urgent need for a transition to a greener economy.¹³⁸ South Africa’s National Development Plan 2030 and its updated Nationally Determined Contribution (NDC) target a reduction in GHG emissions to 350–420 metric tonnes of CO₂e by 2030, with the broader goal of achieving carbon neutrality by the middle of the century.¹³⁹ Achieving these ambitious targets will require the implementation of robust climate mitigation policies.¹⁴⁰

The country’s carbon emissions are dominated by the metals industry, the electricity sector and transport sector, which together account for approximately 80% of South Africa’s CO₂ emissions.¹⁴¹ The electricity sector’s heavy reliance on low-cost, fossil fuel-based generation is a primary driver of this carbon intensity.¹⁴² As the economy continues to grow, these already high levels of GHG emissions are expected to increase further. The South African government acknowledges the critical need to reduce GHG emissions while simultaneously fostering economic growth, increasing employment and addressing poverty and inequality.

Contrary to common perceptions, these objectives are not mutually exclusive.¹⁴³ Climate change taxes, environmental pollution levies and related policies, for example, can discourage high-emission activities while generating revenue that can be reinvested into renewable energy projects, job training and infrastructure improvements. South Africa’s Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) is a case in point, as it attracts private investment into renewable energy, creating jobs in sectors like solar and wind energy.¹⁴⁴ Additionally, carbon tax revenues can be channelled into programmes that support low-income communities with energy-efficient housing and public transportation, reducing energy costs and promoting green job growth. By strategically investing in clean energy and social development, South Africa can advance sustainable economic growth while lowering its carbon footprint.¹⁴⁵

As illustrated in Figure 1., the introduction of the carbon tax in 2019 marked a significant turning point. South Africa witnessed a reduction in carbon emissions from 465,429,250

137. Olivier, Jos GJ, K. M. Schure, and J. A. H. W. Peters. “Trends in global CO2 and total greenhouse gas emissions.” *PBL Netherlands Environmental Assessment Agency* 5 (2017): 1-11.

138. Makgetla, Neva, and Muhammed Patel. “The coal value chain in South Africa.” *Trade & Indust. Pol. Strat. Pretoria* (2021).

139. Olivier, Jos GJ, K. M. Schure, and J. A. H. W. Peters. “Trends in global CO2 and total greenhouse gas emissions.” *PBL Netherlands Environmental Assessment Agency* 5 (2017): 1-11.

140. Swilling, Mark. “Growth, sustainability and dematerialisation: Resource use options for South Africa 2019.” In *Paper commissioned by the Presidency, South African Government, presented at a Workshop on Scenarios* (2019).

141. Olivier, Jos GJ, K. M. Schure, and J. A. H. W. Peters. “Trends in global CO2 and total greenhouse gas emissions.” *PBL Netherlands Environmental Assessment Agency* 5 (2017): 1-11.

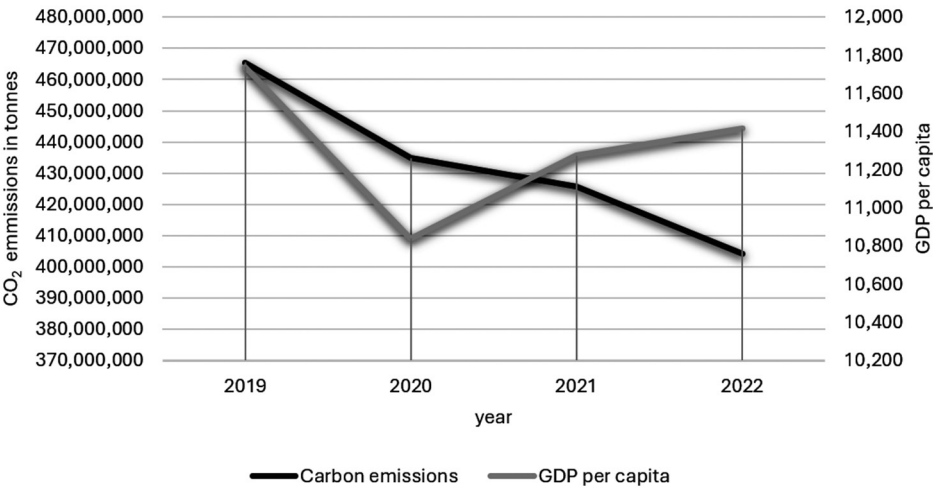
142. Swilling, Mark. “Growth, sustainability and dematerialisation: Resource use options for South Africa 2019.” In *Paper commissioned by the Presidency, South African Government, presented at a Workshop on Scenarios* (2019).

143. Agan, Busra. “Assessing the dynamic impacts of climate change adaptation and clean energy innovations on economic growth in OECD countries.” In *Natural Resources Forum*. (Oxford, UK: Blackwell Publishing Ltd, 2024).

144. Davies, Megan Lynne. “South Africa’s contested transition to energy democracy: lessons and struggles from the Renewable Energy Independent Power Producer Procurement Programme.” *PhD diss., Stellenbosch* (Stellenbosch University, 2021).

145. Soday, Aamirah. “The impact of the South African Renewable Energy Independent Power Producers Procurement Programme on South African communities: A case study.” (2021).

Figure 1. Comparison of annual CO₂ emissions from fossil fuels and industry to gross development product per capita in South Africa



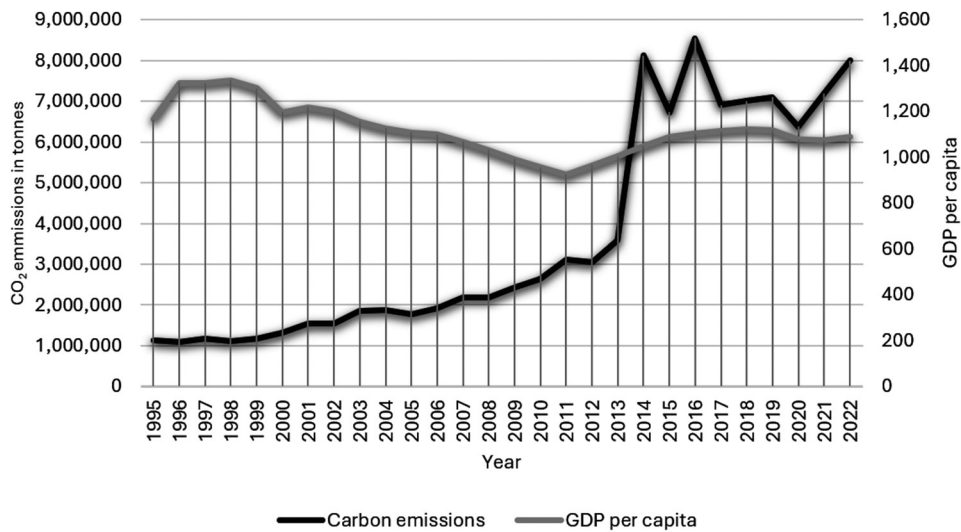
tonnes to 404,053,980 tonnes by 2022, representing a 13% decline.¹⁴⁶ While the initial drop in emissions in 2020 can be partly attributed to an 8% decrease in GDP per capita,¹⁴⁷ emissions continued to decline even as GDP per capita began to recover from 2021 onwards.

3.2.2. *Assessing the relationship between environmental policies, CO₂ emissions and economic growth in Mozambique*

Mozambique has increasingly grappled with the challenges posed by climate change over the past two decades, a situation exacerbated by its geographical vulnerability to severe natural disasters, including droughts, cyclones and floods.¹⁴⁸ These climatic events have had a particularly devastating impact on the agricultural sector, worsening existing socio-economic challenges.¹⁴⁹ Due to Mozambique's geographical location and infrastructural limitations, a significant portion of the country remains highly susceptible to the adverse effects of climate change. Historical data from the *Instituto Nacional de Gestao de Calamidades* (National Institute for Disaster Management) reveals that Mozambique has experienced approximately 75 significant natural disasters over the past three and a half decades, including droughts, floods, cyclones and epidemics.¹⁵⁰ This susceptibility emphasizes Mozambique's heightened vulnerability compared to many of its African counterparts.

146. Ritchie, Hannah. and Roser, Max - "CO₂ emissions" (OurWorldInData.org, 2024), <https://ourworldindata.org/co2-emissions>.
147. Maddison Project Database, version 2018. Bolt, Jutta, Robert Inklaar, Herman de Jong and Jan Luiten van Zanden, "Rebasing 'Maddison': new income comparisons and the shape of long-run economic development", Maddison Project Working paper 10 (2018).
148. Ritchie, Hannah. and Roser, Max - "CO₂ emissions" (OurWorldInData.org, 2024), <https://ourworldindata.org/co2-emissions>.
149. Ritchie, Hannah. and Roser, Max - "CO₂ emissions" (OurWorldInData.org, 2024), <https://ourworldindata.org/co2-emissions>.
150. Ritchie, Hannah. and Roser, Max - "CO₂ emissions" (OurWorldInData.org, 2024), <https://ourworldindata.org/co2-emissions>.

Figure 2. Comparison of annual CO₂ emissions from fossil fuels and industry to gross development product per capita in Mozambique



As shown in Figure 2., despite implementing a National Environmental Policy in 1995, Mozambique has seen a dramatic increase in carbon emissions, from 1,130,973 tonnes to 8,003,215 tonnes in 2022, marking a 608% rise.¹⁵¹ This increase occurred even during periods of declining GDP per capita.¹⁵² A more comprehensive understanding of Mozambique’s carbon emissions necessitates a comparison with global emissions. Figure 5. highlights that Mozambique has one of the lowest carbon emissions globally, which has prompted the country to engage in carbon tax credit trading – a strategy discussed in section 5.1.4.

3.2.3. *Assessing the relationship between taxation, CO₂ emissions and economic growth in the United Kingdom*

The United Kingdom’s carbon dioxide emissions primarily originate from the industrial, residential and transport sectors.¹⁵³ Despite a general decline in total emissions, the contributions from different sources have varied. For example, the increase in transport emissions is largely due to the rising volume of traffic, which has offset gains in vehicle efficiency.¹⁵⁴ As a major industrialized economy, the United Kingdom contributes a significant portion

151. Ritchie, Hannah. and Roser, Max - “CO₂ emissions” (OurWorldInData.org, 2024), <https://ourworldindata.org/co2-emissions>.

152. Maddison Project Database, version 2018. Bolt, Jutta, Robert Inklaar, Herman de Jong and Jan Luiten van Zanden, “Rebasing ‘Maddison’: new income comparisons and the shape of long-run economic development”, Maddison Project Working paper 10 (2018).

153. Dresner, Simon, Jackson, Tim and Gilbert, Nigel. “History and social responses to environmental tax reform in the United Kingdom.” *Energy Policy* 34, no. 8 (2006): 930-939.

154. Thomas, Hugh, and André Cabrera Serrenho. “Using different transport modes: An opportunity to reduce UK passenger transport emissions?.” *Transportation Research Part D: Transport and Environment* 126 (2024): 103989.

of global emissions (see Figure 5.). The global nature of climate change necessitates international agreements, such as the Kyoto Protocol, to address the issue comprehensively.¹⁵⁵

As a signatory of the 1997 Kyoto Protocol, the United Kingdom committed to reducing its GHG emissions by 8% from 1990 levels by the period 2008-2012, alongside other EU Member States.¹⁵⁶ In 2002, the European Union announced that its Member States would collectively meet this target, allowing some states to reduce emissions by less than others while maintaining an average reduction of 8% across the European Union.¹⁵⁷ The United Kingdom was assigned a more ambitious target of a 12.5% reduction by 2008-2012.¹⁵⁸ Furthering its commitment, the United Kingdom set a domestic target in November 2000 as part of its “Climate Change Programme”, aiming for a 20% reduction in CO₂ emissions by 2010 compared to 1990 levels.¹⁵⁹

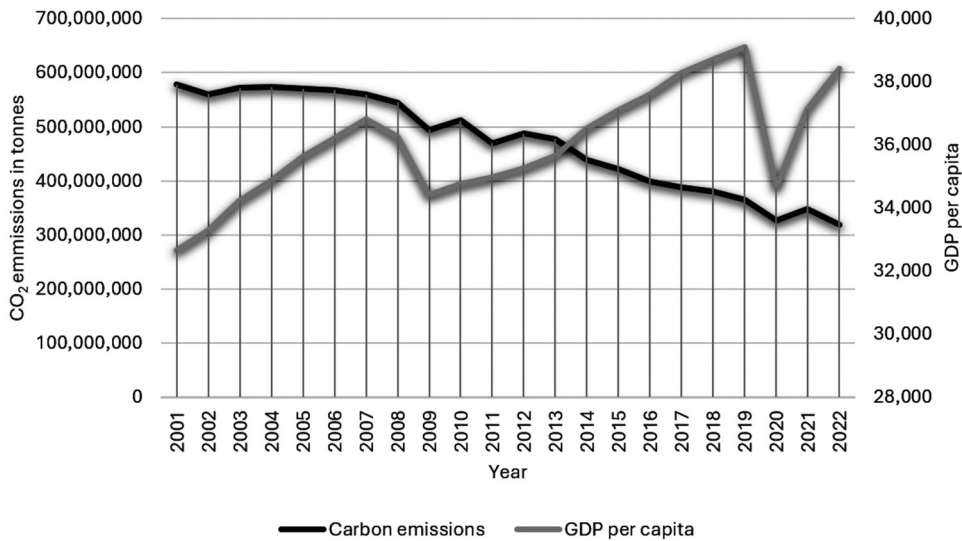
Figure 3. shows that, since the implementation of the Climate Change Levy in 2001, the United Kingdom’s carbon emissions have decreased significantly – from 577,970,560 tonnes to 318,654,370 tonnes in 2022, a 44.8% reduction.¹⁶⁰ Notably, between 2009 and 2019, emissions consistently decreased despite an increase in GDP per capita.¹⁶¹

3.2.4. Assessing the relationship between taxation, CO₂ emissions and economic growth in Sweden

Sweden has been at the forefront of a significant tax shift from income taxes to energy and pollution taxes. In 1991, Sweden introduced a carbon tax alongside existing energy taxes and later implemented taxes on nitrogen oxides (NOx) and sulphur dioxide (SO₂).¹⁶² The revenue from these climate change taxes was strategically used to support a tax shift, allowing Sweden to lower high marginal tax rates on labour income.¹⁶³ This approach, known as a “tax shift” or “revenue-neutral environmental tax reform”, enables governments to reduce the tax burden on income and employment by increasing taxes on environmental pollutants instead. By reallocating tax burdens in this way, Sweden aimed not only to incen-

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- 155. Böhringer, Christoph. “The Kyoto protocol: a review and perspectives.” *Oxford Review of Economic Policy* 19, no. 3 (2003): 451-466.
 - 156. Maamoun, Nada. “The Kyoto protocol: Empirical evidence of a hidden success.” *Journal of Environmental Economics and Management* 95 (2019): 227-256.
 - 157. Bianco, Vincenzo, Furio Cascetta, and Sergio Nardini. “Analysis of the carbon emissions trend in European Union. A decomposition and decoupling approach.” *Science of The Total Environment* 909 (2024): 168528.
 - 158. Barrett, John, Steve Pye, Sam Betts-Davies, Oliver Broad, James Price, Nick Eyre, Jillian Anable et al. “Energy demand reduction options for meeting national zero-emission targets in the United Kingdom.” *Nature energy* 7, no. 8 (2022): 726-735.
 - 159. Shahbaz, Muhammad, Muhammad Ali Nasir, Erik Hille, and Mantu Kumar Mahalik. “UK’s net-zero carbon emissions target: Investigating the potential role of economic growth, financial development, and R&D expenditures based on historical data (1870–2017).” *Technological Forecasting and Social Change* 161 (2020): 120255.
 - 160. Ritchie, Hannah, and Roser, Max - “CO₂ emissions” (OurWorldInData.org, 2024), <https://ourworldindata.org/co2-emissions>.
 - 161. Maddison Project Database, version 2018. Bolt, Jutta, Robert Inklaar, Herman de Jong and Jan Luiten van Zanden, “Rebasing ‘Maddison’: new income comparisons and the shape of long-run economic development”, Maddison Project Working paper 10 (2018).
 - 162. Shmelev, Stanislav E., and Stefan U. Speck. “Green fiscal reform in Sweden: econometric assessment of the carbon and energy taxation scheme.” *Renewable and Sustainable Energy Reviews* 90 (2018): 969-981.
 - 163. Sterner, Thomas, and Marianne Löwgren. “Environmental taxes: a cautious start in Sweden.” In *Economic policies for sustainable development*, (Dordrecht: Springer Netherlands, 1994): 46-67.

