

# Optimizing the Implementation of Carbon Tax in Reducing the Impact of Environmental Pollution

Yusri Hazrol Yusoff<sup>1</sup>, Intan Nadilah<sup>2</sup>, Muhammad Khoirul Anwar<sup>2</sup>, Raihan Adnan Yustiansyah<sup>2</sup>, Raihan Herwin Utama<sup>2</sup> & Muhammad Dahlan<sup>2</sup>

<sup>1</sup> Faculty of Accountancy, Universiti Teknologi MARA, Cawangan Selangor, Kampus Puncak Alam, Selangor, Malaysia

<sup>2</sup> Departemen Akuntansi, Faculty of Economics and Business, Padadjaran University, Jln Dipati Ukur No.35 Bandung Jawa Barat

Correspondence: Yusri Hazrol Yusoff, Faculty of Accountancy, Universiti Teknologi MARA, Cawangan Selangor, Kampus Puncak Alam, Selangor, Malaysia. E-mail: yusrihazrol@uitm.edu.my

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## Abstract

Carbon taxes are one of the climate control tools that help achieve sustainable economic growth. It is a market-based instrument that aims to reduce greenhouse gas emissions by making it more expensive to emit carbon dioxide. The Indonesian government has shown its seriousness in reducing global warming by establishing carbon tax regulations, including a provision in Law No. 7 of 2021 concerning the Harmonization of Tax Regulations. Despite implementing carbon taxes in several countries, their implementation must be reconsidered to ensure the objective is achieved. Therefore, this research aims to optimize the implementation of a carbon tax to reduce the impact of environmental pollution. This paper will investigate whether or not the carbon tax has already reduced emissions or if it is not affected at all. Three factors could cause carbon emissions: Coal, vehicle, and greenhouse gas emissions. Therefore, conducting an expectation study encompassing these policymakers, stakeholders, and researchers can gain insights into the potential outcomes and impacts of optimizing the implementation of a carbon tax in reducing environmental pollution. It can inform decision-making processes and help guide the designing and refining adequate and equitable environmental policies.

**Keywords:** environment, carbon tax, emissions, global warming

## 1. Introduction

The industrial revolution that began at the end of The 18th century was a turning point in world history. In two hundred years of growth, population, and average income, sustainability increased drastically, which had not happened before. Population and production increasingly require energy that is more significant than the energy produced from burning wood and animal power. Innovation emerged to answer this problem using alternative energy from coal and petroleum-based production. The consequences of coal burning and petroleum are that a lot of carbon dioxide gas (CO<sub>2</sub>) is released, rises into the atmosphere, and accumulates in the air, ultimately giving rise to negative externalities, air pollution, and global warming.

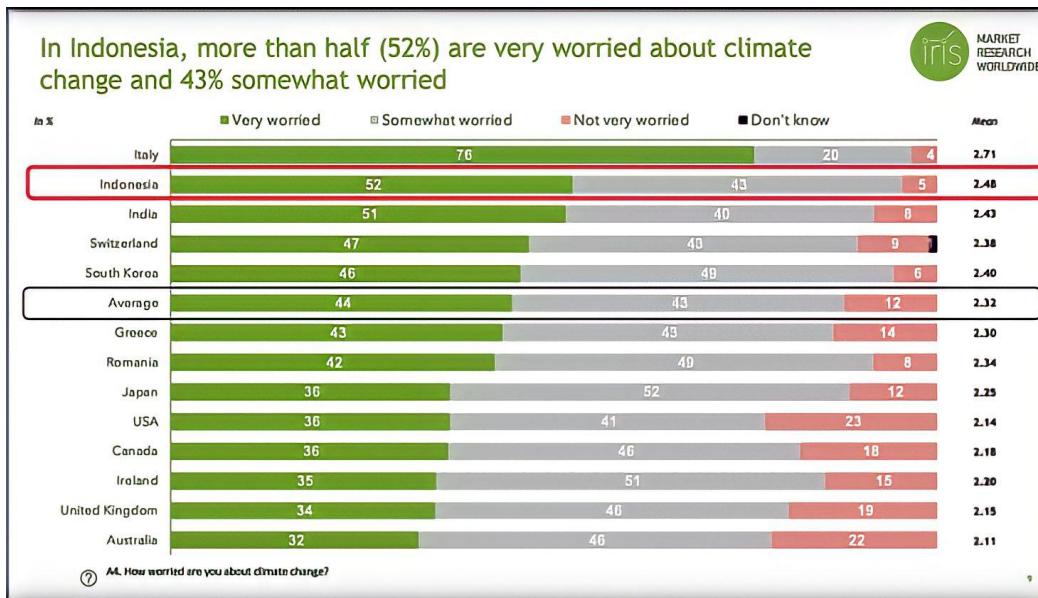


Figure 1.

