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Analysis of potential carbon tax calculation schemes for steam power plant company registered on the Indonesia stock exchange

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Abstract

Research aims: This research aims to select the best scheme—carbon tax or carbon credits—based on Cap and Tax and Cap and Trade for Steam Power Plant Company (SPPC) listed on the Indonesia Stock Exchange (IDX), following the carbon tax requirement under the Harmonization of Tax Regulations Law Number 7 of 2021.

Design/Methodology/Approach: This study employs qualitative descriptive analysis to simulate carbon tax calculations based on the minimum rates outlined in Indonesian regulations or to assess the cost of purchasing carbon credits, with the goal of identifying the most efficient scheme in accordance with the carbon market regulations set by the Financial Services Authority (FSA).

Research findings: The analysis results show that paying for carbon is the right choice for SPPC because the cash spent is lower than buying an Emission Reduction Certificate (ERC).

Theoretical contribution/ Originality: This study compares carbon tax payments and Emission Reduction Certificate (ERC) purchases in Indonesia, reinforcing legitimacy theory on taxpayer compliance and informing government tax policy. It also encourages public support for the Nationally Determined Contribution (NDC) policy.

Practitioner/Policy implication: This study provides input for organizations in policy-making related to emission reduction obligations and supports the government's Economic Value of Carbon (EVC) policy, aiding infrastructure development and the goal of Net Zero Emissions.

Research limitation/Implication: The data obtained was only 3 companies that had complete emissions reports from 2020 to 2022, but even though only 3 companies were able to reflect the choice of whether to pay carbon tax or buy ERC.

Keywords: Cap and tax; Cap and trade; Carbon Credit; Carbon Tax Scheme; SPPC Carbon Emissions

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Introduction

One of the interesting issues in the world of industry and commerce today is the impact of climate change, which is becoming a global debate. Climate change is one of the most important environmental challenges, with academics, corporate practitioners, and governments all paying close attention (Aji et al., 2023; Ariani et al., 2023). In 2016, Indonesia ratified

the Paris Agreement, which included a Nationally Determined Contribution (NDC) commitment (Panggabean, 2021). Indonesia is committed to decreasing greenhouse gas emissions by 29% on its own and 41% with international cooperation by 2030. Climate change is a real problem that is in the world's spotlight. Several industrial sectors today can be a source of environmental change. Climate change mitigation is one aspect of business that is believed to be able to lower the risk of climate issues, such as global warming and rising greenhouse gas emissions (Calderón et al., 2014). A global initiative aimed at reducing the effects of climate change is the United Nations Framework Convention on Climate Change (UNFCCC), which was ratified in Rio de Janeiro in 1992 (Murray & Rivers, 2015). In line with the Paris Agreement, Indonesia is committed to increasing resilience to the effects of climate change. Five major areas—waste, energy and transportation, industry, agriculture, forests, and land, including peat—are the focus of this NDC's efforts to reduce greenhouse gas emissions (World Bank, 2019).

The Emissions Database for Global Atmospheric Research (EDGAR) of the European Commission projects that by 2022, greenhouse gas emissions worldwide will amount to 53.79 gigatons of carbon dioxide equivalent (Gt CO2e). This represents an increase of 1.37% year over year above the prior total of 53.06 Gt CO2e. China, the United States, India, the European Union, Russia, and Brazil are the top six countries globally in terms of greenhouse gas emissions in 2022. According to sources from the Kata Data website, these countries account for 61.2% of greenhouse gas emissions globally. As of 2022, Indonesia emits 1.24 Gt CO2e, placing it eighth in the world. This amount, 1.12 Gt CO2e, has increased from 2021. Below Indonesia, Japan releases greenhouse gas emissions of 1.18 Gt CO2e. Then there are Iran, Mexico, and Saudi Arabia, which emit greenhouse gas emissions of 0.95 Gt CO2e, 0.81 Gt CO2e, and 0.81 Gt CO2e, respectively. More details can be seen in Table 1, namely data on the eleven countries that contribute the world's greatest CO2 emissions.

Table 1 Eleven countries that contribute the largest carbon dioxide emissions in the world (2022)

No.	Data Name	Value / Gt CO2e
1	China	15.68
2	United States	6.01
3	India	3.94
4	UE27	3.58
5	Russia	2.57
6	Brazil	1.31
7	Indonesia	1.24
8	Japan	1.18
9	Iran	0.95
10	Mexico	0.81
11	Saudi Arabia	0.81

Source: Katadata.co.id

Based on the IQAir Global Air Quality Report, Indonesia is expected to be ranked 17th out of 118 nations worldwide in 2022, with the highest PM2.5 concentration of 34.3g/m3 (Murray & Rivers, 2015). This location makes Indonesia the country with the most

polluted air in Southeast Asia. Controlling emissions, especially greenhouse gases (GHG), is an important issue related to climate change that is receiving increasing attention. Therefore, all parties must pay attention to efforts to reduce greenhouse gases emissions by referring to the National Action Plan for Reducing Greenhouse Gas Emissions and other regulations set by the government (Marron & Toder, 2014). A potential method of achieving Indonesia's guarantee to reduce emissions is by implementing a carbon price, among other measures. Besides that, Indonesia can replace its dependence on fossil fuels with environmentally friendly and renewable energies by implementing a carbon price. The recent adoption of Law No. 7 of 2022 regarding Harmonization of Tax Regulations on October 7, 2021, demonstrates the government's strong commitment to lowering carbon emissions.