Figure 3. Comparison of annual CO2 emissions from fossil fuels and industry to gross development product per capita in the United Kingdom



tivize reductions in GHG emissions but also to enhance economic efficiency and increase employment.¹⁶⁴

Initially, Sweden set a carbon-energy taxation level nearly equivalent to the European Commission’s 2000 proposal of USD 100 per ton of CO₂, but with some exemptions for energy-intensive industries.¹⁶⁵ In 1992, Sweden adjusted the carbon-energy tax structure, reducing the tax burden on industries while increasing taxes on households – a move reflecting the growing adoption of carbon-energy taxation principles.¹⁶⁶

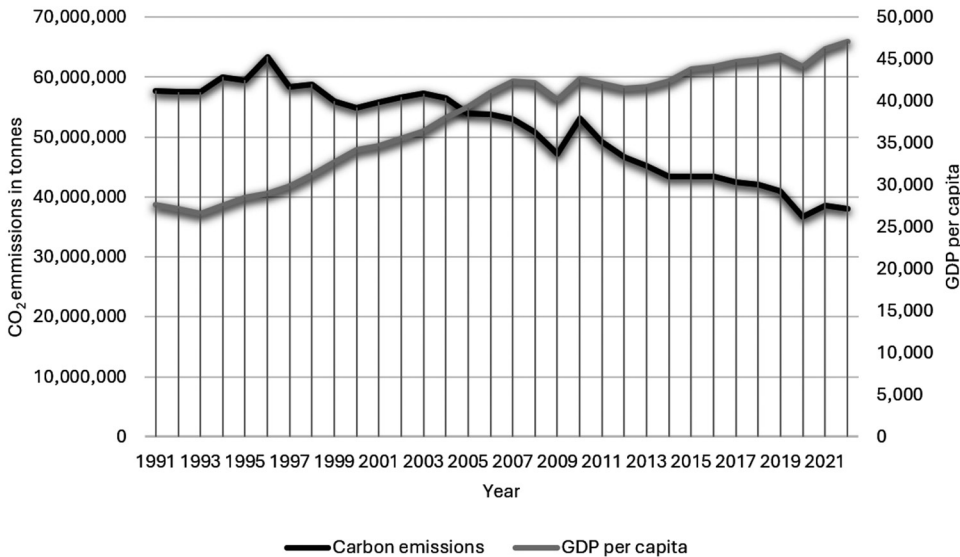
Figure 4. indicates that Sweden has achieved considerable success in reducing its carbon emissions. Since the introduction of its carbon tax in 1991, Sweden’s carbon emissions have decreased from 57,739,636 tonnes to 38,050,544 tonnes in 2022, representing a 34% reduction.¹⁶⁷ Notably, this decrease in carbon emissions occurred despite an increase in GDP per capita,¹⁶⁸ pointing to the effectiveness of Sweden’s climate policies.

3.2.5. Comparison of the effects of taxation and environmental policies on the GDP and CO₂ emissions in South Africa, Mozambique, the United Kingdom and Sweden

Climate change taxes are pivotal in driving investments in renewable technologies and reducing carbon emissions, although they are susceptible to political influence and policy

164. Johansson, Bengt. “The carbon tax in Sweden.” *Innovation and the Environment* 85 (2000): 85-148.
165. Sterner, Thomas. “The carbon tax in Sweden.” *Standing up for a Sustainable World* (2020): 59-67.
166. Köppl, Angela, and Margit Schratzenstaller. “Carbon taxation: A review of the empirical literature.” *Journal of Economic Surveys* 37, no. 4 (2023): 1353-1388.
167. Ritchie, Hannah. and Roser, Max - “CO₂ emissions” (OurWorldInData.org, 2024), <https://ourworldindata.org/co2-emissions>.
168. Maddison Project Database, version 2018. Bolt, Jutta, Robert Inklaar, Herman de Jong and Jan Luiten van Zanden, “Rebasing ‘Maddison’: new income comparisons and the shape of long-run economic development”, Maddison Project Working paper 10 (2018).

Figure 4. Comparison of annual CO2 emissions from fossil fuels and industry to gross development product per capita Sweden



fluctuations. For these taxes to be effective, they should be straightforward, incentivize positive environmental behaviour and minimize evasion. However, it is essential to recognize that comparing carbon emission reductions in developing countries with those of developed countries can be misleading due to differing economic contexts and resource constraints.

As illustrated in Figure 5., Sweden, among the four countries studied, has achieved the highest revenue from carbon taxes – USD 2.173 billion – while also maintaining some of the lowest carbon emissions per capita.¹⁶⁹ Sweden’s high carbon tax rate has been instrumental in reducing emissions, particularly in sectors like transport and energy, demonstrating the effectiveness of well-designed carbon taxation in encouraging long-term emission reductions. In the United Kingdom, which does not have a specific carbon tax but which implements a carbon price support (CPS) mechanism, the government has collected USD 994 million. This revenue aligns with its significant emission reductions in the energy sector, largely attributed to the CPS, which has effectively discouraged coal use in electricity generation.

South Africa, by contrast, collected only USD 127 million in carbon tax revenue, with emissions of 404 million tonnes.¹⁷⁰ This relatively low revenue and high emissions profile reflect both a modest carbon tax rate and ongoing dependence on coal in the energy sector, suggesting that the tax’s design and coverage may need further adjustments to achieve substantial emission reductions. While the revenue generated from these taxes can be indicative of the tax rate or environmental challenges that broaden the tax base, it does not solely determine the success of carbon taxes in reducing emissions.

169. Statista. “Revenues generated by carbon taxes worldwide in 2023, by select jurisdiction” (2023), <https://www.statista.com/statistics/1241742/carbon-tax-revenues-worldwide-by-selected-country>.

170. Statista. “Revenues generated by carbon taxes worldwide in 2023, by select jurisdiction” (2023), <https://www.statista.com/statistics/1241742/carbon-tax-revenues-worldwide-by-selected-country>.

Figure 5. Comparison of 2022 annual CO₂ emissions from fossil fuels and industry to gross development product per capita in Sweden since the implementation of carbon tax

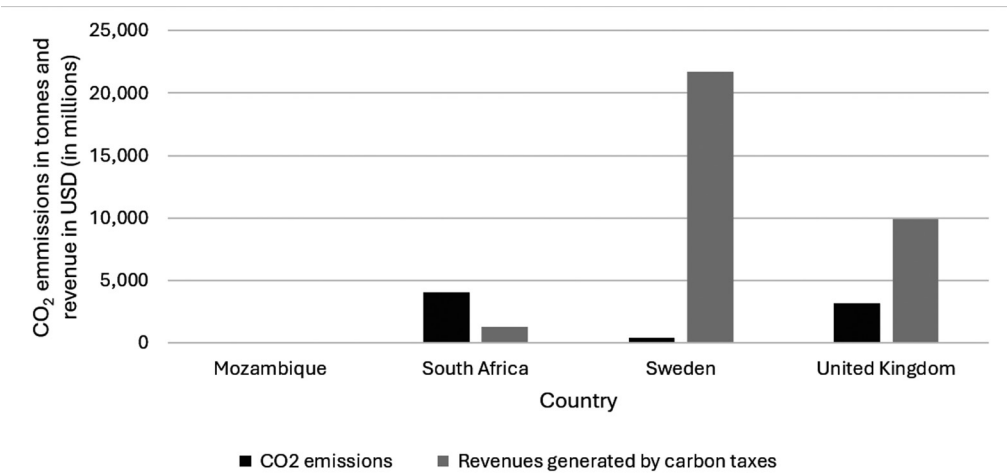


Figure 5. provides a visual comparison of CO₂ emissions from fossil fuels and industry relative to GDP per capita in each country since the implementation of their respective carbon tax policies. These comparisons reveal that effective carbon pricing, as seen in Sweden and the United Kingdom, has contributed to significant emissions reductions, whereas countries with lower tax rates or less comprehensive coverage, like South Africa, face greater challenges in achieving similar results. This analysis highlights the importance of robust, context-specific carbon tax policies that are capable of both generating revenue and achieving substantial emissions reductions.

4. Evaluating Climate Change Taxation and Environmental Sustainability Policies in South Africa

South Africa’s significant contribution to climate change is largely due to its heavy reliance on coal for energy production, making it one of the top 15 global GHG emitters.¹⁷¹ In 2017, the country emitted 512 million tons of CO₂e, a 14% increase since 2000.¹⁷² This carbon-intensive economy is driven by vast coal resources and subsidies for coal-fired electricity, with the energy sector alone responsible for 80% of gross emissions.¹⁷³ Coal, in particular, represents 75% of fossil fuel consumption and 93% of electricity generation.¹⁷⁴

The impacts of climate change on South Africa are severe, with national temperatures rising at twice the global rate since 1990. This accelerated warming has intensified water security issues, leading to more frequent droughts and acute water shortages. Recognizing the

171. Du Plessis, C., Irurah, D. and Scholes, R.J., 2003. “The built environment and climate change in South Africa”. *Building Research and Information*, 31(3-4), 240-256.

172. US AID, 2022. USAID Climate Strategy 2022–2030: Advancing Equitable and Ambitious Actions to Confront the Climate Crisis. Available at <https://www.usaid.gov/policy/climate-strategy>.

173. Mirzania, Pegah, Joel A. Gordon, Nazmiye Balta-Ozkan, Ramazan Caner Sayan, and Lochner Marais. “Barriers to powering past coal: Implications for a just energy transition in South Africa.” *Energy Research & Social Science* 101 (2023): 103122.

174. Winkler, Harald, and Andrew Marquard. “Analysis of the economic implications of a carbon tax.” *Journal of Energy in Southern Africa* 22, no. 1 (2011): 55-68.

urgency of these challenges, South Africa has reaffirmed its commitments under the Paris Climate Agreement, setting ambitious targets to peak GHG emissions between 398-510 million tonnes by 2025 and to further reduce them to 350-420 million tonnes from 2026 onward.¹⁷⁵ However, achieving these targets will require not only a transition from coal to renewable energy but also a comprehensive policy framework that extends beyond climate change taxation alone.

While carbon taxes are essential in discouraging high-emission practices and generating revenue for green initiatives, they are most effective when integrated with other governmental strategies. South Africa's transition to renewable energy will also necessitate substantial investment in renewable infrastructure, incentives for green innovation and policies supporting job transitions for workers in coal-dependent sectors. Additionally, regulatory measures, such as emissions caps, subsidies for clean energy and public-private partnerships for sustainable development, are crucial for building resilience and achieving emissions targets. This multi-faceted approach aims to ensure that tax policies work in concert with broader, more proactive measures, creating a robust foundation for sustainable growth and reinforcing South Africa's commitments to global climate goals.

In October 2023, South Africa's National Assembly passed the Climate Change Act, marking a pivotal step in the country's environmental policy.¹⁷⁶ The Act, alongside the Carbon Tax Act of 2019, is designed to drive the transition to a low-carbon economy by encouraging emissions reductions and funding green initiatives.¹⁷⁷ The bill sets sector-specific reduction targets and mandates the creation of a National Adaptation Strategy, guiding South Africa towards climate resilience.¹⁷⁸

Balancing the transition with economic growth, the government is investing in less carbon-intensive transition fuels like natural gas, which emits 50% less CO₂ than coal.¹⁷⁹ This approach aims to maintain energy security while advancing towards renewable technologies such as solar and wind, which are now competitive with fossil fuels.¹⁸⁰

4.1. How South Africa uses carbon tax to address climate change, decarbonize its economy and promote growth

The introduction of South Africa's Carbon Tax Act in June 2019 marked a significant step in the country's commitment to addressing climate change.¹⁸¹ This policy initiative stems from the National Treasury's Carbon Tax Policy Paper released in May 2013, followed by the

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- 175. Fakoya, Michael Bamidele. "Proposed carbon tax policy in South Africa: learning from the experience of other countries and effect on consumer price index." *Environmental economics* 4, Iss. 4 (2013): 65-74.
 - 176. Setzer, Joana, and Catherine Higham. "Global trends in climate change litigation: 2023 snapshot." *Grantham Research Institute on Climate Change and the Environment*, London, UK (2023).
 - 177. Yiadom, Eric B., Lord Mensah, Godfred A. Bokpin, and John KM Mawutor. "Carbon tax adoption and foreign direct investment: Evidence from Africa." *Cogent Economics & Finance* 12, no. 1 (2024): 2312783.
 - 178. Fakoya, Michael Bamidele. "Proposed carbon tax policy in South Africa: learning from the experience of other countries and effect on consumer price index." *Environmental economics* 4, Iss. 4 (2013): 65-74.
 - 179. Ntombela, Sifiso M., Heinrich R. Bohlmann, and Mmatlou W. Kalaba. "Greening the South Africa's economy could benefit the food sector: Evidence from a carbon tax policy assessment." *Environmental and Resource Economics* 74 (2019): 891-910.
 - 180. Vorster, Shaun, Harald Winkler, and Meagan Jooste. "Mitigating climate change through carbon pricing: An emerging policy debate in South Africa." *Climate and Development* 3, no. 3 (2011): 242-258.
 - 181. Alton, Theresa, Channing Arndt, Rob Davies, Faaiqa Hartley, Konstantin Makrelov, James Thurlow, and Dumebi Ubogu. "Introducing carbon taxes in South Africa." *Applied Energy* 116 (2014): 344-354.

Draft Carbon Tax Bill in December 2015.¹⁸² The Act targets Scope 1 emitters, which are entities that directly release GHG from owned or controlled sources, such as fuel combustion and industrial processes. In contrast, Scope 2 emissions result from purchased electricity, heat or steam and are not covered under this Act. Scope 3 emissions refer to indirect emissions that occur in a company's value chain, including those from suppliers, business travel and the use of sold products; these are also not subject to the Act. The Act imposes a tax on direct GHG emissions, with the first phase running from 1 June 2019 to 31 December 2022.¹⁸³ This phase included tax-free allowances ranging from 60% to 95%, providing industries with a buffer period to adapt.¹⁸⁴

South Africa's implementation of the Carbon Tax Act reflects its adherence to international climate commitments, including the Kyoto Protocol, the 2015 Paris Agreement,¹⁸⁵ the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Sustainable Development Goals (UN SDGs).¹⁸⁶ As a result of the need for effective emission mitigation tools, the National Treasury assessed the viability of either a carbon tax or an ETS in 2013.¹⁸⁷

After extensive evaluation, the carbon tax was chosen as the primary mechanism to achieve the targeted emissions reductions by 2030.¹⁸⁸ The carbon tax is thus seen as a crucial component of South Africa's broader climate strategy, leveraging economic incentives to drive down GHG emissions.¹⁸⁹ By setting a price on carbon, the government aims to encourage industries to shrink their carbon footprint and transition towards more sustainable practices, aligning with both national and global climate objectives.¹⁹⁰

The Carbon Tax Act, implemented in 2019, is a cornerstone of South Africa's strategy to mitigate carbon emissions and transition to a low-carbon economy.¹⁹¹ As a legislative tool, the Act enforces the principle that those responsible for environmental degradation should bear the costs of mitigating its impact, a concept rooted in the "polluter pays principle".¹⁹² This approach aligns with global climate frameworks, including the Paris Agreement,

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182. Ntombela, Sifiso M., Heinrich R. Bohlmann, and Mmatlou W. Kalaba. "Greening the South Africa's economy could benefit the food sector: Evidence from a carbon tax policy assessment." *Environmental and Resource Economics* 74 (2019): 891-910.

183. South African Carbon Tax Act No. 15 of 2019.

184. Vorster, Shaun, Harald Winkler, and Meagan Jooste. "Mitigating climate change through carbon pricing: An emerging policy debate in South Africa." *Climate and Development* 3, no. 3 (2011): 242-258.

185. Di Salvatore, Lea. "Energy Transition and Investment Protection in the Global South: The Case of Mozambique." *The Palgrave Handbook of Zero Carbon Energy Systems and Energy Transitions* (2024): 373-408.

186. Nemavhidi, M. and Jegede, A.O. 2023, "Carbon tax as a climate intervention in South Africa: A potential aid or hindrance to human rights?", *Environmental Law Review*, SAGE Publications Ltd, Vol. 25 No. 1, pp. 11-27, <https://doi.org/10.1177/14614529221149836>.