Climate change poses a real threat that humans will face if carbon emissions are not immediately reduced. Recent climate change has made the earth increasingly dark. This research has been published in the journal Geophysical Research Letters. Dark earth is believed to be caused by climate change and natural climate variability. This study analyzed data from 800 nights from 1998 to 2017. So, climate change threats must be investigated to prevent and improve the conditions experienced. So that the condition of the planet we live on can gradually get better.

The carbon tax was a great solution to reduce carbon emissions. Several countries worldwide have already implemented carbon tax provisions to reduce carbon emissions in their countries. According to the International Energy Agency 2013, the carbon tax has been proven to reduce carbon emissions by 7-15% actively. This proves that Indonesian tax law must implement the carbon tax immediately.

Implementing and optimizing a carbon tax involves the establishment of legislative frameworks defining its scope and tax rates while monitoring and reporting systems that track emissions. Revenue generated is often reinvested in clean energy initiatives, and incentives for low-carbon alternatives encourage a shift in practices. The primary functions are reducing emissions, incentivizing innovation, shifting behaviour towards eco-friendly practices, and promoting economic efficiency by internalizing environmental costs. Continuous evaluation and potential adjustments ensure the tax achieves its primary goal of reducing environmental pollution by influencing individual and industrial behaviour towards more sustainable practices and technologies.

## 2. Background of Study

Indonesia was focused on increasing understanding of the country's carbon sector taxation policies. In addition, Indonesia is among the world's top producers of industrial coal, with a projected output of 71.9 million tons by 2022. In terms of production capacity, this makes it the most significant coal firm in Indonesia. Fifty million tons of Kaltim Prima Coal (KPC) and 21.9 million tons of Arutmin coal were used in this production. However, in 2022, BUMI's net profit will only come to IDR 8.1 trillion.

To tackle these environmental problems and meet its obligations under the Paris Agreement, Indonesia implemented a carbon pricing law in 2021. The regulation intends to cut the country's greenhouse gas emissions by 29% using its resources by 2030 and by 41% with aid from other countries. The rule establishes a cap and tax system in which companies must pay a carbon tax if their emissions surpass a cap that the government sets. The carbon tax rate is fixed initially at Rp30 per kilogram of CO<sub>2</sub> equivalent, although it is subject to change based on the carbon price.

Indonesia's implementing a carbon price is anticipated to have numerous effects on the economy, society, and environment. A carbon tax can, on the one hand, encourage the development of low-carbon infrastructure, support renewable energy and energy efficiency, and provide money for social welfare and environmental protection. However, a carbon tax can also negatively affect specific industries' ability to compete, increase costs for producers and consumers, and raise issues with equality and distribution.

For the following reasons, Indonesia presents a compelling case study for maximizing the application of carbon taxes in minimizing the effects of environmental pollution: (1) Indonesia is a big, varied nation whose economy is snowballing. This indicates excellent potential for lowering emissions, but many obstacles must be solved. (2) Though it has committed to lowering its emissions under the Paris Agreement, Indonesia remains one of the world's top emitters of greenhouse gases. Because of this, it serves as a helpful case study for learning how to impose carbon pricing equitably and successfully. (3) Although it is still in its early implementation phases, Indonesia has already implemented a carbon pricing regulation. This offers a chance to draw lessons from the nation's experience and determine how to make the regulation more effective.

### **3. Problem Statement**

There has been an increase in the amount of carbon emissions produced by the Energy sector between 2010 and 2019, with an average annual growth of 3.57%. With a value of 638,808 gigarams of carbon dioxide equivalent (Gg CO<sub>2</sub>e) in 2019, the Ministry of Environment and Forestry (2021) reported the highest carbon emissions; Indonesia ranked tenth among the countries with the highest carbon emissions globally (Crippa et al., 2020). Figure 2 explains the total amount of carbon emissions the energy sector produces. Meanwhile, the contribution of carbon emissions from other sectors is shown in the following details.