Via Reuters (2018), the government will impose a carbon tax on the power generation sector or coal-fired power plants, which are deemed to have inefficient processes or emissions that are higher than the upper limit, which will be implemented on July 1, 2022. A carbon tax is a charge imposed on the usage of fossil fuel resources such as gasoline, aviation fuel, gas, and others. In addition to Law Number 7 of 2021 concerning Harmonization of Tax Regulations, Presidential Regulation Number 98 of 2021 about the implementation of the economic value of carbon to achieve nationally determined contribution targets and controlling house gas emissions glass in National Development strengthens the regulations regarding the carbon tax (Sutartib & Purwana, 2021) and regulation Number 16 of 2022 issued by the Minister of Energy and Mineral Resources outlines the steps to be taken to implement the subsector of electricity generation's carbon economic value (Darajati et al., 2022). The money collected by the state from carbon taxes can be utilized for social initiatives that assist low-income communities, investments in environmentally friendly technology, and reducing greenhouse gases emissions from emission sources and development funds (Selvi et al., 2020).

As stated in Presidential Regulation No. 98 of 2021, levies on products and services that contain or have the potential to contain carbon, as well as activities that have the potential to produce carbon emissions that have a negative impact on the environment, are provisions about the mechanism for a carbon tax (P. P. R. Indonesia, 2021). A total of 57 countries have implemented carbon pricing or taxation of carbon emissions (carbon tax) through the Emissions Trading System (ETS) (World Bank, 2019). According to Murray & Rivers, (2015) British Columbia's carbon price cut greenhouse gases emissions by 5% to 15%. In its 2013 Sustainable Prosperity British Columbia report, per capita fossil fuel consumption had fallen 17.4% since the introduction of the carbon tax in 2008, which allegedly did not threaten economic growth. According to a study conducted by Marron & Toder (2014), research revealed that the implementation of carbon taxes in multiple developed nations, including Finland, Denmark, and Sweden, effectively decreased emissions from approximately 1.5% to over 6% (Reuters, 2018). Reuters Japan claimed to have cut its carbon emissions in 2013 by 8.2 billion. Based on data from the 2018 Carbon Tax Center (CTC), the United Kingdom has effectively decreased its carbon emissions through the implementation of carbon value-added tax (VAT). From 2015 to 2016, the country's carbon emissions decreased by 600 million CO2e, amounting to 374 MtCO2e (~7%). Overall, UK CO2 emissions fell by 37% between 1990 and 2016. Ireland has reduced

emissions by more than 15% since 2008. According to professionals and researchers, the country's emissions decreased by 6.7% in 2011 as a result of the carbon price, and there was even a small economic growth.

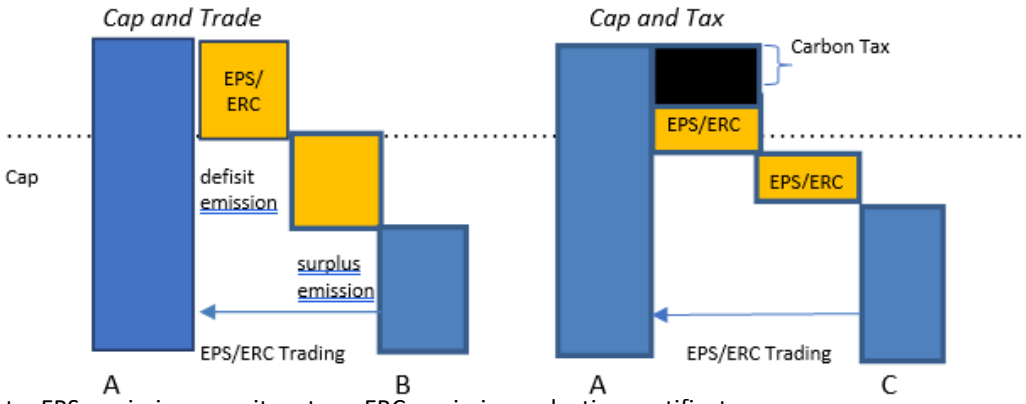
Even though the law regarding the carbon tax and its reduction was only rolled out in 2021, several researchers have researched the carbon tax in Indonesia. Previous carbon tax research was still an analysis of tax regulations if they were to be rolled out. Since the carbon tax law won't go into effect until the first week of July 2022, research on the implementation of a carbon tax in Indonesia hasn't yet addressed the relevant legislation. Research on carbon tax conducted by Sutartib & Purwana (2021) states that the tariffs provided by the government for the sector SPPC IDR 30/kg CO2e are considered very low and are considered not an optimal combination in the instrument concept because in its implementation subsidies are still provided for fossil energy. Meanwhile, research by Darajati et al. (2022) states that the imposition of a carbon tax is considered appropriate because, apart from increasing state revenues, it will also be an instrument used as an effort to reduce emissions and stimulate the emergence of renewable energy innovation. However, if the carbon tax is implemented, this effort will not be enough for Indonesia to prevent the climate crisis in the near term. Furthermore, research conducted by Sutartib & Purwana (2021) argues that the government should consider economic factors when adopting the carbon tax policy because it will have an impact on the selling prices of goods and services for companies that produce carbon emissions, impeding Indonesia's efforts to recover economically. Meanwhile, research conducted by Selvi et al. (2020) revealed that it is feared that the imposition of a carbon tax will increase production prices and even inflation. This, of course, has an impact on reducing demand for goods so that companies will tend to save on labor costs and potentially cause unemployment. Therefore, the carbon tax policy should consider carbon tax revenues allocated as public health costs in areas affected by industrial waste.