187. Vorster, Shaun, Harald Winkler, and Meagan Jooste. "Mitigating climate change through carbon pricing: An emerging policy debate in South Africa." *Climate and Development* 3, no. 3 (2011): 242-258.

188. Abel, Sanderson, Julius Mukarati, Leward Jeke, and Pierre Le Roux. "Carbon Tax and Environmental Quality in South Africa." *International Journal of Energy Economics and Policy* 13, no. 2 (2023): 484-488.

189. Nemavhidi, Muano, and Ademola Oluborode Jegede. "Carbon tax as a climate intervention in South Africa: A potential aid or hindrance to human rights?" *Environmental Law Review* 25, no. 1 (2023): 11-27.

190. Fakoya, Michael Bamidele. "Proposed carbon tax policy in South Africa: learning from the experience of other countries and effect on consumer price index." *Environmental economics* 4, Iss. 4 (2013): 65-74.

191. Abel, Sanderson, Julius Mukarati, Leward Jeke, and Pierre Le Roux. "Carbon Tax and Environmental Quality in South Africa." *International Journal of Energy Economics and Policy* 13, no. 2 (2023): 484-488.

192. Karsten, Advocate ASJ, and Ms M. van der Bank. "The role of carbon emissions taxes and carbon greenhouse gas emissions on the renewable energy output: evidence from South Africa." *International Journal of Economics and Finance Studies* 14, no. 2 (2022): 156-174.

which acknowledges the need for developing countries to balance economic growth with climate responsibilities.¹⁹³

Administered by the South African Revenue Service (SARS), the carbon tax targets GHG emissions from key industrial activities, such as fuel combustion and industrial processes.^{194,195} It focuses on six primary GHGs – CO₂, perfluorocarbons (PFCs), nitrous oxide (N₂O), methane (CH₄), sulphur hexafluoride (SF₆) and hydrofluorocarbons (HFCs) – each with varying global warming potentials as established by the IPCC.¹⁹⁶ The tax is levied at the source of emissions, requiring entities that exceed specific thresholds, as outlined in Schedule 2 of the Act, to self-assess their liability and submit declarations via the SARS eFiling system.¹⁹⁷

The phased implementation of the carbon tax aims to encourage innovation and investment in renewable energy and cleaner technologies, providing industries with a pathway to transition toward sustainable practices.¹⁹⁸ However, for this goal to be feasible, supporting infrastructure – such as reliable access to renewable energy sources and necessary incentives – must be in place. Without these, industries may struggle to adapt, potentially leading to adverse economic effects as some may face financial strain or even consider shutting down operations rather than bear the high tax burden. This highlights the need for a holistic approach to climate policy, combining tax measures with infrastructure development and sector-specific support.

The first phase of the carbon tax, initially set to conclude in December 2022, has been extended to December 2025, providing industries with extra time to adjust to the tax regime.¹⁹⁹ This extension emphasizes the government's commitment not only to gradually aligning with global carbon pricing standards but also to prioritizing economic stability throughout the transition. In addition to the extension, the government has begun exploring complementary infrastructure and support initiatives, including enhancing natural gas availability as a transitional energy source. By facilitating access to lower-carbon alternatives like natural gas and developing renewable energy infrastructure, the government aims to provide industries with viable pathways to reduce emissions in a manner that mitigates potential economic strain. These efforts are intended to strengthen the impact of carbon pricing while fostering a more supportive environment for sustainable industrial practices.

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193. Ntombela, Sifiso M., Heinrich R. Bohlmann, and Mmatlou W. Kalaba. "Greening the South Africa's economy could benefit the food sector: Evidence from a carbon tax policy assessment." *Environmental and Resource Economics* 74 (2019): 891-910.
194. Nemavhidi, Muano, and Ademola Oluborode Jegede. "Carbon tax as a climate intervention in South Africa: A potential aid or hindrance to human rights?." *Environmental Law Review* 25, no. 1 (2023): 11-27.
195. Karsten, Advocate ASJ, and Ms M. van der Bank. "The role of carbon emissions taxes and carbon greenhouse gas emissions on the renewable energy output: evidence from South Africa." *International Journal of Economics and Finance Studies* 14, no. 2 (2022): 156-174.
196. Abel, Sanderson, Julius Mukarati, Leward Jeke, and Pierre Le Roux. "Carbon Tax and Environmental Quality in South Africa." *International Journal of Energy Economics and Policy* 13, no. 2 (2023): 484-488.
197. Karsten, Advocate ASJ, and Ms M. van der Bank. "The role of carbon emissions taxes and carbon greenhouse gas emissions on the renewable energy output: evidence from South Africa." *International Journal of Economics and Finance Studies* 14, no. 2 (2022): 156-174.
198. Nemavhidi, Muano, and Ademola Oluborode Jegede. "Carbon tax as a climate intervention in South Africa: A potential aid or hindrance to human rights?." *Environmental Law Review* 25, no. 1 (2023): 11-27.
199. Ntombela, Sifiso M., Heinrich R. Bohlmann, and Mmatlou W. Kalaba. "Greening the South Africa's economy could benefit the food sector: Evidence from a carbon tax policy assessment." *Environmental and Resource Economics* 74 (2019): 891-910.

The carbon tax is not just a revenue-generating measure; it is a strategic tool to internalize the environmental costs of carbon emissions.²⁰⁰ By aligning the price of carbon with its social cost, the tax incentivizes businesses to reduce their carbon footprint, thereby contributing to broader environmental conservation efforts.²⁰¹ Although the carbon tax currently contributes less than 0.2% of South Africa’s total revenue, it covers approximately 90% of the country’s GHG emissions, making it a crucial tool in national climate policy. This extensive emissions coverage means that, despite its relatively modest revenue contribution, the tax directly targets the largest emitters, incentivizing substantial reductions in carbon output. By applying a cost to emissions on such a broad scale, the tax plays a pivotal role in South Africa’s transition to a lower-carbon economy.

The effectiveness of the carbon tax stems from its dual impact: a demand effect, where increased energy prices incentivize businesses and consumers to reduce consumption, and a substitution effect, which encourages a shift toward less carbon-intensive alternatives. However, for this substitution effect to be successful, accessible and affordable alternatives to fossil fuels must be available.²⁰² In cases where industries have limited access to low-carbon energy options or technologies, the tax burden may simply translate into increased costs rather than encouraging meaningful emissions reductions. For instance, sectors with limited renewable infrastructure – such as manufacturing and mining in South Africa – may struggle to transition without significant government support in renewable energy deployment or incentives for cleaner technologies. Therefore, the carbon tax must be implemented alongside policies that facilitate access to alternative energy sources and innovations, such as public investment in renewable energy infrastructure, to ensure that it drives both emissions reductions and sustainable economic development. This integrated approach not only makes compliance feasible but also promotes cleaner production practices across sectors. This approach not only drives emissions reductions but also fosters sustainable economic development by promoting cleaner production practices.²⁰³

The Carbon Tax Act represents South Africa’s pragmatic yet ambitious approach to addressing climate change through economic mechanisms that align with global climate goals while fostering sustainable development. By implementing a Pigouvian tax structure, where the marginal cost of emissions aligns with the marginal benefit of emission reduction, the Act establishes a critical pathway for South Africa to balance industrial growth with environmental responsibility. This approach places South Africa as an active participant in global climate governance, reinforcing the country’s commitment to reducing GHG emissions and advancing a low-carbon economy.²⁰⁴

200. Bekun, Festus Victor. “Race to carbon neutrality in South Africa: what role does environmental technological innovation play?.” *Applied Energy* 354 (2024): 122212.

201. Van Heerden, J., Blignaut, J., Bohlmann, H., Cartwright, A., Diederichs, N. and Mander, M., 2016. “The economic and environmental effects of a carbon tax in South Africa: A dynamic CGE modelling approach”. *South African Journal of Economic and Management Sciences*, 19(5), 714-732.

202. Winkler, Harald, and Andrew Marquard. “Analysis of the economic implications of a carbon tax.” *Journal of Energy in Southern Africa* 22, no. 1 (2011): 55-68.

203. Mbadlanyana, Thembeni. “The political economy of carbon tax in South Africa-a critical analysis.” *Africa insight* 43, no. 1 (2013): 77-90.

204. Alton, Theresa, Channing Arndt, Rob Davies, Faaiga Hartley, Konstantin Makrelov, James Thurlow, and Dumebi Ubogu. “The economic implications of introducing carbon taxes in South Africa”. No. 2012/46. (WIDER working paper, 2012).

The Act targets high-emission sectors – including energy production, fuel combustion, industrial processes, transportation and waste management – by setting emissions thresholds beyond which companies are taxed, thus addressing emissions from the highest-polluting sectors without stifling smaller emitters.²⁰⁵ Through section 5 of the Act, the tax rate, initially set at ZAR 159 per tonne of CO₂, was raised by 16% in 2024 to ZAR 190, adjusted annually to ensure the tax retains its corrective effect. While the self-assessment model in section 6 encourages corporate accountability, it also places the onus on businesses to evaluate their emissions accurately, reinforcing transparency and alignment with sustainable practices.²⁰⁶

One of the Act's most complex balancing mechanisms is its suite of allowances, designed to reduce the financial impact on high-emission but essential sectors.²⁰⁷ While these provisions alleviate potential economic disruptions, they also risk diluting the incentive for high-emission sectors to fully commit to low-carbon transitions. The flexibility of these allowances could allow emissions to remain above optimal levels, thus potentially delaying meaningful progress toward a low-carbon economy.²⁰⁸

By balancing financial incentives with regulatory oversight, the Carbon Tax Act aligns South Africa's domestic climate policies with the principle of common but differentiated responsibilities outlined in the Paris Agreement. This alignment emphasizes a key insight for the study: effective climate change taxation in developing contexts may require adaptive frameworks that consider both environmental imperatives and socio-economic realities. The Carbon Tax Act exemplifies a blended approach, where incentivizing emissions reductions through financial mechanisms go hand in hand with allowances to manage industrial resilience and competitiveness. This model not only drives national climate action but contributes to South Africa's role in the global fight against climate change, highlighting a pathway for other developing countries seeking to harmonize climate action with economic development.

4.1.1. Assessing South Africa's challenges with carbon tax

Implementing an effective and cost-efficient ETS is crucial for mitigating climate change.²⁰⁹ South Africa faces unique challenges due to its oligopolistic energy sector, which may hinder the efficiency gains typically associated with such mechanisms.²¹⁰ The limited number of industry actors, coupled with a market structure characterized by varied abatement costs, can lead to suboptimal permit pricing and limited domestic trading opportunities. This environment risks entrenching emission-intensive technologies, as high upfront costs may deter industries from adopting greener alternatives. Additionally, it can create significant

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205. Devarajan, Shantayanan, Delfin S. Go, Sherman Robinson, and Karen Thierfelder. "Tax policy to reduce carbon emissions in South Africa." *World Bank Policy Research Working Paper* 4933 (2009).
206. Nemavhidi, Muano, and Ademola Oluborode Jegede. "Carbon tax as a climate intervention in South Africa: A potential aid or hindrance to human rights?." *Environmental Law Review* 25, no. 1 (2023): 11-27.
207. Kalaba, Mmatlou. "South Africa's carbon tax: Balancing climate action and economic development." *South African Institute of International Affairs* (2020), <https://www.jstor.org/stable/resrep29531>.
208. Vorster, Shaun, Harald Winkler, and Meagan Jooste. "Mitigating climate change through carbon pricing: An emerging policy debate in South Africa." *Climate and Development* 3, no. 3 (2011): 242-258.
209. Alton, Theresa, Channing Arndt, Rob Davies, Faaiqa Hartley, Konstantin Makrelov, James Thurlow, and Dumebi Ubogu. "Introducing carbon taxes in South Africa." *Applied Energy* 116 (2014): 344-354.
210. Goldblatt, Michael. "Comparison of emissions trading and carbon taxation in South Africa." In *Putting a Price on Carbon in South Africa and Other Developing Countries*, pp. 511-526. Routledge, 2020.

entry barriers for new, potentially more sustainable market participants.²¹¹ To counteract these challenges, government intervention is essential. Policies that incentivize innovation, facilitate access to cleaner technology and establish fair pricing structures can prevent the market from favouring established, high-emission players. For instance, implementing subsidies for renewable energy, offering tax credits for lower-carbon technology and creating competitive grants for start-ups in green sectors could help level the playing field. Such measures not only enhance the effectiveness of emissions trading but also support a transition to a more sustainable and competitive industries.

Nevertheless, South Africa’s carbon tax poses significant challenges, including potential impacts on unemployment and economic growth.²¹² Higher production costs due to the tax could translate into increased prices for goods and services, affecting consumers adversely. Essential sectors such as transport, energy and food production, as listed in Schedule 2 of the Carbon Tax Act, are critical to maintaining quality of life.²¹³ Although the health sector is indirectly impacted through higher transportation and electricity costs, this could exacerbate inequalities and accessibility issues for poorer communities.²¹⁴

Moreover, taxation on sectors like food processing, agriculture, forestry and fisheries could undermine efforts to ensure food security.²¹⁵ Similarly, increased costs for construction and machinery could affect water provision to disadvantaged communities.²¹⁶

The implementation of a carbon tax in a developing country like South Africa presents distinct challenges compared to developed countries. Although the official carbon tax rate in South Africa was set at ZAR 134 per tonne by the end of 2022, the effective rate for many companies remains substantially lower, averaging around ZAR 7 per tonne due to the availability of various tax offsets and allowances. These offsets were introduced to ease the initial burden of the tax on industries heavily dependent on carbon-intensive activities, including Eskom, South Africa’s largest coal-dependent energy producer.²¹⁷ By allowing Eskom and similar companies to reduce their taxable emissions through offsets, the policy reduces their immediate carbon tax liability. However, this also diminishes the financial pressure on Eskom to shift to cleaner energy sources, as the lower effective tax rate reduces the cost advantage of investing in renewables.²¹⁸ While the intent was to support economic stability

211. Timilsina, Govinda R. “Carbon taxes.” *Journal of Economic Literature* 60, no. 4 (2022): 1456-1502.

212. Alton, Theresa, Channing Arndt, Rob Davies, Faaiqa Hartley, Konstantin Makrelov, James Thurlow, and Dumebi Ubogu. “Introducing carbon taxes in South Africa.” *Applied Energy* 116 (2014): 344-354.

213. Garidzirai, Rufaro. “Time series analysis of carbon dioxide emission, population, carbon tax and energy use in South Africa.” *International Journal of Energy Economics and Policy* 10, no. 5 (2020): 353-360.

214. Shang, Baoping. “The poverty and distributional impacts of carbon pricing: Channels and policy implications.” *Review of Environmental Economics and Policy* 17, no. 1 (2023): 64-85.

215. Kabundu, Emmanuel, Sijekula Mbanga, and Paul Makasa. “The 2019 Carbon Tax In South Africa: Effects On Relative Cost Of Building Materials, Welfare, Emissions, And Energy Consumption For Households.” *Acta Structilia* 29, no. 2 (2022): 150-189.

216. Winkler, Harald. “Reducing Energy Poverty Through Carbon Tax Revenues In South Africa.” *Journal of Energy in Southern Africa* 28, no. 3 (2017): 12-26.

217. Steenkamp, Lee-Ann. “To incentivise or penalise: an analysis of the proposed carbon tax in South Africa.” In *The Green Market Transition*, (Edward Elgar Publishing, 2017): 47-63.