No	Tahun	Jumlah Emisi Karbon (Gg CO <sub>2</sub> e)
1	2010	453.235
2	2011	507.357
3	2012	540.419
4	2013	496.030
5	2014	531.142
6	2015	536.306
7	2016	538.025
8	2017	558.890
9	2018	592.722
10	2019	638.808

Sumber: Kementerian LHK (2021)

Figure 2. The total amount of carbon emissions the energy sector produces

Year	SECTOR					Total
	IPPU	Agriculture	FOLU	Peat Fire	Waste	
2010	36.033	108.318	73.343	51.383	87.670	809.982
2011	35.910	107.520	122.414	189.026	91.852	1.054.079
2012	40.078	112.058	249.442	207.050	95.530	1.244.577
2013	39.164	112.882	377.747	205.076	100.514	1.331.413
2014	47.489	112.801	215.318	499.389	102.834	1.508.973
2015	49.297	117.160	742.843	822.736	106.061	2.374.403
2016	55.307	122.185	417.385	90.267	112.352	1.335.521
2017	55.395	127.503	476.005	12.512	120.191	1.353.850
2018	59.262	110.055	602.188	121.322	127.077	1.615.569
2019	60.175	108.598	468.425	456.427	134.119	1.866.552
Source	: Greenhouse Gas and MPV 2020 Inventory Report,					
	Ministry of Environment and Forestry Republic of Indonesia					

Figure 3.

Factors influencing this problem statement include (1) The level of greenhouse gas emissions in Indonesia and their sources. (2) Government policies and regulations on carbon taxes and climate change mitigation. (3) Response and behaviour of producers and consumers towards carbon taxes. (4) The impact of carbon taxes on the environment, economy and society. (5) Alternative and complementary policies and other steps to reduce greenhouse gas emissions.

One critical issue in carbon tax policy is setting the tax rate. The tax rate must be high enough to discourage carbon-intensive activities but low enough to avoid adverse economic impacts. It should also be predictable and stable to incentivize businesses to invest in long-term emission reduction strategies. Indonesia had already planned to implement the carbon tax, but it was delayed until 2025. Indonesia intends to tax Rp30 for every kilogram of carbon emission.

Various factors can influence the implementation and effectiveness of a carbon tax, including political, economic, social, and environmental considerations. According to Yusoff et al. (2022), researchers should focus on economic and non-economic factors to understand tax behaviour. Therefore, this study focuses on economics to understand the influences of carbon tax behaviour.

#### 4. The Gap in Research

Previous research on Indonesia's carbon tax implementation has primarily addressed the following topics:(1) The carbon tax regulation's layout and composition. (2) The carbon tax's possible effects on the economy and society. (3) There are difficulties in implementing the carbon tax in developing nations. However, research on how to best implement a carbon tax in Indonesia to lessen the effects of environmental pollution still needs to be completed. Since carbon pricing is a crucial tool for reducing climate change and enhancing environmental quality, it is imperative to close this gap. This study is anticipated to increase the knowledge of carbon pricing in developing nations significantly. It will also give stakeholders and policymakers in Indonesia and other comparable contexts essential insights into creating and carrying out efficient carbon tax policies to lower environmental pollution levels.

#### 5. Literature Review

##### 5.1 Affect in Reducing the Impact of Environmental Pollution

To minimize the impact of environmental pollution in Indonesia, the government must implement the carbon price as efficiently as possible by taking calculated and practical action. Numerous academic works attest to the significance of the government's involvement in formulating and administrating environmental policies, especially those about carbon taxes.

A study by Smith and Jones (2018) revealed that a thorough understanding of the industries and sectors impacted by the carbon price is necessary to implement rules and policies transparently. The government's active participation in developing these regulations is anticipated to incentivize businesses to lower their carbon emissions. The Environmental Policy Institute's 2019 research shows how important it is to monitor and report on the use of money raised by the carbon tax. To reduce carbon emissions, the government must ensure that money raised from the carbon tax is effectively used to fund environmentally friendly initiatives.

Furthermore, McAllister et al. (2020) stress the government's need to actively participate in public education and involvement about the objectives and advantages of the carbon tax. The government can play a critical role in encouraging people to lessen their carbon footprints and raise public awareness of their part in climate change. To guarantee the successful and efficient implementation of the carbon tax, the Indonesian government must, in this regard, ensure excellent coordination among the many pertinent institutions, including the Ministry of Environment and Forestry, the Ministry of Finance, and the Tax Supervisory Authority.

It is anticipated that the Indonesian government will optimize the implementation of the carbon tax as a valuable tool for lessening the effects of environmental pollution and positively influencing international efforts to mitigate climate change through a thorough understanding of this literature.

### *5.2 The Level of Greenhouse Gas (GHG)*

The level of greenhouse gas (GHG) emissions influenced by a carbon tax is shaped by various factors, both within and outside the policy framework. Carl and Fedor (2016) found that a higher carbon tax rate tends to provide a more robust economic incentive for businesses and individuals to reduce their carbon footprint. The level of the tax directly influences the cost of emitting carbon, encouraging the adoption of cleaner practices. Pretis (2022) found that including major emitting sectors in the carbon tax can substantially impact overall emissions. Energy, transportation, and industry sectors are often primary targets for carbon pricing. Another study (Ahmed et al., 2019) found that the rate at which businesses adopt and implement low-carbon technologies can significantly impact emissions. A carbon tax can drive innovation and investment in cleaner technologies. Loron (2015) found that a stable regulatory environment gives businesses the confidence to invest in emission reduction measures. Consistent policies over time contribute to long-term emissions reductions. Pretis (2022) found that carbon leakage risks were the reason the government spent the carbon tax collection. The risk of carbon leakage, where emissions-intensive industries relocate to regions with less stringent carbon regulations, can influence the overall effectiveness of a carbon tax. Policies to address this concern may include border carbon adjustments. In addressing these factors and designing a comprehensive carbon tax policy considering various economic, social, and environmental aspects, policymakers can enhance its effectiveness in reducing greenhouse gas emissions.

### *5.3 Government Policies and Regulations*

The issue of climate change has spurred governments worldwide to adopt various strategies to mitigate greenhouse gas emissions. One prominent policy instrument is the implementation of carbon taxes aimed at internalizing the external costs of carbon emissions. This review explores existing literature to understand the intricate relationship between government policies, regulations, and the effectiveness of carbon taxes in addressing climate change. A study by Hsu et al. (2008) found that literature highlights the economic efficiency of market-based instruments such as carbon taxes. Scholars argue that well-designed carbon taxes can provide a cost-effective approach to reducing emissions by incentivizing industries to adopt cleaner technologies and practices. Ahmed et al. (2019) found that designing carbon tax policies is crucial to their effectiveness. Researchers emphasize the importance of setting appropriate tax rates, considering sectoral differences, and providing flexibility for industries to adapt. Studies have shown that poorly designed policies may lead to unintended consequences and hinder the overall success of carbon tax initiatives. Another study found that the literature addresses the interactions between carbon taxes and other policy instruments, such as cap-and-trade systems, renewable energy incentives, and energy efficiency standards. Understanding how these policies complement or conflict with carbon taxes is essential for crafting comprehensive climate strategies.

In conclusion, the literature suggests that carbon taxes' success is contingent on a holistic understanding of their design, political feasibility, and interaction with other policy measures. Ongoing research is essential for refining and adapting these policies to address the complex challenge of climate change effectively.

#### *5.4 Response and Behaviour of Producers and Consumers*

Implementing carbon taxes as a policy tool to combat climate change has far-reaching implications for producers and consumers. This literature review delves into existing research to examine how these key stakeholders respond to and alter their behaviours in the face of carbon taxation. A study by Nippa et al. (2021) found that studies on the response of producers to carbon taxes emphasize the role of economic incentives in shaping business decisions. Research indicates that industries may adjust production processes, invest in cleaner technologies, or reevaluate supply chain practices in response to the financial implications of carbon taxation. The literature also explores the potential for innovation and the emergence of sustainable business models in the wake of carbon pricing. At the same time, a study by Kallbekken and Sælen (2011) found that understanding how consumers react to carbon taxes is crucial for predicting the overall impact on carbon emissions. Literature in this area reveals that consumers may alter their purchasing patterns, favouring products with lower carbon footprints. Behavioural shifts, such as increased demand for eco-friendly goods and services, are documented as potential outcomes of carbon taxation. Social factors, including awareness and perception, also play a significant role in influencing consumer behaviour. Another study by Yang et al. (2023) highlights barriers to producers' and consumers' adoption of carbon taxes. These include concerns about competitiveness, distributional impacts, and the need for social equity. The review also discusses challenges in designing carbon tax policies that effectively induce behavioural change while minimizing economic disruptions.