218. Kabundu, Emmanuel, Sijekula Mbanga, and Paul Makasa. “The 2019 Carbon Tax In South Africa: Effects On Relative Cost Of Building Materials, Welfare, Emissions, And Energy Consumption For Households.” *Acta Structilia* 29, no. 2 (2022): 150-189.

during the transition to lower emissions, this structure may delay Eskom's shift away from coal and lessen the overall impact of the carbon tax on emissions reduction.²¹⁹

4.1.2. The effectiveness of South Africa's carbon tax

While the carbon tax holds potential for driving climate action, its effectiveness in South Africa is constrained by structural challenges within the energy sector and broader economic impacts.²²⁰ Government transfers to carbon-intensive sectors, particularly Eskom, reduce the effective price of carbon, undermining efforts to move away from coal-fuelled power generation.²²¹ Globally, subsidies for fossil fuel usage and environmentally harmful activities far exceed commitments to green transitions, as highlighted by the World Bank's report "Detox Development: Repurposing Environmentally Harmful Subsidies".²²²

Domestically, critics express concerns over the carbon tax's effectiveness in reducing emissions and its impact on production costs and consumer prices, particularly for low-income households.²²³ The tax's implications for food security and accessibility are worrisome, as it affects activities related to food processing, transportation and agriculture, potentially leading to higher food prices and reduced availability.²²⁴ Recent increases in the carbon tax rate by the South African government are expected to further influence fuel and electricity prices, impacting individuals' financial well-being.²²⁵ Moreover, the differential taxation approach of the Carbon Tax Act for activities with direct environmental impact may inadvertently hinder efforts towards achieving a healthier environment.²²⁶

Despite the restrictive potential of the carbon tax, the inclusion of emission allowances raises concerns about perpetuating a business-as-usual approach to carbon emissions, which contradicts the commitment to achieving net-zero CO₂ emissions under the Paris Agreement.²²⁷ The efficacy of international environmental commitments, such as the Paris Agreement and the Kyoto Protocol, often suffers from limited enforcement mechanisms.²²⁸ These commitments primarily rely on facilitative and consensual approaches, which emphasize cooperation and voluntary compliance over punitive measures. For instance, while the Paris Agreement requires countries to set emissions reduction targets, there are no legally

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219. Goldblatt, Michael. "Comparison of emissions trading and carbon taxation in South Africa." In *Putting a Price on Carbon in South Africa and Other Developing Countries*, (Routledge, 2020): 511-526.
 220. Kabundu, Emmanuel, Sijekula Mbanga, and Paul Makasa. "The 2019 Carbon Tax In South Africa: Effects On Relative Cost Of Building Materials, Welfare, Emissions, And Energy Consumption For Households." *Acta Structilia* 29, no. 2 (2022): 150-189.
 221. Vorster, Shaun, Harald Winkler, and Meagan Jooste. "Mitigating climate change through carbon pricing: An emerging policy debate in South Africa." *Climate and Development* 3, no. 3 (2011): 242-258.
 222. Qu, Mr Haonan, Suphachol Suphachalasai, Sneha D. Thube, and Mr Sébastien Walker. "South Africa carbon pricing and climate mitigation policy". (International Monetary Fund, 2023).
 223. Kabundu, Emmanuel, Sijekula Mbanga, and Paul Makasa. "The 2019 Carbon Tax In South Africa: Effects On Relative Cost Of Building Materials, Welfare, Emissions, And Energy Consumption For Households." *Acta Structilia* 29, no. 2 (2022): 150-189.
 224. Vorster, Shaun, Harald Winkler, and Meagan Jooste. "Mitigating climate change through carbon pricing: An emerging policy debate in South Africa." *Climate and Development* 3, no. 3 (2011): 242-258.
 225. Timilsina, Govinda R. "Carbon taxes." *Journal of Economic Literature* 60, no. 4 (2022): 1456-1502.
 226. Ko, Yu-Chia, Krystin Zigan, and Yu-Lun Liu. "Carbon capture and storage in South Africa: A technological innovation system with a political economy focus." *Technological Forecasting and Social Change* 166 (2021): 120633.
 227. Falkner, Robert. "The Paris Agreement and the new logic of international climate politics." *International Affairs* 92, no. 5 (2016): 1107-1125.
 228. Streck, Charlotte, Paul Keenlyside, and Moritz Von Unger. "The Paris Agreement: a new beginning." *Journal for European Environmental & Planning Law* 13, no. 1 (2016): 3-29.

binding penalties for non-compliance. Instead, the Agreement encourages transparency and peer pressure through mechanisms like regular reporting and global stocktaking. This approach is intended to foster goodwill and mutual accountability among countries. However, without strong enforcement, some countries may fall short of their commitments, ultimately weakening global efforts to address climate change.

The Carbon Tax Act addresses these concerns through sections 15, 16 and 17, which detail the administration, tax periods and payment procedures.²²⁹ The Commissioner is tasked with implementing the Act in accordance with the Customs and Excise Act, ensuring accountability and closing potential loopholes for tax evasion. Further provisions on reporting, regulations and amendments reinforce the Carbon Tax Act's accountability, enhancing its effectiveness as a climate action tool.²³⁰

In conclusion, South Africa's carbon tax uses a direct emissions approach, applied downstream at the processing or distribution level. The tax is calculated based on actual emissions released by facilities, requiring robust monitoring, review and verification systems.²³¹ While this method ensures accuracy, it incurs high administrative costs due to the need to manage numerous emission sources and to cross-check data.²³² Small facilities are often excluded to limit these costs and transport fuels may also be exempt. Establishing initial tax rates can be time-intensive if an emissions inventory or oscillation data is used to guide implementation. Public acceptance depends on aligning rates with the socio-economic context.

5. Evaluating Environmental Policies in Mozambique

Mozambique's First National Communication identified seven key sectors particularly vulnerable to climate change: agriculture, forestry, health, fisheries, water resources, infrastructure, coastal areas and livestock. The Communication subsequently outlined a dual trajectory aimed at integrating environmental considerations into socio-economic development and ensuring the sustainable management of natural resources across sectors.²³³ Additionally, the Mozambican government formulated a Master Plan for Prevention and Mitigation of Natural Disasters in 2016, subsequently renewed in 2017. This strategic framework aims to mitigate the adverse impacts of climate change on communities, infrastructure and the overall economy.²³⁴ Through these initiatives, Mozambique endeavours to address the multifaceted challenges posed by climate change and bolster its resilience against future climatic events.

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229. Abel, Sanderson, Julius Mukarati, Leward Jeke, and Pierre Le Roux. "Carbon Tax and Environmental Quality in South Africa." *International Journal of Energy Economics and Policy* 13, no. 2 (2023): 484-488.

230. Van Heerden, Jan, James Blignaut, Heinrich Bohlmann, Anton Cartwright, Nicci Diederichs, and Myles Mander. "The economic and environmental effects of a carbon tax in South Africa: A dynamic CGE modelling approach." *South African Journal of Economic and Management Sciences* 19, no. 5 (2016): 714-732.

231. African Tax Administration Forum (ATAF), Carbon Taxation in Africa, ATAF Policy Brief, May 2023.

232. Falcão, Tatiana. "Policy note: highlights of the United Nations handbook on carbon taxation." *Intertax* 49, no. 11 (2021): 897-914.

233. Nachmany, Michal, Sam Fankhauser, Jana Davidová, Nick Kingsmill, Tucker Landesman, Hitomi Roppongi, Philip Schleifer et al. "The 2015 global climate legislation study: a review of climate change legislation in 99 countries: summary for policy-makers." (2015).

234. Bruna, Natacha, and Boaventura Monjane. "Action Research for Climate Justice: Challenging the Carbon Market and False Climate Solutions in Mozambique." *Climate justice and participatory research: Building climate-resilient commons, Calgary, Alberta: University of Calgary LCR Publishing Services* (2023).

Despite possessing various mitigation tools and strategies to combat climate change, Mozambique notably lacks a reliance on tax policies for such efforts. Unlike its African counterpart, South Africa, which has explored the implementation of taxes as a means to address climate change, Mozambique has yet to embrace such measures.²³⁵ This absence of tax-based approaches impedes the establishment of a comprehensive global framework and hinders the country from assuming a leadership role within the African continent in leveraging taxes for climate change mitigation.

As a developing country, Mozambique confronts inherent limitations in resources and capabilities necessary for effective climate change mitigation. This challenge is compounded by the inadequacy of existing agricultural policies to address the pressing concerns posed by climate change.²³⁶ Nonetheless, the enactment of climate change legislation in Mozambique signifies a pivotal step forward. Despite the absence of a clear climate change strategy prior to 2003, the period between 2003 and 2012 saw incremental progress in the government's approach to climate change. During this time, Mozambique submitted its first national communication to the UNFCCC in 2003, which highlighted the country's vulnerabilities and the need for adaptation measures.²³⁷ This period also involved the development of various sectoral policies and the integration of climate considerations into national development plans.²³⁸ The adoption of the National Climate Change Strategy in 2012 marked a significant shift, consolidating these efforts into a comprehensive framework for addressing climate change.²³⁹ This strategy outlines actionable measures integrating both adaptation and mitigation efforts aimed at transitioning Mozambique toward a low-carbon economy.²⁴⁰

The Ministry for Coordination of Environmental Affairs (MICOA) assumes a central role in addressing climate change issues in Mozambique. Tasked with facilitating the implementation of the Environmental Strategy for Sustainable Development in Mozambique, MICOA spearheads initiatives aimed at promoting the sustainable utilization of natural resources, poverty alleviation, infrastructure enhancement and economic and social development.²⁴¹ Through these endeavours, Mozambique attempts to fortify its resilience against climate change impacts and foster sustainable development pathways.

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235. Machaqueiro, Raquel Rodrigues. "Persistent Connections and Exclusions in Mozambique: From Colonial Anxieties to Contemporary Discourses about the Environment." *Studies in Global Social History* (2023): 201.
236. Kirshner, Joshua. "A Luta Continua: contending high and low carbon energy transitions in Mozambique." In *The routledge research companion to energy geographies*, (Routledge, 2017): 347-361.
237. Nachmany, Michal, Sam Fankhauser, Jana Davidová, Nick Kingsmill, Tucker Landesman, Hitomi Roppongi, Philip Schleifer et al. "The 2015 global climate legislation study." A review of climate change legislation in 99 countries: *Summary for policy-makers* (2015): 3.
238. Chavana, Xavier Agostinho. "Policy, legal frameworks and country strategies and priority sectors for investments in climate resilience: Case study of Mozambique." *Annual In-session Workshop on Long-term Climate Finance 4 and 5 June, 2015, Bonn, Germany*.
239. Artur, Luis, and Dorothea Hilhorst. "Climate change adaptation in Mozambique." In *The social and behavioural aspects of climate change*. (Routledge, 2017): 114-129.
240. Morgado, Fernando, Maria de Fátima Alves, and Luis R. Vieira. "Linguistic diversity and environmental literacy in the context of climate change in Mozambique." *Climate Action* (2020): 630-640.
241. Whittington, Jerome. "The Carbon Calculation: Global Climate Policy, Forests, and Transnational Governance in Brazil and Mozambique by Raquel Rodrigues Machaqueiro." *Anthropological Quarterly* 97, no. 3 (2024): 597-602.

5.1. Assessing Mozambique’s strategy for solving the challenges of climate change

Although Mozambique has not yet explored the use of tax policies as a means to tackle climate change, it has demonstrated proactive efforts in addressing its adverse effects. The Mozambican government has implemented various mitigation measures through its Climate Change Legislation to reduce the impacts of climate change.

5.1.1. The role of the National Poverty Plan in decarbonizing Mozambique’s economy during the period 2011-2014

Recognizing climate issues as one of the foremost challenges to the country’s economic development, the National Poverty Plan of 2011-2014 aimed to reduce disaster risks and adapt to climate change. The National Poverty Plan, also known as the updated Poverty Reduction Action Plan (*Plano de Acção para a Redução da Pobreza*, PARP), of 2011-2014 was the medium-term strategy of the Government of Mozambique for implementing the Five-Year Government Program of 2010-2014, focused on combating poverty and promoting inclusive economic growth.²⁴² During this period, the strategy entailed promoting initiatives to mitigate GHG emissions resulting from deforestation and wildfires, advocating for agricultural practices that prioritize conservation, establishing local risk management committees, and implementing REDD+ programmes to enhance carbon stocks.²⁴³ REDD+, or Reduction of Emissions from Deforestation and Forest Degradation, aimed to incentivize forest conservation and carbon trading, particularly in developing countries abundant with tropical forests.²⁴⁴

The National Poverty Plan (2011-2014) represented the continuation of the Action Plan for Reducing Absolute Poverty (PARPA II) of 2006-2009, extended to 2010, which aimed to reduce the incidence of food poverty from 55% to 42% by 2014.²⁴⁵ Given the importance of agriculture to Mozambique’s economy, the agriculture and fishery sectors played a key role in the country’s development plans. The updated National Poverty Plan (2011-2014) emphasized the development of agriculture and fisheries for both food security and commercial purposes as one of its top three objectives.²⁴⁶ Additionally, Mozambique’s national strategies recognized the role of forests in climate change mitigation and adaptation. Within the context of the National Poverty Plan (2011-2014), one priority was to improve the sustainable management of natural resources (land, water, fisheries and forests), with a strategic objective to adopt measures to reduce disasters and adapt to climate change, including forest-based climate change mitigation measures.

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242. Siteo, Almeida, Alda Salomão and Sheila Wertz-Kanounnikoff. “The context of REDD+ in Mozambique Drivers, agents and institutions” *Center for International Forestry Research, Occasional Paper* 79 (2012).

243. Quan, Julian, Lars Otto Naess, Andrew Newsham, Almeida Siteo, and María Corral Fernandez. “The political economy of REDD+ in Mozambique: Implications for climate compatible development.” In *Making Climate Compatible Development Happen*, (Routledge, 2017): 151-181.

244. Virtanen, Pekka, and Eero Palmujoki. “Practices of development assistance and climate change mitigation in reshaping the Mozambican REDD+ strategy.” *The Journal of Modern African Studies* 58, no. 4 (2020): 649-670.

245. International Monetary Fund. “Republic of Mozambique: poverty reduction strategy paper- progress report”. IMF Country Report No. 14/147 (2007).

246. International Monetary Fund. “Republic of Mozambique: Poverty Reduction Strategy Paper”. IMF Country Report No. 11/132 (June 2011).

5.1.2. *The role of the National Adaptation Action Plan in decarbonizing Mozambique's economy*

The National Adaptation Action Plan stands as a robust initiative aimed at integrating climate change adaptation into national policies and strategies. It emphasizes the reinforcement of early warning systems, enhancement of the capacity of local agricultural communities to cope with climate change challenges, and mitigation of adverse impacts such as coastal erosion and water resource management.²⁴⁷ Through these measures, the plan seeks to enable proactive responses to the effects of climate change, particularly in vulnerable regions heavily reliant on agriculture.²⁴⁸

5.1.3. *The role of Mozambique's National Strategy for Climate Change in decarbonizing Mozambique's economy during the period 2013 to 2025*

Introduced in November 2012, the National Strategy for Climate Change outlines a comprehensive approach to mitigate Mozambique's vulnerability and exposure to climate change while enhancing the living standards of its population.²⁴⁹ Central to this policy is the pursuit of mitigation strategies geared towards fostering low-carbon development.²⁵⁰ Additionally, it aims to establish guidelines for enhancing climate resilience in both the country's economic framework and local communities. The strategy further endeavours to promote a green economy by integrating climate considerations into local and sectoral planning processes.²⁵¹ Core areas of focus include climate risk management, low carbon development and addressing cross-cutting aspects of climate change through legal reforms and leveraging training and technology.²⁵²

In essence, Mozambique has yet to implement specific environmental tax policies aimed at addressing climate change. The country has introduced mitigation strategies such as the National Poverty Plan, National Adaptation Action Plan and the National Strategy for Climate Change, among others. These strategies collectively strive to diminish the country's vulnerability and exposure to climate change impacts through the promotion of low-carbon development and the reduction of GHG emissions.

5.1.4. *The role of carbon tax credits in decarbonizing Mozambique's economy*

Mozambique's approach to carbon credits is emerging but remains fragmented, focusing largely on trading rather than comprehensive regulation.²⁵³ Initial legal references appear in the 2014 Regulation Establishing the Tariff Regime for New and Renewable Energies

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- 247. Artur, Luís, and Dorothea Hilhorst. "Climate change adaptation in Mozambique." In *The social and behavioural aspects of climate change*, (Routledge, 2017): 114-129.
 - 248. Bambaige, Albertina. "National Adaptation Strategies to Climate Change Impacts. A Case Study of Mozambique." *Human Development Report* 7, no. 008 (2007).
 - 249. Wingqvist, Gunilla Ölund. "Environment and Climate Change Policy Brief-Mozambique Generic outline." *Sida's helpdesk for environment and climate change* (2011).
 - 250. Artur, Luís, and Dorothea Hilhorst. "Climate change adaptation in Mozambique." In *The social and behavioural aspects of climate change*, (Routledge, 2017): 114-129.
 - 251. Hervey, Angus, and Jessica Blythe. "Reducing climate change vulnerability in Mozambique: from policy to practice." *Climate governance in the developing world*. Polity Press, London, UK (2013): 238-257.
 - 252. Manuel, Lourenço, Emílio Tostão, Orcidia Vilanculos, Gaby Mandlhate, and Faaiqa Hartley. "Economic implications of climate change in Mozambique." *SA-TIED Working Paper* 136 (2020).
 - 253. Quan, Julian, Lars Otto Naess, Andrew Newsham, Almeida Siteo, and María Corral Fernandez. "Carbon forestry and climate compatible development in Mozambique: a political economy analysis." (2014).

(REFIT), which grants the state ownership of carbon credits from renewable energy projects, potentially sharing revenues with independent producers as incentives.²⁵⁴ In 2017, the Regulation on the Protection, Conservation and Sustainable Use of Biological Diversity stipulated that carbon credits generated within conservation areas belong to their managing entities, subject to Mozambican laws and specific project approvals.²⁵⁵

The most recent regulatory advancement is the 2023 REDD+ project approval framework, managed by the REDD+ Technical Unit, which oversees carbon credit allocations and benefits.²⁵⁶ This demonstrates Mozambique’s growing recognition of carbon markets for climate mitigation, emphasized by its 2019 commitment to the Paris Agreement.²⁵⁷ Article 6 of the Agreement enables international cooperative mechanisms for trading emissions reductions, which Mozambique could leverage to meet its Nationally Determined Contributions (NDCs).²⁵⁸ However, the country’s regulatory foundation remains nascent, with many aspects still underdeveloped.²⁵⁹

Globally, carbon markets function through compliance and voluntary mechanisms. Compliance markets, such as the European Union ETS, impose quotas and penalties on excess emissions, mandating reductions through pricing strategies.²⁶⁰ In contrast, voluntary markets, driven by corporate social responsibility, enable organizations to offset emissions by purchasing credits from certified projects.²⁶¹ Mozambique’s interest in these markets aligns with its membership in the African Carbon Markets Initiative and its Carbon Market Activation Plan, which seeks to establish clear regulations, ensure environmental integrity, promote community benefits and support international market participation.²⁶²

5.1.4.1. The effectiveness of Mozambique’s carbon credits market

Mozambique’s Forest Carbon Partnership Facility collaboration, verified by ASTER Global, exemplifies progress, with 2.04 million emissions reductions validated under the Zambézia Integrated Landscape Management Program.²⁶³ This milestone represents Mozambique’s

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254. Virtanen, Pekka, and Eero Palmujoki. “Practices of development assistance and climate change mitigation in reshaping the Mozambican REDD+ strategy.” *The Journal of Modern African Studies* 58, no. 4 (2020): 649-670.

255. Moreira, Sandro Lucio Silva, Hewlley Maria Acioli Imbuzeiro, Colby Silvert, Otto Herbert Schuhmacher Dietrich, Leonardo Duarte Pimentel, and Raphael Bragança Alves Fernandes. “Above-and below-ground carbon accumulation in cultivated macauba palm and potential to generate carbon credits.” *Journal of Cleaner Production* 265 (2020): 121628.

256. Siteo, Almeida, Alda Salomão, and Sheila Wertz-Kanounnikoff. “The context of REDD+ in Mozambique: Drivers, agents and institutions.” Vol. 79. (CIFOR, 2012).

257. Di Salvatore, Lea. “Energy Transition and Investment Protection in the Global South: The Case of Mozambique.” *The Palgrave Handbook of Zero Carbon Energy Systems and Energy Transitions* (2024): 373-408.

258. Cook, Gregory, Paul Zakkour, Samantha Neades, and Tim Dixon. “CCS under Article 6 of the Paris Agreement.” *International Journal of Greenhouse Gas Control* 134 (2024): 104110.

259. Minas, Stephen. “Market making for the planet: the Paris Agreement Article 6 decisions and transnational carbon markets.” *Transnational Legal Theory* 13, no. 2-3 (2022): 287-320.

260. Fuss, Sabine, Christian Flachslund, Nicolas Koch, Ulrike Kornek, Brigitte Knopf, and Ottmar Edenhofer. “A framework for assessing the performance of cap-and-trade systems: insights from the European Union Emissions Trading System.” *Review of Environmental Economics and Policy* (2018).

261. Fankhauser, Samuel, and Cameron Hepburn. “Designing carbon markets. Part I: Carbon markets in time.” *Energy Policy* 38, no. 8 (2010): 4363-4370.

262. Streck, Charlotte. “How voluntary carbon markets can drive climate ambition.” *Journal of energy & natural resources law* 39, no. 3 (2021): 367-374.

263. Machaqueiro, Raquel Rodrigues. “The Carbon Calculation: Global Climate Policy, Forests, and Transnational Governance in Brazil and Mozambique”. (University of Arizona Press, 2023).

first issued credits and signals its readiness to strategically harness carbon markets.²⁶⁴ With 45 million credits announced for trading, Mozambique aims to solidify its presence in global carbon markets, balancing emission reduction goals with local economic and environmental gains.²⁶⁵

6. Evaluating Climate Change Taxation and Environmental Sustainability Policies in the United Kingdom

Climate change taxation in the United Kingdom represents a strategic approach to addressing climate change by leveraging fiscal policies to achieve environmental outcomes. Defined as taxes levied on physical units or proxies thereof, climate change taxes include pollution-related levies as well as energy and transport taxes, all designed to mitigate environmental degradation and promote sustainable practices. Unlike traditional revenue-generating taxes, climate change taxes serve as behavioural instruments aiming to incentivize businesses and individuals toward environmentally responsible conduct.

In the United Kingdom, climate change taxes target four core areas: electricity, landfills, aggregates and cap-and-trade systems. These taxes aim to reduce demand for resources like electricity, gas and coal, consequently lowering carbon emissions.²⁶⁶ Between 2004 and 2014, CO₂ emissions declined by an average of 2.1% annually. The ratio of ETS emissions to GDP decreased by 3% per year from 2000 to 2004, with a 20% reduction in ETS emissions over the past decade, signalling significant progress in mitigating carbon emissions.²⁶⁷ The climate change levy, in particular, plays a crucial role in reducing demand for carbon-intensive resources, furthering the United Kingdom's efforts to meet its environmental targets.²⁶⁸

HM Treasury's classification of climate change taxes highlights their significant purpose, noting that even taxes primarily aimed at revenue generation may still fall within this category.²⁶⁹ The Office for National Statistics (ONS) includes fuel duty, VAT on fuel duty, renewable energy obligations, vehicle excise duty and air passenger duty under climate change taxes.²⁷⁰ To be considered climate change, a tax must align with governmental environmental objectives, primarily incentivize environmentally acceptable behaviour and establish a clear link to environmental outcomes, such that greater pollution corresponds to higher tax levies.²⁷¹

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264. Siagian, Abdhy Walid, and Anton Rosari. "Regulation on the Utilization of Carbon Service as a Forest Protection Effort in Indonesia." *The Journal of Indonesia Sustainable Development Planning* 4, no. 3 (2023): 299-317.
265. Redmond, Luke, and Frank Convery. "The global carbon market-mechanism landscape: pre and post 2020 perspectives." *Climate Policy* 15, no. 5 (2015): 647-669.
266. Bowen, Alex, and James Rydge. "Climate-change policy in the United Kingdom." (OECD Library, 2011).
267. Feng, Kuishuang, Klaus Hubacek, Dabo Guan, Monica Contestabile, Jan Minx, and John Barrett. "Distributional effects of climate change taxation: the case of the UK." (2010): 3670-3676.
268. Bulkeley, Harriet, and Kristine Kern. "Local climate change policy in the United Kingdom and Germany". No. SP IV 2004-103. *WZB Discussion Paper*, (2004).
269. Gough, Ian. "Climate change, double injustice and social policy: A case study of the United Kingdom". No. 1. *UNRISD Occasional Paper: Social Dimensions of Green Economy and Sustainable Development*, (2011).
270. Potter, Stephen, Marcus Enoch, and Malcolm Fergusson. "Fuel taxes and beyond." *London, World Wide Fund for Nature* 38 (2001).
271. Dresner, Simon, Tim Jackson, and Nigel Gilbert. "History and social responses to environmental tax reform in the United Kingdom." *Energy Policy* 34, no. 8 (2006): 930-939.

The United Kingdom government assumes that climate change taxes target environmentally harmful activities while promoting environmentally beneficial or neutral endeavours.²⁷² The EU Commission has approved the implementation of these taxes and the European Environmental Agency endorses their reform and widespread use to achieve environmental objectives.²⁷³

6.1. The role of the Climate Change Levy in decarbonizing United Kingdom’s economy

The Climate Change Levy (CCL), introduced as a policy measure in the 1999 Budget, is a tax imposed on the energy supply to businesses and was implemented in April 2001, allowing businesses time to adapt before its enforcement.²⁷⁴ The inception of the CCL stemmed from a 1998 report by Lord Marshall, advocating for economic instruments to mitigate industrial and commercial GHG emissions, particularly targeting small and medium-sized enterprises which might not be covered effectively by a permit system alone.^{275,276}

Lord Marshall’s recommendations heavily influenced the design of the CCL, focusing on levying taxes on energy supply rather than usage to distinguish between domestic and business users easily.²⁷⁷ To alleviate the impact on competitiveness, the government concurrently reduced employers’ National Insurance contributions by 0.3 percentage points upon the introduction of the CCL.²⁷⁸ By increasing energy costs, the CCL aims to incentivize energy efficiency, reduced consumption and the adoption of low-emission fuels exempt from the tax, such as renewable energy sources, waste solids and combined heat and power stations.²⁷⁹

Initially, the CCL differentiated tax rates based on the fuel type supplied and its energy content, with electricity taxed at the highest rate due to significant losses during generation, transmission and distribution.²⁸⁰ Lower rates were applied to gas, coal and liquefied petroleum gas (LPG), with specific exemptions such as natural gas in Northern Ireland, justified by its lesser environmental impact compared to alternatives like coal or oil.²⁸¹

272. Feng, Kuishuang, Klaus Hubacek, Dabo Guan, Monica Contestabile, Jan Minx, and John Barrett. “Distributional effects of climate change taxation: the case of the UK.” (2010): 3670-3676.

273. Varma, Adarsh. “UK’s climate change levy: cost effectiveness, competitiveness and environmental impacts.” In *Environmental Taxation in Practice*, (Routledge, 2017): 285-295.

274. Averchenkova, Alina, Sam Fankhauser, and Jared J. Finnegan. “The impact of strategic climate legislation: evidence from expert interviews on the UK Climate Change Act.” *Climate Policy* 21, no. 2 (2021): 251-263.

275. Pearce, David. “The political economy of an energy tax: The United Kingdom’s Climate Change Levy.” *Energy Economics* 28, no. 2 (2006): 149-158.

276. Bowen, Alex, and James Rydge. “Climate-change policy in the United Kingdom.” (OECD, 2011).

277. Pocklington, David. “The UK Climate Change Levy–Innovative, but Flawed.” *European Energy and Environmental Law Review* 10, no. 7 (2001).

278. De Souza, Jeremy, and John Snape. “Environmental tax proposals: analysis and evaluation.” *Environmental Law Review* 2, no. 2 (2000): 74-101.

279. Averchenkova, Alina, Sam Fankhauser, and Jared J. Finnegan. “The impact of strategic climate legislation: evidence from expert interviews on the UK Climate Change Act.” *Climate Policy* 21, no. 2 (2021): 251-263.

280. Pearce, David. “The political economy of an energy tax: The United Kingdom’s Climate Change Levy.” *Energy Economics* 28, no. 2 (2006): 149-158.

281. Pocklington, David. “The UK Climate Change Levy–Innovative, but Flawed.” *European Energy and Environmental Law Review* 10, no. 7 (2001).

6.1.1. The effectiveness of the UK's CCL

The CCL's operational success has been emphasized by its integral role in reducing CO₂ emissions, aligning with the United Kingdom's commitment to achieving a 20% reduction in emissions between 1990 and 2010.²⁸² Its implementation synergizes with Climate Change Agreements (CCAs), offering energy-intensive sectors an 80% tax reduction by adhering to energy efficiency targets. This collaborative framework has facilitated substantial emission reductions, estimated at 3.5 and 1.9 million tonnes of carbon by 2010, supported by enhanced industry awareness and proactive emissions management through CCAs.²⁸³

Furthermore, the CCL has fostered innovation in environmental technologies and practices through initiatives like the Energy Efficiency Fund, administered by the Carbon Trust.²⁸⁴ This fund incentivizes investments in eco-friendly infrastructure by offering tax subsidies and enhanced capital allowances, thereby bolstering industry efforts towards sustainable energy consumption practices.²⁸⁵

Despite its achievements, critiques of the CCL persist, particularly regarding its impact on the manufacturing sector and calls for a shift towards a carbon tax that directly targets emissions.^{286,287} This proposed alternative would entail levying taxes on fossil fuels utilized by motor vehicles, thereby effectively curbing CO₂ emissions.²⁸⁸ Another critique levelled against the CCL is its disproportionate impact on the manufacturing sector, resulting in increased operational costs for manufacturing enterprises due to the imposition of the levy.²⁸⁹ Governments' reluctance to embrace a carbon tax, citing administrative challenges, further adds to the burden on businesses as they grapple with the perceived redundant tax obligations imposed by the CCL.²⁹⁰ Nevertheless, the CCL's role in steering the United Kingdom towards a low-carbon economy remains pivotal, demonstrating significant strides in emissions reduction and energy efficiency across industrial and commercial sectors.²⁹¹

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- 282. Pearce, David. "The political economy of an energy tax: The United Kingdom's Climate Change Levy." *Energy Economics* 28, no. 2 (2006): 149-158.
 - 283. De Souza, Jeremy, and John Snape. "Environmental tax proposals: analysis and evaluation." *Environmental Law Review* 2, no. 2 (2000): 74-101.
 - 284. McEldowney, John, and David Salter. "Environmental taxation in the UK: the climate change levy and policy making." *Denning LJ* 28 (2016): 37.
 - 285. Hansford, Ann, John Hasseldine, and Thérèse Woodward. "The UK climate change levy: good intentions but potentially damaging to business." *Corporate Social Responsibility and Environmental Management* 11, no. 4 (2004): 196-210.
 - 286. Varma, Adarsh. "UK's climate change levy and emissions trading scheme: implications for businesses' productivity and economic efficiency." *Emissions Trading and Business* (2006): 313-326.
 - 287. De Souza, Jeremy, and John Snape. "Environmental tax proposals: analysis and evaluation." *Environmental Law Review* 2, no. 2 (2000): 74-101.
 - 288. Pearce, David. "The political economy of an energy tax: The United Kingdom's Climate Change Levy." *Energy Economics* 28, no. 2 (2006): 149-158.
 - 289. McEldowney, John, and David Salter. "Environmental taxation in the UK: the climate change levy and policy making." *Denning LJ* 28 (2016): 37.
 - 290. Hansford, Ann, John Hasseldine, and Thérèse Woodward. "The UK climate change levy: good intentions but potentially damaging to business." *Corporate Social Responsibility and Environmental Management* 11, no. 4 (2004): 196-210.
 - 291. Varma, Adarsh. "UK's climate change levy and emissions trading scheme: implications for businesses' productivity and economic efficiency." *Emissions Trading and Business* (2006): 313-326.

6.2. *The role of the Landfill Tax in the United Kingdom's climate strategy*

Landfills are substantial contributors to GHG emissions, as landfill gas typically comprises 45%-60% methane (CH₄) and 40%-60% CO₂ by volume, along with trace amounts of nitrogen, oxygen, ammonia, sulphides, hydrogen and various volatile organic compounds.²⁹² Methane, a GHG roughly 25 times more potent than CO₂ over a 100-year period, represents a significant driver of climate change.²⁹³ Recognizing the need to mitigate these emissions, the United Kingdom introduced the Landfill Tax in 1996 as a companion measure to the Climate Change Levy.²⁹⁴ This tax sought not only to raise disposal costs but also to establish a stronger economic rationale for reducing landfill dependency and encouraging more sustainable waste management practices.²⁹⁵

6.2.1. *The effectiveness of the UK Landfill Tax*

Critically, the effectiveness of the Landfill Tax in advancing decarbonization, economic growth and sustainable waste practices has remained contentious.²⁹⁶ Proponents argue it prompted the United Kingdom's shift away from landfill dependency, aligning waste management with environmental objectives.²⁹⁷ Conversely, critics contend that while the tax may have reduced landfill waste volumes, its influence on overall waste generation and the adoption of renewable waste technologies has been limited.²⁹⁸

While the Landfill Tax plays a prominent role in the United Kingdom's environmental policy framework, its impact on fostering broader decarbonization and promoting sustainable economic growth is mixed. Despite its limitations, the Landfill Tax has been a significant step in aligning waste management practices with decarbonization goals.²⁹⁹ By incentivizing reductions in landfill waste, the tax has not only helped to decrease methane emissions but has also set a precedent for integrating environmental costs into economic decision-making. However, effective decarbonization requires a more integrated policy approach, wherein fiscal instruments like the Landfill Tax are complemented by robust infrastructure investments and stronger regulations.³⁰⁰ Without such supportive measures, the tax alone may fall short of advancing comprehensive sustainability objectives, particularly in stimulating waste reduction and circular economy practices at the source.