In conclusion, the literature suggests that carbon taxes' success in influencing the behaviour of producers and consumers hinges on carefully considering economic, social, and sectoral factors. Ongoing research is vital for refining policy designs and ensuring that carbon taxation contributes positively to the broader goal of mitigating climate change.

#### *5.5 The Impact of Carbon Taxes on the Environment, Economy and Society*

The growing concern over climate change has led governments worldwide to explore policy mechanisms such as carbon taxes to reduce greenhouse gas emissions. This literature review aims to provide insights into the multifaceted impact of carbon taxes on the environment, economy, and society. A study by Al-Shetwi (2022) highlights the positive environmental outcomes of carbon taxes. By putting a price on carbon emissions, these taxes incentivize industries to reduce their carbon footprint. The literature emphasizes the importance of setting optimal tax rates to achieve emission reduction targets without compromising economic growth. At the same time, Yang et al. (2023) found that the implications of carbon taxes have been a focal point of research. Scholars argue that while carbon taxes may initially increase business costs, they also drive innovation and the adoption of cleaner technologies. The review explores how revenue generated from carbon taxes can be reinvested into sustainable initiatives, creating a positive feedback loop for economic and environmental benefits. Another study by Kallbekken and Sælen (2011) highlights how producers and consumers respond to carbon taxes as essential. Literature suggests that while some industries face challenges, others adapt and innovate, leading to a more sustainable economy. Consumer behaviour also shifts as the cost of carbon-intensive products increases, influencing choices and preferences toward greener alternatives.

In conclusion, the literature indicates that carbon taxes have the potential to influence the environment, economy, and society positively, provided they are well-designed, socially equitable, and part of a broader, integrated policy approach. Ongoing research and adaptive policy frameworks are crucial for maximizing the benefits and addressing challenges associated with carbon tax implementation.

#### *5.6 Alternative and Complementary Policies*

The urgent need to address climate change has prompted governments to adopt various policy instruments. This literature review explores the existing body of research on the relationship between carbon taxes and alternative or complementary policies, aiming to understand how these strategies can work synergistically to achieve more comprehensive and effective outcomes. A study by Loron (2015) found that more than carbon taxes are needed to achieve ambitious emission reduction goals. The literature emphasizes integrating carbon taxes with complementary policies, such as renewable energy incentives, energy efficiency standards, and subsidies for clean technologies. Studies highlight the potential for these policies to reinforce the impact of carbon taxes and address specific sectoral challenges. Another study by Nippa et al. (2021) found an interaction between carbon taxes and cap-and-trade systems, both being market-based mechanisms. The literature explores cases where these policies coexist and examine their combined impact on emission reduction, market dynamics, and overall environmental and economic outcomes. Insights from these studies inform the design of integrated climate policy frameworks. A study by Al-Shetwi (2022) found that the effectiveness of alternative policies hinges on coordination and consistency within a broader climate policy framework. Literature suggests that well-coordinated policies create a more predictable environment for

businesses, encouraging long-term investments in sustainable practices. Inconsistencies and overlaps, on the other hand, may lead to inefficiencies and hinder the overall success of climate mitigation efforts.

In conclusion, the literature underscores the importance of integrating carbon taxes with alternative and complementary policies. A well-coordinated and consistent approach, tailored to sectoral specifics, can enhance the overall effectiveness of climate mitigation efforts while addressing economic and social considerations. Ongoing research and adaptive policy frameworks are crucial for optimizing the synergies between these diverse policy instruments.