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293. Davies, Bob, and Michael Doble. "The development and implementation of a landfill tax in the UK." *Addressing The Economics Of Waste* (2004): 63-80.

294. Morris, John R., Paul S. Phillips, and Adam D. Read. "Developments: the UK landfill tax: financial implications for local authorities." *Public Money and Management* 20, no. 3 (2000): 51-54.

295. Morris, John R., Paul S. Phillips, and Adam D. Read. "Developments: the UK landfill tax: financial implications for local authorities." *Public Money and Management* 20, no. 3 (2000): 51-54.

296. Elliott, Tim. "Landfill tax in the United Kingdom." *Institute for European and Environmental Policy IEEP* (2016).

297. Davies, Bob, and Michael Doble. "The development and implementation of a landfill tax in the UK." *Addressing The Economics Of Waste* (2004): 63-80.

298. Roy, Sharanya Basu, and Sayantan Ghosh Dastidar. "Are Environmental Taxes Effective in Curbing Air Pollution? Evidence from the United Kingdom." *Economic Issues* 26, no. Part 2 (2021).

299. Martin, Adrian, and Ian Scott. "The effectiveness of the UK landfill tax." *Journal Of Environmental Planning And Management* 46, no. 5 (2003): 673-689.

300. Powell, Jane, and Amelia Craighill. *The UK Landfill Tax*. (London: Earthscan, 1997).

6.3. The Aggregates Levy and its role in sustainable economic growth

By incentivizing recycled aggregates over virgin materials, the Aggregates Levy, introduced in the United Kingdom in April 2002,³⁰¹ works in tandem with other policies to drive a shift toward low-carbon construction practices and enhance the United Kingdom's decarbonization strategy.³⁰² This policy is especially relevant given the environmental toll of natural aggregate production, which generates approximately 8.1 kg of CO₂ per tonne.³⁰³ With concrete being the most widely used construction material globally – paving roads, highways and supporting water resources infrastructure – the aggregate demand is expected to rise alongside global urbanization and industrialization.³⁰⁴ This demand not only exacerbates carbon emissions but also accelerates ecological degradation through extensive mining of natural aggregates.³⁰⁵ The levy's approach centres on correcting a market failure, where environmental costs valued at GBP 380 million annually associated with quarrying, including emissions, dust and noise, are not reflected in the prices of virgin aggregates.³⁰⁶

6.3.1. The effectiveness of the UK Aggregates Levy

While the Aggregates Levy represents an early attempt at embedding environmental costs into market pricing within the United Kingdom's construction sector, its limitations highlight the need for adaptive, inflation-sensitive policy design and consistent implementation.³⁰⁷ To contribute meaningfully to decarbonization and sustainable economic growth, policies like the Aggregates Levy must be part of a cohesive framework that addresses sectoral disparities, regional adjustments and the alignment of incentives with environmental objectives.

Furthermore, despite the Aggregates Levy facing implementation challenges, it remains a significant policy tool within the United Kingdom's commitment to decarbonization and sustainable development.³⁰⁸ By imposing costs on the production of natural aggregates, the levy encourages the adoption of recycled materials, which significantly lower carbon emissions and reduce environmental degradation.³⁰⁹

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301. Brown, Teresa, Fiona McEvoy, and John Ward. "Aggregates in England – Economic contribution and environmental cost of indigenous supply." *Resources Policy* 36, no. 4 (2011): 295-303.
 302. Barbhuiya, Salim, Bibhuti Bhusan Das, and Dibyendu Adak. "Roadmap to a net-zero carbon cement sector: Strategies, innovations and policy imperatives." *Journal of Environmental Management* 359 (2024): 121052.
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 304. Miller, Sabbie A., and Frances C. Moore. "Climate and health damages from global concrete production." *Nature Climate Change* 10, no. 5 (2020): 439-443.
 305. Barbhuiya, Salim, Fragkoulis Kanavaris, Bibhuti Bhusan Das, and Maria Idrees. "Decarbonising cement and concrete production: Strategies, challenges and pathways for sustainable development." *Journal of Building Engineering* (2024): 108861.
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 308. Ettlinger, Sarah. "Aggregates levy in the United Kingdom." *Institute for European Environmental Policy: London, UK* (2017).
 309. Cox, Benjamin, Sally Innis, Nadja C. Kunz, and John Steen. "The mining industry as a net beneficiary of a global tax on carbon emissions." *Communications Earth & Environment* 3, no. 1 (2022): 1-8.

6.4. Assessing the impacts of the UK ETS, the EU ETS and adaptations in carbon pricing strategies through implementation of the Carbon Price Floor

The UK ETS, launched in 2002, marked a pioneering attempt at reducing GHG emissions through financial incentives and market-driven mechanisms.³¹⁰ This early scheme encouraged participants to cut emissions by providing GBP 215 million in incentives for meeting emission reduction targets.³¹¹ The EU ETS, launched in 2005,³¹² took a more extensive and mandatory approach, covering high-emission sectors across EU Member States and three additional European Economic Area countries.³¹³ Designed as a cap-and-trade system, the EU ETS set emissions caps aligned with Kyoto Protocol targets, permitting companies to buy and trade allowances as necessary.³¹⁴ However, the reliance on market prices meant that carbon costs fluctuated, sometimes undermining the intended financial pressure on polluting industries. To complement the EU ETS, the United Kingdom introduced the Carbon Price Floor (CPF) on 1 April 2013.³¹⁵ The CPF aims to ensure a minimum carbon price to drive investments in low-carbon technologies, addressing a gap that the EU ETS alone has struggled to fill.³¹⁶

6.4.1. The effectiveness of the UK CPF

Despite its aims, the CPF in the United Kingdom has faced criticism for not significantly reducing emissions and for raising costs for both consumers and businesses. Recognizing the competitive strain on energy-intensive industries, the UK government introduced compensation measures to offset the financial impacts of both the CPF and the EU ETS.³¹⁷ These compensations were essential in alleviating the burden on affected industries, helping them remain competitive while still adhering to climate goals. Critics argue that the CPF alone has not achieved the intended emissions reduction targets and has put economic pressure on businesses.³¹⁸ However, the policy has gained support from certain power companies and environmental advocates for stimulating low-carbon investments and advancing the climate agenda.

This example highlights an essential lesson for developing countries: environmental taxation policies should be bolstered by additional governmental measures. In contexts where industries may struggle to bear the costs of emissions regulations, complementary policies – such as financial compensation, investment incentives in cleaner technology and infra-

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- 310. Jung, Hail, and Chang-Keun Song. “Effects of emission trading scheme (ETS) on change rate of carbon emission.” *Scientific Reports* 13, no. 1 (2023): 912.
 - 311. Temoche González, Karina. “Carbon pricing: a comparison between Germany and the United Kingdom.” *Junior Management Science (JUMS)* 7, no. 3 (2022): 731-755.
 - 312. Its first phase lasted until the end of 2007, followed by a second phase from 2008 to 2012.
 - 313. It operates across the European Union’s 28 Member States and three EEA countries: Norway, Iceland, and Liechtenstein.
 - 314. Firms that fail to acquire enough allowances face a penalty of EUR 40 per tonne of CO₂. Each EU Member State submits a National Allocation Plan (NAP) that dictates the total number of permits allocated, aligning with Kyoto Protocol targets.
 - 315. Hist, David and Keep, Matthew. 2023, “Carbon Price Floor (CPF) and the price support mechanism” Available at: <https://commonslibrary.parliament.uk/research-briefings/sn05927/>.
 - 316. Ramaker, Alienke. “A carbon price floor: today’s solution for yesterday’s problem?” *Renewable Energy L. & Pol’y Rev.* 9 (2018): 19.
 - 317. Temoche González, Karina. “Carbon pricing: a comparison between Germany and the United Kingdom.” *Junior Management Science (JUMS)* 7, no. 3 (2022): 731-755.
 - 318. Newbery, David M., David M. Reiner, and Robert A. Ritz. “The political economy of a carbon price floor for power generation.” *The Energy Journal* 40, no. 1 (2019): 1-24.

structure support – are vital.³¹⁹ Such measures can balance the economic impact of taxation while still driving toward meaningful emissions reductions, offering a feasible pathway for lower-income economies aiming to balance industrial competitiveness with climate goals.

7. Evaluating Climate Change Taxation in Sweden

In 1896, Swedish scientist Svante Arrhenius made a pioneering contribution by calculating the relationship between atmospheric CO₂ levels and Earth's temperature – a foundational insight for understanding the greenhouse effect.³²⁰ Yet, it was not until nearly a century later, in 1991, that Sweden, building on this scientific groundwork, enacted one of the world's first carbon taxes, positioning itself as a leader in climate policy. This move marked a shift from Sweden's earlier environmental strategies, which had relied mainly on regulation rather than market mechanisms to drive behavioural change.

Sweden's historical approach to energy taxation highlights this transformation. Starting in the early 20th century, the country began taxing energy products – beginning with petrol in 1924, followed by diesel in 1937, and later extending to coal, oil and electricity consumption in the 1950s. Additionally, specific fuels used for heating, such as heating oil, were also subject to taxation.³²¹ However, these taxes primarily served revenue-generating purposes rather than environmental objectives. By the 1980s, perspectives began to evolve, with increasing recognition of the economic potential of market-based instruments for reducing emissions. This change in mindset was catalyzed by Swedish economist Erik Dahmén's critique of overly regulatory political discourse, which led to meteorologist Bert Bohlin's 1988 carbon tax proposal as an alternative to traditional regulatory approaches.³²²

7.1. *How Sweden's carbon tax evolution shows that economic growth can be balanced with emission reductions through progressive climate policy*

The eventual implementation of the Swedish carbon tax in 1991 was not isolated; it was part of a sweeping 1990-91 tax reform under the "green tax-switching" (*grön skatteväxling*) initiative.³²³ This policy reform strategically aligned environmental and economic goals by raising climate change taxes while decreasing the marginal income and corporate tax rates – reducing them from 80% to 50% and 57% to 30%, respectively.³²⁴ Notably, additional wealth, inheritance and entrepreneurial taxes were later either abolished or reformed. This reform highlights Sweden's balanced approach to environmental taxation, aiming not only to incentivize emissions reductions but also to mitigate potential economic burdens on individuals and businesses.

The design of the Swedish carbon tax targets fossil fuels such as petrol, oil and coal for heating and transportation, with tax rates calibrated to the CO₂ emissions released upon

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319. Houser, Trevor, Rob Bradley, Britt Childs, Jacob Werksman, and Robert Heilmayr. "Leveling The Carbon Playing Field: International Competition And US Climate Policy Design". (Peterson Institute, 2008).
320. Sterner, Thomas. "The carbon tax in Sweden." *Standing up for a Sustainable World* (2020): 59-67.
321. Cruciani, Michel. "The energy transition in Sweden." *Études de l'Ifri*, (Paris, 2016).
322. Jonsson, Samuel, Anders Ydstedt, and Elke Asen. "Looking back on 30 years of carbon taxes in Sweden." *Fiscal Fact* 727 (2020).
323. Fudge, Colin, and Janet Rowe. "Ecological modernisation as a framework for sustainable development: a case study in Sweden." *Environment and Planning A* 33, no. 9 (2001): 1527-1546.
324. Lindbeck, Assar. "The Swedish experiment." *Journal of Economic Literature* 35, no. 3 (1997): 1273-1319.

combustion.³²⁵ However, the tax’s scope is constrained by significant exemptions: heavy industry and energy-intensive sectors participating in the EU ETS since 2005, as well as sectors such as agriculture, forestry and mining, are partially or fully exempt.³²⁶ Other exclusions apply to fuels used outside of heating or motor functions, and international aviation and maritime fuels also escape taxation. These exemptions limit the tax’s coverage to roughly 40% of Sweden’s GHG emissions, raising questions about the trade-offs Sweden has made between competitiveness, economic impact and environmental effectiveness.³²⁷

Since its inception, the Swedish carbon tax has escalated significantly – from an initial rate of SEK 250 (USD 26) per tonne of CO₂ in 1991 to SEK 1,190 (USD 126) by 2020.³²⁸ This progressive increase illustrates Sweden’s commitment to a price trajectory that reinforces decarbonization goals while maintaining administrative simplicity by targeting collection at importers, distributors and large consumers. The broader policy choice in Sweden is further bolstered by additional measures, including the energy tax, aviation tax, EU ETS and vehicle taxes, which collectively create a robust regulatory and fiscal framework aimed at emissions reductions.³²⁹ Notably, the bonus-malus vehicle tax system, introduced in 2018, offers a direct incentive structure for low-emission vehicles, illustrating Sweden’s commitment to targeted and sector-specific solutions within its wider environmental policy agenda.

Through its evolving climate tax policy, Sweden provides a compelling model of balancing fiscal policy with climate action. However, the limitations and exemptions within the system suggest a nuanced trade-off between economic considerations and the goal of achieving comprehensive decarbonization. The effectiveness of Sweden’s approach thus lies not only in its ambitious tax rates but also in its strategic adaptations that reflect the complexities of balancing growth, competitiveness and environmental responsibility in pursuit of a low-carbon economy.

7.2. The effectiveness of Sweden’s carbon tax

The introduction of the carbon tax in Sweden was driven by a dual objective: reducing the high marginal tax rates on labour income and addressing climate change.³³⁰ The Swedish government aimed to set an example for other countries, anticipating a broader adoption of similar carbon taxes.³³¹ As international uptake was slower than expected, Sweden adjusted its approach in 1992.³³² The carbon tax rate for industry was reduced to 25% of its original

325. Oppelt, Paolo. “The effect of carbon taxes on directed technological innovation: A case study of Sweden.” *Junior Management Science (JUMS)* 9, no. 1 (2024): 1286-1305.

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327. Pareliussen, Jon, and Axel Purwin. “Climate policies and Sweden’s green industrial revolution.” (OECD, 2023).

328. Karras, Jana. “Country Reports and their Comparative Analysis.” In *Legal Barriers To The Energy Modernisation Of Dwellings Occupied By Low-Income Tenants And Opportunities To Overcome These Barriers: Case Study Of Germany*, (Wiesbaden: Springer Fachmedien Wiesbaden, 2024): 99-162.

329. Fölster, Stefan, and Johan Kreicbergs. “Twenty five years of Swedish reforms.” *Institute R ed. Stockholm: Reform Institute* (2014).

330. Sterner, Thomas. “The carbon tax in Sweden.” *Standing up for a Sustainable World* (2020): 59-67.

331. Cheng, Ya, Avik Sinha, Vinit Ghosh, Tuhin Sengupta, and Huawei Luo. “Carbon tax and energy innovation at crossroads of carbon neutrality: Designing a sustainable decarbonization policy.” *Journal of Environmental Management* 294 (2021), <https://doi.org/10.1016/j.jenvman.2021.112957>.

332. Martinsson, Gustav, László Sajtos, Per Strömberg, and Christian Thomann. “The effect of carbon pricing on firm emissions: Evidence from the Swedish CO2 tax.” *The Review of Financial Studies* 37, no. 6 (2024): 1848-1886.

level and the energy tax component was removed, shifting part of the tax burden from industry to households.³³³ This adjustment was accompanied by an increase in carbon-energy taxes for households, reflecting the country's commitment to carbon pricing.³³⁴

Sweden's carbon tax in 1991 was aligned with the European Commission's 2000 proposal of USD 100 per tonne of CO₂, though it included exemptions for energy-intensive industries.³³⁵ In 1992, Sweden decided to lower the tax on industry after a study revealed that it had the highest carbon-energy taxation among industrialized countries.³³⁶ The Commission's analysis suggested that reducing the tax could potentially create around 10,000 jobs, particularly in energy-intensive sectors.³³⁷ This analysis was considered conservative, as it did not fully account for technological advancements and improvements in energy efficiency within industries.³³⁸

Over the past 30 years, Sweden has successfully reduced carbon emissions while maintaining economic growth,³³⁹ a feat attributed to its early adoption of carbon taxation and its strong commitment to renewable energy. By implementing one of the world's highest carbon taxes in 1991 and gradually increasing it, Sweden incentivized shifts toward energy efficiency and the use of clean energy sources. GDP per capita increased by over 50% in real terms between 1990 and 2019, emphasizing how climate policies did not hinder economic expansion. Empirical studies, like that of economist Gilbert Metcalf, suggest that carbon taxes may have a neutral or slightly positive impact on GDP, possibly due to revenue being used to lower other taxes, an approach effectively utilized by Sweden reinvesting tax revenues into lowering labour taxes and supporting green innovation.³⁴⁰ Through this blend of fiscal policy and green incentives, Sweden offers a case study of how climate change taxes can align with, rather than impede, economic growth.

Between 1990 and 2018, Sweden reduced GHG emissions by 27%, with significant reductions in heating and industrial sectors, aided by the carbon tax and CO₂-free electricity production initiatives.³⁴¹ Despite its successes, the carbon tax has faced criticism.³⁴² A 2019

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333. Nurhayati, Yati, M. Yasir Said, and Muhammad Hendri Yanova. "Carbon Pricing Policy to Support Net Zero Emission: A Comparative Study of Indonesia, Finland and Sweden." *Environmental Policy and Law* 54, no. 1 (2024): 53-63.
 334. Köppl, Angela, and Margit Schratzenstaller. "Carbon taxation: A review of the empirical literature." *Journal of Economic Surveys* 37, no. 4 (2023): 1353-1388.
 335. Millot, Ariane, Anna Krook-Riekkola, and Nadia Maïzi. "Guiding the future energy transition to net-zero emissions: Lessons from exploring the differences between France and Sweden." *Energy Policy* 139 (2020), <https://doi.org/10.1016/j.enpol.2020.111358>.
 336. Martinsson, Elin, and Helena Hansson. "Adjusting eco-efficiency to greenhouse gas emissions targets at farm level—The case of Swedish dairy farms." *Journal of environmental management* 287 (2021), <https://doi.org/10.1016/j.jenvman.2021.112313>.
 337. Dawkins, Elena, Daniel Moran, Viveka Palm, Richard Wood, and Ida Björk. "The Swedish footprint: a multi-model comparison." *Journal of Cleaner Production* 209 (2019): 1578-1592.
 338. Bonilla, David, David Banister, and Uberto Salgado Nieto. "Tax or clean technology? measuring the true effect on carbon emissions mitigation for Sweden and Norway." *Energies* 15, no. 11 (2022), <https://doi.org/10.3390/en15113885>.
 339. Metcalf, Gilbert E., and James H. Stock. "The macroeconomic impact of Europe's carbon taxes." *American Economic Journal: Macroeconomics* 15, no. 3 (2023): 265-286.
 340. Metcalf, Gilbert E. "Carbon taxes in theory and practice." *Annual Review of Resource Economics* 13, no. 1 (2021): 245-265.
 341. Millot, Ariane, Anna Krook-Riekkola, and Nadia Maïzi. "Guiding the future energy transition to net-zero emissions: Lessons from exploring the differences between France and Sweden." *Energy Policy* 139 (2020), <https://doi.org/10.1016/j.enpol.2020.111358>.
 342. Martinsson, Elin, and Helena Hansson. "Adjusting eco-efficiency to greenhouse gas emissions targets at farm level—The case of Swedish dairy farms." *Journal of environmental management* 287 (2021), <https://doi.org/10.1016/j.jenvman.2021.112313>.

report from the Stockholm School of Economics found that the tax’s impact on emissions reduction was less effective than expected, partly due to caps and exemptions for large polluters.³⁴³ Similarly, Jacob Lundberg’s 2014 report argued that the tax rate was too high, suggesting an optimal rate of SEK 300-400 (USD 32-42) per metric tonne, significantly lower than the current rate.³⁴⁴

In conclusion, Sweden employs a fuel-based approach, targeting upstream activities like fossil fuel extraction or importation. The tax is levied on specific fuels – crude oil, gas and coal – based on their carbon content, using pre-calculated tables. Unlike the direct emissions method, this approach eliminates the need for emissions measurement, reducing administrative complexity.³⁴⁵ Taxes are collected at the earliest production stages, minimizing the number of taxpayers. For imported fuels, integration with customs duties further simplifies administration. The fuel-based approach also ensures full accounting of CO₂ emissions, including fugitive emissions, and provides environmental incentives.³⁴⁶ Carbon-intensive industries, such as cement and steel, are encouraged to switch to less carbon-intensive fuels, improve efficiency or adopt renewable energy, driven by the economic impact of the tax.

8. Evaluating How the European Union’s Carbon Border Adjustment Mechanism Assists the United Kingdom and Sweden in Balancing Decarbonization with Global Economic Equity

The European Union, as a leading economy with ambitious climate targets, has implemented the Carbon Border Adjustment Mechanism (CBAM) to align trade practices with its decarbonization goals and to address the significant issue of carbon leakage. This policy tool is a strategic response to ensure that imported goods from regions with less stringent carbon regulations are subject to similar carbon costs as EU products.³⁴⁷ By setting a price on imported carbon-intensive goods such as iron, steel and aluminium, CBAM aims to incentivize reductions in global carbon emissions while safeguarding the competitiveness of EU industries.³⁴⁸ The mechanism emphasizes the European Union’s broader objective to promote a decarbonized economy and prevent industries from relocating to jurisdictions with weaker environmental policies, a trend that undercuts EU-wide carbon reductions.

The United Kingdom’s Aggregates Levy and Climate Change Levy, Sweden’s carbon tax and now the CBAM all highlight the European Union’s systematic approach to reducing emissions across various economic sectors, encouraging global climate action through both domestic and international channels. The CBAM’s phased approach to emissions reporting,

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doi.org/10.1016/j.jenvman.2021.112313.
343. Jonsson, Samuel, Anders Ydstedt, and Elke Asen. “Looking back on 30 years of carbon taxes in Sweden.” *Fiscal fact* 727 (2020).
344. Jonsson, Samuel, Anders Ydstedt, and Elke Asen. “Looking back on 30 years of carbon taxes in Sweden.” *Fiscal fact* 727 (2020).
345. Falcão, Tatiana. “Policy note: highlights of the United Nations handbook on carbon taxation.” *Intertax* 49, no. 11 (2021): 897-914.
346. African Tax Administration Forum (ATAF), *Environmental Taxes defined*, ATAF Policy Brief 2021.
347. Smith, Ida Dokk, Indra Overland, and Kacper Szulecki. “The EU’s CBAM and its ‘significant others’: Three perspectives on the Political Fallout from Europe’s unilateral climate policy initiative.” *JCMS: Journal of Common Market Studies* 62, no. 2 (2024): 603-618.
348. Magacho, Guilherme, Etienne Espagne, and Antoine Godin. “Impacts of the CBAM on EU trade partners: consequences for developing countries.” *Climate Policy* 24, no. 2 (2024): 243-259.

certificate purchases and eventual elimination of free allowances is a direct step towards achieving the European Union's overarching climate goals.³⁴⁹

The CBAM reflects a major shift in global climate policy, aiming to level the playing field by imposing environmental tariffs on carbon-intensive imports.³⁵⁰ While theoretically designed to mitigate carbon leakage – where industries relocate to jurisdictions with less stringent regulations to avoid domestic carbon costs – the CBAM's practical implications reveal significant complexities. Import tariffs for environmental reasons raise challenging questions around sovereignty and the inherent fairness of imposing EU-specific carbon standards on global trade.³⁵¹ This approach may prompt accusations of protectionism, as its enforcement risks violating World Trade Organization (WTO) principles designed to avoid economic favouritism, which could, in turn, hinder international cooperation on climate goals.³⁵² Such criticisms emphasize the tension between the European Union's environmental ambitions and the broader need for globally inclusive climate policies that consider varying levels of economic development.

Critics argue that the CBAM's narrow focus on emissions reduction overlooks its broader socio-economic implications for countries reliant on carbon-intensive exports. The imposition of tariffs on these exports risks displacing labour in key sectors, leading to job losses and amplifying poverty in affected regions. In light of these challenges, organizations like the UN Conference on Trade and Development (UNCTAD) caution that developing countries could experience substantial income losses if the European Union's carbon price continues to rise.³⁵³ Thus, while the CBAM may serve as an innovative tool for combating carbon leakage, its implementation reveals a pressing need for measures that account for both environmental and social impacts, particularly for the world's most vulnerable economies.³⁵⁴

While the CBAM signifies a bold attempt to integrate climate priorities into international trade, its execution raises questions about equity and feasibility for developing countries.³⁵⁵ Striking a balance between environmental protection and economic inclusivity is crucial to the CBAM's long-term viability and its alignment with the European Union's broader decarbonization and growth objectives.³⁵⁶

The European Union's CBAM exemplifies a landmark approach in integrating environmental goals within international trade frameworks, signalling a shift toward decarbonized

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- 349. Sejdiu, Erblina. "Decarbonizing the World: Can the EU CBAM Provide the Incentive We Need?." *Energy LJ* 44 (2023): 219.
 - 350. Bellora, Cecilia, and Lionel Fontagné. "EU in search of a Carbon Border Adjustment Mechanism." *Energy Economics* 123 (2023), <https://doi.org/10.1016/j.eneco.2023.106673>.
 - 351. Brandi, Clara. Priorities for a development-friendly EU Carbon Border Adjustment (CBAM). No. 20/2021. (Briefing Paper, 2021).
 - 352. Jousseume, Marion, Martin Menner, and Götz Reichert. "CBAM: Damaging to Climate Protection and EU Export Industries." Cep-Study (2021).
 - 353. Li, Wei, Xing Liu, and Can Lu. "Analysis of China's steel response ways to EU CBAM policy based on embodied carbon intensity prediction." *Energy* 282 (2023), <https://doi.org/10.1016/j.energy.2023.128812>.
 - 354. Szulecki, Kacper, Indra Overland, and Ida Dokk Smith. "The European Union's CBAM as a de facto climate club: The governance challenges." *Frontiers in Climate* 4 (2022): 942583.
 - 355. Magacho, Guilherme, Etienne Espagne, and Antoine Godin. "Impacts of the CBAM on EU trade partners: consequences for developing countries." *Climate Policy* 24, no. 2 (2024): 243-259.
 - 356. Smith, Ida Dokk, Indra Overland, and Kacper Szulecki. "The EU's CBAM and its 'significant others': Three perspectives on the Political Fallout from Europe's unilateral climate policy initiative." *JCMS: Journal of Common Market Studies* 62, no. 2 (2024): 603-618.

economic growth on a global scale. However, this regulatory tool also raises critical questions regarding its potential socio-economic impacts, particularly for developing countries with significant trade dependencies on carbon-intensive exports. Balancing the European Union’s ambitious decarbonization targets with considerations of equitable trade practices remains a challenging yet essential task. The CBAM highlights the complex balance that policymakers must strike between reducing global carbon emissions and fostering inclusive, sustainable economic development.

9. Discussion and Recommendations

This section proposes a climate change taxation and environmental sustainability policy design framework for Mozambique and synthesizes key lessons from the experiences of South Africa, the United Kingdom and Sweden, aiming to inform future climate policy design in developing countries. The insights drawn from these countries are particularly relevant for other countries facing the dual challenges of economic development and environmental sustainability, such as South Africa (a middle-income country) and Mozambique (a low-income, climate-vulnerable country). The recommendations are tailored to address the distinct contexts of these countries.

9.1. A recommendation for Mozambique’s potential climate change regime

Given Mozambique’s unique economic and environmental context, a well-designed climate change taxation and environmental sustainability policies framework must balance emissions reduction with sustainable economic growth. Mozambique, as a low-income, climate-vulnerable nation, is in a position where climate change taxation and environmental sustainability policies could play a crucial role in decarbonizing the economy. The proposed framework combines a carbon tax, revenue recycling, complementary environmental taxes and an ETS to address both environmental and developmental challenges effectively.

The proposed carbon tax would be levied on high-emission sectors, such as energy, industry and transportation. This tax would target fossil fuels and the carbon content of emissions from industrial activities. The primary goal is to provide a direct incentive for businesses and individuals to adopt cleaner energy sources and technologies. A modest carbon tax would allow Mozambique to stimulate a transition to renewable energy, while ensuring that the tax burden does not overly disrupt its growing economy. Such a tax would also help Mozambique meet its NDCs under the Paris Agreement, contributing to global climate goals. When setting a carbon tax rate, Mozambique should consider economic development and taxpayer acceptability. While the Carbon Pricing Leadership Coalition recommends a rate of USD 40-80/tCO₂e by 2020 and USD 50-100/tCO₂e by 2030 to meet the Paris Agreement goals, such rates may not be feasible for middle- or low-income countries.³⁵⁷ As a result, many countries opt for a lower initial carbon price and gradually increase it over time. However, this approach risks triggering the “green paradox”, a phenomenon where fossil fuel producers accelerate extraction and sales before stricter carbon pricing policies take effect, leading to higher emissions in the short term under business-as-usual scenarios. This unintended consequence can undermine the effectiveness of carbon pricing in reducing emissions.

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357. African Tax Administration Forum (ATAF), Carbon Taxation in Africa, ATAF Policy Brief, May (2023).

Carbon taxation is expanding globally, yet its effectiveness depends on several factors: the tax rate, the allocation of revenues (e.g. for environmental projects versus the general budget) and clear taxpayer identification. Mozambique's policy must balance economic realities with environmental goals to ensure long-term success. Implementing a direct emissions-based carbon tax in Mozambique could face delays, especially if the country develops an emissions inventory to set initial tax rates. Such an approach ensures public acceptance by aligning rates with the country's socio-economic context and perceived fairness.³⁵⁸ Additionally, an emissions inventory may allow for future integration into an ETS or the use of offsets to reduce the tax burden on sustainable taxpayers. However, this method demands significant technical expertise in environmental and energy issues. A fuel-based carbon tax may complement an emissions-based approach by targeting upstream supply chain choke points, effectively covering both formal and informal economies.³⁵⁹ This upstream application reduces evasion risks and ensures a broader tax base, unlike downstream taxes that predominantly target formal entities.

In addition to the carbon tax, Mozambique could introduce revenue recycling mechanisms, where the funds generated from the tax would be reinvested into climate resilience projects, renewable energy development and energy efficiency programmes. This approach would ease the financial burden on households and industries impacted by the tax, while ensuring that the revenue is used to foster sustainable development. For Mozambique, this reinvestment could support critical infrastructure, such as climate adaptation initiatives, which are especially important given the country's vulnerability to extreme weather events like floods and droughts.

To address other environmental challenges, Mozambique could implement complementary environmental taxes, such as a landfill tax and a deforestation tax. A landfill tax would incentivize better waste management practices and reduce waste disposal, while a deforestation tax could help curb illegal logging and land degradation. This broader environmental taxation strategy would complement the carbon tax and provide a comprehensive approach to tackling multiple environmental issues simultaneously.

The introduction of an ETS could further complement the carbon tax. An ETS allows large emitters to trade carbon credits within an allocated cap, offering flexibility in how emission reductions are achieved. While Mozambique's economy is largely dependent on industries like energy and mining, an ETS would enable these industries to meet emission reduction targets in a cost-efficient manner. Starting with a pilot ETS for high-emission sectors, Mozambique could gradually expand the system as it builds the necessary infrastructure and expertise to manage the programme.

Mozambique could also explore opportunities for international collaboration under carbon markets, such as those defined in article 6 of the Paris Agreement, which allows for trading carbon credits with other countries. This approach would enable Mozambique to generate additional revenue through the sale of carbon credits, while simultaneously strengthening its position in global climate negotiations. Participation in international carbon markets

358. Falcão, Tatiana. "Policy note: highlights of the United Nations handbook on carbon taxation." *Intertax* 49, no. 11 (2021): 897-914.

359. Horowitz, John Keith, Julie-Anne Cronin, Hannah Hawkins, Laura Konda, and Alex Yuskavage. *Methodology for analyzing a carbon tax*. Department of the Treasury, (2017).

would also provide access to valuable technologies, investments and knowledge that would support Mozambique’s climate goals.