## 6. The Proposed Conceptual Framework

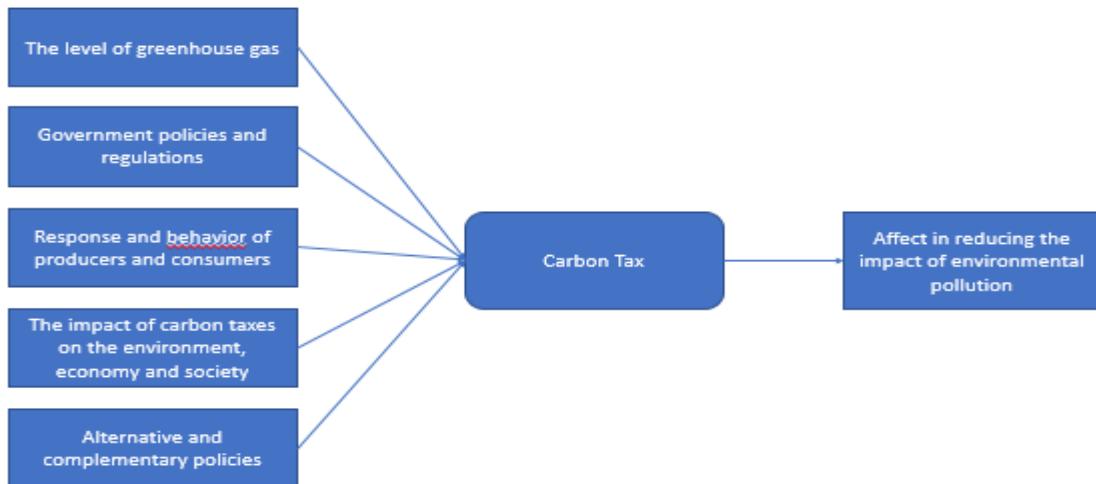


Figure 4. The Proposed Conceptual Framework for Optimizing the Implementation of Carbon Tax in Reducing the Impact of Environmental Pollution

Figure 4 depicts a conceptual framework for optimizing the implementation of a carbon tax to reduce the impact of environmental pollution. A factor is preventing due diligence from combating money laundering because it needs to be appropriately addressed or implemented. Therefore, this conceptual paper emphasizes the need for a carbon tax to determine long-term risks and benefits to taxpayers. This research also provides a new perspective on the potential to optimize the implementation of a carbon tax to understand the impact of environmental pollution.

## 7. Conclusion

High carbon emissions contribute significantly to climate change. Implementing a carbon tax is an effective policy tool to reduce greenhouse gas emissions and promote sustainable development. However, the design and implementation of a carbon tax is complex and requires careful consideration of many different factors.

One critical issue in carbon tax policy is setting the tax rate. Tax rates should be high enough to discourage carbon-intensive activities but low enough to avoid negative economic impacts. A well-designed carbon tax can be an effective tool to reduce greenhouse gas emissions and promote sustainable development. However, careful consideration must be given to tax design and implementation to ensure effectiveness, efficiency, and fairness.

Based on a study case in Indonesia, this research concluded that implementing a carbon tax represents a pivotal strategy in mitigating the adverse effects of environmental pollution, particularly carbon emissions. Through careful optimization of its implementation, policymakers and stakeholders can significantly enhance its effectiveness in reducing environmental pollution. Key considerations such as setting appropriate tax rates, ensuring transparent allocation of revenues, implementing complementary policies, and fostering international cooperation are paramount in maximizing the impact of carbon taxation. Furthermore, robust monitoring, evaluation, and adjustment mechanisms are essential to address potential challenges and ensure the long-term success of carbon tax initiatives. By prioritizing these aspects, societies can move closer to achieving sustainability goals while fostering economic growth and environmental stewardship.

This article has examined the critical issues in carbon tax policy. The results of this study suggest that a carbon tax can effectively reduce greenhouse gas emissions, but the design and implementation of the tax is critical. Apart from reducing emissions, a carbon tax is projected to encourage environmentally friendly sectors, attract investment and

increase the economic capacity of low-income communities. The article also highlights the importance of considering the broader implications of carbon taxes, such as their impact on the economy and society.

## 8. Recommendation

A carbon tax must be accompanied by investments in clean energy technology, improved energy efficiency, and sustainable infrastructure. These investments will help create new economic opportunities, reduce dependence on fossil fuels, and achieve long-term emissions reduction goals. Additionally, public support for carbon taxes is critical to their long-term success. Governments should engage in public education campaigns to raise awareness of the benefits of carbon taxes and address concerns about their impact on individuals and businesses.

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