This design is motivated by Mozambique’s developmental priorities and the need to foster economic growth without compromising environmental sustainability. By combining a carbon tax with flexible market-based mechanisms like an ETS, the proposed framework would stimulate a shift toward cleaner industries while supporting the transition to a low-carbon economy. Moreover, revenue recycling ensures that the financial burden on households and industries is mitigated by reinvesting funds into climate resilience and sustainable development projects.

In conclusion, Mozambique’s climate change taxation and environmental sustainability policies framework should focus on creating a balanced and adaptive system that addresses the country’s pressing environmental and economic challenges. The proposed combination of a carbon tax, revenue recycling, complementary environmental taxes and an ETS offers a holistic approach to mitigating climate change, promoting sustainable development and aligning Mozambique with international climate goals. By adopting such a framework, Mozambique could not only reduce its carbon emissions but also enhance its resilience to climate change, positioning itself as a proactive participant in the global effort to combat climate change.

9.2. Lessons for developing countries

9.2.1. Learning from South Africa: Effective approaches for developing countries

South Africa’s implementation of a carbon tax offers valuable lessons for other middle-income and low-income, climate-vulnerable developing countries striving to balance economic growth with environmental objectives. As a country with high carbon intensity and significant GHG emissions, South Africa serves as a case study in aligning national policies with global climate commitments, such as those outlined in the Paris Agreement.³⁶⁰

Initially, South Africa explored the implementation of an ETS but ultimately opted for a carbon tax, implemented on 1 June 2019. This choice reflects the importance of selecting a carbon pricing mechanism that is administratively feasible and effective in the local context.³⁶¹

For middle-income developing countries like South Africa, several key considerations emerge from this experience:

- (1) These countries should understand that evaluating the potential economic impact on carbon-intensive industries is critical. Policymakers in these countries must assess how the carbon tax may strain these sectors, potentially leading to reduced production and job losses.³⁶² Designing tax policies that acknowledge the economic realities of these industries while promoting environmental goals is essential.

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360. Di Salvatore, Lea. “Energy Transition and Investment Protection in the Global South: The Case of Mozambique.” *The Palgrave Handbook of Zero Carbon Energy Systems and Energy Transitions* (2024): 373-408.

361. Baker, Lucy. “The political economy of South Africa’s carbon tax”. *The Institute of Development Studies and partner organisations*, (2022).

362. El-Hermisy, Hamid. “The economic effects of environmental and climatic changes on the economic sector.” *International Journal of Modern Agriculture and Environment* 1, no. 1 (2021): 51-78, <https://doi.10.21608/ijmae.2023.216207.1017>.

- (2) These countries should consider complementary measures. While South Africa demonstrates a commitment to climate action, the effectiveness of the carbon tax in significantly reducing emissions is still under evaluation. Developing countries should adopt a cautious approach, incorporating complementary measures – drawing insights from the United Kingdom’s broader climate change taxation and environmental sustainability policies – to enhance the effectiveness of carbon pricing mechanisms.
- (3) If the countries have subsidies in place for carbon-intensive industries such as those in South Africa, then they should strongly consider phasing out subsidies for carbon-intensive industries, particularly in the energy sector, to level the playing field for renewable energy sources and accelerate the transition to low-carbon technologies.
- (4) These countries should enhance incentives for adopting clean energy technologies through tax breaks, grants or preferential tariffs for renewable energy projects. This can drive innovation and investment in low-carbon solutions.
- (5) These countries should develop comprehensive strategies to transition from coal to cleaner energy sources, including investments in renewable energy infrastructure and support for low-income households affected by this shift.
- (6) These countries should invest in research, development and innovation to foster innovation in low-carbon technologies and climate-resilient infrastructure, and to encourage collaboration between academia, industry and public institutions.

Based on the lessons learned from South Africa, the following tailored recommendations are proposed for low-income, climate-vulnerable developing countries like Mozambique:

- (1) Leverage international partnerships for sharing best practices, technical expertise and financial resources, facilitating capacity-building for climate action.³⁶³
- (2) Implement policies that complement carbon taxation, such as investments in renewable energy, promoting energy efficiency and providing support to vulnerable communities to mitigate the socio-economic impacts of climate policies.
- (3) Strengthen monitoring and reporting systems to ensure compliance with environmental regulations, ensuring transparency and accountability in carbon tax implementation.
- (4) Develop strategies that prioritize adaptation to climate impacts, focusing on building resilience within vulnerable communities and sectors.

The lessons derived from South Africa’s carbon tax experience provide crucial guidance for developing countries circumnavigating the intricacies of climate policy.

9.2.2. *Mozambique’s experience: Guiding principles for low-income developing countries*

Mozambique, as a developing African country, contrasts with advanced economies like the United Kingdom and Sweden in its approach to climate change mitigation. Unlike the United Kingdom, which has implemented an array of climate change taxes, Mozambique

363. Songwe, Vera, Nicholas Stern, and Amar Bhattacharya. “Finance for climate action: Scaling up investment for climate and development.” *London: Grantham Research Institute on Climate Change and the Environment*, (London School of Economics and Political Science, 2022).

has focused on adaptive and supportive strategies rather than taxation. Limited by resource constraints and differing economic priorities, Mozambique’s strategy is rooted in plans like the National Poverty Plan, National Adaptation Action Plan and the National Strategy for Climate Change.³⁶⁴ These initiatives prioritize enhancing resilience to climate impacts, investing in infrastructure and fostering a gradual transition toward a low-carbon economy.

This approach, often called a “carrot” strategy, highlights that climate change taxes, while effective for many developed countries, are not the only path to climate action.³⁶⁵ Mozambique’s adaptive strategies demonstrate a viable alternative for other low-income developing countries facing limited capacity to implement complex tax systems. A comparative analysis of strategies suggests that, in developing contexts, prioritizing adaptive measures and investments in resilience – over punitive carbon taxes – may yield more sustainable results. Thus, for developing countries, Mozambique’s experience highlights the benefit of embedding climate action within broader developmental agendas, which include poverty alleviation, infrastructure investment and community-based adaptation.

Given the heavy reliance on coal in many developing countries, a coordinated government policy is essential for transitioning to cleaner energy sources.³⁶⁶ This includes not only targeting energy producers but also supporting households and industries affected by the shift. Comprehensive strategies should involve government-backed investments in renewable energy infrastructure, incentives for advancing research in energy storage technologies, and mechanisms for phasing out outdated coal-fired power plants.³⁶⁷ Critically, such policies must include protections for low-income households to shield them from potential economic impacts, ensuring that the transition to renewable energy is both equitable and sustainable.

The effectiveness of climate change taxation and environmental sustainability policies in developed countries like the United Kingdom and Sweden is largely attributed to their extensive resources and strong administrative capacity, enabling them to implement and manage complex tax policies effectively.³⁶⁸ These resources include not only financial stability but also robust institutional frameworks and public buy-in, which facilitate compliance and enforcement.³⁶⁹ However, for developing countries such as Mozambique, the economic and institutional landscape is markedly different. As a result, a direct application of similar tax measures without modification may be neither practical nor effective.

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364. Naess, Lars Otto, Peter Newell, Andrew Newsham, Jon Phillips, Julian Quan, and Thomas Tanner. “Climate policy meets national development contexts: Insights from Kenya and Mozambique.” *Global Environmental Change* 35 (2015): 534-544, <https://doi.org/10.1016/j.gloenvcha.2015.08.015>.

365. Wolde-Rufael, Yemane, and Eyob Mulat-Weldemeskel. “Do environmental taxes and environmental stringency policies reduce CO2 emissions? Evidence from 7 emerging economies.” *Environmental Science and Pollution Research* 28, no. 18 (2021): 22392-22408.

366. Goodman, James, Jonathan Paul Marshall, and Rebecca Pearse. “Coal, climate and development: Comparative perspectives.” *Energy Policy* (2016).

367. Nong, Nguyen Bang, and Struway Kevin Vargas. “Policy and Market Reforms to Facilitate Renewable Energy Integration in Developing Countries.” *Tensorgate Journal of Sustainable Technology and Infrastructure for Developing Countries* 7, no. 6 (2024): 11-30.

368. He, Pinglin, Shuhao Zhang, Lei Wang, and Jing Ning. “Will environmental taxes help to mitigate climate change? A comparative study based on OECD countries.” *Economic Analysis and Policy* 78 (2023): 1440-1464, <https://doi.org/10.1016/j.eap.2023.04.032>.

369. Koziuk, V., Yu Hayda, O. Dluhopolskyi, V. Martynyuk, and Yu Klapkiv. “Efficiency of environmental taxation in European countries: comparative analysis.” *Natsional’nyi Hirnychiy Universytet. Naukovyi Visnyk* 5 (2020): 115-121, <https://doi.org/10.33271/nvngu/20205/115>.

For low-income developing countries considering climate taxes, it is crucial to conduct a rigorous assessment of their own economic conditions, administrative capacity and institutional strength.³⁷⁰ Exploring hybrid models – such as blending adaptive strategies with targeted fiscal policies – might offer a feasible middle ground, allowing these countries to advance climate goals while accounting for local constraints.³⁷¹

The key takeaway from Mozambique’s experience is the value of integrating climate action into broader development strategies.³⁷² The focus on adaptation and poverty reduction demonstrates that climate policies need not be limited to tax measures alone.³⁷³ Developing countries can benefit from adopting a multi-pronged approach that combines fiscal policies with investments in resilience, infrastructure and sustainable development.

9.2.3. *Insights from United Kingdom and Sweden: Strategic lessons for low-income developing countries*

The United Kingdom and Sweden have set benchmarks in implementing climate change taxation and environmental sustainability policies, providing valuable insights for developing countries like South Africa and Mozambique, which face the dual challenges of economic growth and environmental sustainability. Over the past decade, these advanced economies have introduced a range of climate change taxes and environmental levies aimed at curbing pollution and promoting sustainable practices, resulting in significant reductions in carbon and GHG emissions. Key measures in the United Kingdom include the CCL, Aggregates Levy, Landfill Tax and the EU ETS. While these initiatives reflect best practices, developing countries must consider their unique contexts to effectively adapt such measures.

For middle-income countries like South Africa, lessons from the United Kingdom and Sweden on environmental taxation can be more directly applicable, provided they are tailored to local economic conditions and capacity. With a relatively advanced industrial base, South Africa could consider the following strategies:

- (1) The CCL in the United Kingdom, which discourages high energy use by increasing costs for electricity, gas and coal, has proven effective in reducing demand for fossil fuels. South Africa could adopt a similar approach, particularly in sectors with high emissions, to gradually shift demand toward cleaner energy sources.³⁷⁴ However, given ongoing energy constraints, the levy should be carefully calibrated to avoid exacerbating energy access issues.

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374. Adedoyin, Festus Fatai, and Abdulrasheed Zakari. “Energy consumption, economic expansion, and CO2 emission in the UK: the role of economic policy uncertainty.” *Science of the Total Environment* 738 (2020), <https://doi.org/10.1016/j.scitotenv.2020.140014>.

- (2) In the United Kingdom, this levy has encouraged sustainable practices in the construction sector by taxing the extraction of materials like gravel and sand.³⁷⁵ South Africa, with a growing construction sector, could consider implementing a similar levy to promote sustainable material use. Success would hinge on administrative capacity and sector-specific monitoring, which could be bolstered through targeted support and public-private partnerships.
- (3) The EU ETS provides a market-based approach to emissions reductions by allowing companies to trade emission allowances. South Africa has considered an ETS but has postponed it due to concerns over complexity and administrative demands.³⁷⁶ As the industrial sector grows, a phased ETS could be more feasible, helping manage emissions while supporting the country's transition to a low-carbon economy.
- (4) South Africa may benefit from adopting a tailored CBAM, modelled after the European Union's approach, to impose carbon pricing on high-emission imports. This measure would support local industries in transitioning toward cleaner practices while protecting them from emissions-heavy competition abroad. Implementing such a mechanism would require collaboration with regional trade partners to address data availability and trade compliance.

For low-income countries like Mozambique, where economic and administrative resources are more constrained, lessons from the United Kingdom and Sweden should be adapted to reflect local realities and focus on achievable, low-cost solutions. Specific takeaways include:

- (1) While the United Kingdom's CCL effectively reduces fossil fuel demand, replicating this approach in Mozambique would require caution. Mozambique's limited electricity access and ongoing energy challenges make an additional levy on energy sources potentially counterproductive.³⁷⁷ Instead, Mozambique could explore targeted subsidies for renewable energy development to gradually increase access to clean energy without imposing additional costs on the population.
- (2) In the United Kingdom, the Landfill Tax has incentivized sustainable waste management and recycling. Mozambique could benefit from a similar approach but should prioritize building basic recycling infrastructure and implementing public awareness programs.³⁷⁸ Modest landfill taxes, along with international support for infrastructure, could encourage waste reduction and help create local recycling industries, aligning with environmental goals without imposing undue financial strain.
- (3) Implementing a full-scale CBAM could be challenging in low-income, climate-vulnerable countries due to limited administrative capacity and data on carbon content. However, Mozambique could collaborate with other African countries to explore a regionally adjusted carbon pricing system. Such a system would ideally incorporate

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international support and take a gradual approach, focusing initially on sectors with the highest emissions.

While the United Kingdom and Sweden provide valuable examples of climate change taxation and environmental sustainability policies, developing countries must adapt these lessons based on local economic contexts.³⁷⁹ For middle-income countries like South Africa, measures such as carbon levies, sustainable construction incentives and phased emissions trading can support a transition to low-carbon growth. In contrast, low-income countries like Mozambique may prioritize fundamental environmental measures, modest taxes on pollutants and regional collaboration on carbon pricing to address sustainability challenges in a way that supports, rather than hinders, economic development. By aligning climate policies with the specific needs of both middle-income and low-income developing countries, policymakers can create effective, contextually appropriate solutions for long-term environmental sustainability.

10. Conclusion

This article highlights the vital role of climate change taxation and environmental sustainability policies as a strategic tool for developing countries striving to decarbonize their economies and foster sustainability. Through a comparative analysis of various countries' experiences, particularly those of developed countries like the United Kingdom and Sweden, it becomes evident that while certain tax policies have yielded positive outcomes, others have encountered significant limitations.

The Landfill Tax and the EU ETS emerge as exemplary models within the United Kingdom. These mechanisms have not only effectively reduced waste and regulated carbon emissions but also provide critical insights for developing countries. By adapting these successful approaches to their unique economic and resource contexts, developing countries can potentially enhance their climate mitigation efforts and achieve substantial progress toward sustainability goals.

Conversely, the limited effectiveness of the CCL and Aggregates Levy serves as a cautionary tale for developing countries. The challenges faced by these levies highlight the importance of tailoring tax policies to align with the specific economic conditions and infrastructural capabilities of each country. It is essential that developing countries prioritize policies that are both adaptable and feasible within their operational constraints.

Moreover, integrating the Landfill Tax and EU ETS should not replace existing carbon tax measures but should rather complement them. As can be seen in Sweden's success with the carbon tax, these policies can broaden the toolkit available for climate change mitigation, offering a more holistic approach. Successful implementation will hinge on meticulous planning, effective resource allocation and robust stakeholder engagement to navigate potential challenges and ensure seamless integration.

The lessons from Mozambique further emphasize that non-tax strategies, such as national adaptation plans and comprehensive climate strategies, are integral to effective climate

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action, though they should not stand alone. Mozambique's experience illustrates the necessity of a multifaceted approach to climate change mitigation that synergizes fiscal and non-fiscal measures. By combining strategic tax policies with broader climate initiatives, a more resilient framework can be established to confront environmental challenges.

Importantly, the analysis of South Africa reveals that relying solely on a carbon tax may not suffice to achieve emission reduction targets. Instead, learning from the United Kingdom, integrating the Landfill Tax and EU ETS represents a promising pathway for developing countries to enhance their existing tax frameworks and advance their climate objectives. These measures can not only drive improvements in waste management and emissions control but also foster collaboration among governments, businesses and communities.

In conclusion, while tax policies are essential components of climate change mitigation strategies, they must be situated within a broader framework that encompasses diverse approaches and measures. Developing countries should actively seek and integrate a variety of solutions to bolster their climate resilience and sustainability. This study advocates for a synergistic approach that enhances the carbon tax with the Landfill Tax and EU ETS, significantly strengthening the collective efforts to combat climate change and align with global environmental goals.