The problem in this research is that even though the government has made a policy to overcome the problem of carbon emissions by imposing a carbon tax and rolling out carbon trading alternatives, a definite mechanism has not yet been formulated for taxpayers to pay the carbon tax. This research aims to select a scheme for the imposition of carbon tax and/or carbon tax trading (Cap and tax and Cap and trade), with the research object IDXng companies in the Coal Power Generation Sub-sector SPPC registered on the IDX as a trial application of the newly introduced law. This object was chosen because the carbon tax was first applied to SPPC companies, as per law number 7 of 2021 concerning the Harmonization of Tax Regulations. Based on Law No. 7 of 2021 the carbon tax will be initially imposed in the coal SPPC sector on April 1, 2022. However, there is no certainty about when it will come into effect. So, it can be concluded that this research provides new knowledge or insight into the mechanism of carbon tax payment obligations through a study of SPPC companies. This research was carried out by projecting the potential for a carbon tax using the minimum tariff as regulated in the regulations applicable to Indonesia as the first scenario. The projection of potential carbon tax will be paid for excess limits on carbon emissions. The second scenario calculates the cost of purchasing a Carbon Emission Certificate (CEC) if a carbon exchange is implemented. The last one reviews schemes that will be profitable by determining whether the scenario is paying a

carbon tax or the scenario of choosing to buy a Carbon Emission Certificate on the carbon market.

Literature Review

The use of fuels containing carbon, such as coal, gas, and oil, is subject to a charge known as the carbon tax. This policy aims to reduce and eliminate utilizing fossil fuels, which damage the climate. Another method of making consumers of carbon fuels pay for anticipated climate harm from releasing carbon dioxide into the atmosphere is through a carbon tax. If a carbon tax is introduced at a high rate, it is hoped that this will be a strong incentive to switch to renewable energy. In addition, cap-and-trade, also known as emissions trading, also known as carbon trading, this market-based strategy for pollution control offers financial incentives for lowering greenhouse gases emissions, particularly those of carbon dioxide (CO2) and other pollutants that worsen global warming. The essence of this concept is to put a financial value on carbon emissions so that companies and governments are encouraged to reduce their emissions to meet certain targets. In addition, companies that disclose carbon emissions will have an impact on the company's reputation (Brilliani et al., 2024). The carbon tax is applied to any remaining emissions if the entity is unable to purchase an emission permit or emission reduction certificates for emissions above the entire cap. The cap and tax scheme is a climate change mitigation policy that sets an upper limit (cap) on the amount of permitted greenhouse gas emissions and imposes a tax on companies that exceed this limit (Zefanya & Kennedy, 2023).



Note: EPS: emission permit system; ERC: emission reduction certificates

Figure 1 Implementation of a carbon tax with a carbon trading mechanism
Source: (Carbon Tax in Indonesia, 2021.)

The implementation of the carbon tax will be synchronized with the carbon trading system. The carbon tax and carbon trading scheme according to the Tax Regulation Harmonization Law can be illustrated in Figure 1, where Entities that produce emissions exceeding the set limit are required to purchase emission permits from entities whose emissions are below the limit or purchase emission reduction certificates (ERC/carbon offset). The implementation of carbon levies refers to the Economic Value of Carbon

Implementation Regulation, which is carried out through the implementation of carbon taxes and is combined with the carbon trading system to create a sustainable carbon market. Several main elements in the substance of the Carbon Economic Value Implementation Regulation include carbon tax, cap and trade, and cap and tax.

The government is putting in place a carbon credit scheme as one of its initiatives to cut greenhouse gas emissions by 29% using its resources and 41% with help from other countries by 2030. Carbon credits are tradable permits that allow companies to emit an equivalent amount of greenhouse gases or carbon dioxide. Carbon credits are the right to allow companies to emit a certain amount of carbon emissions in industrial processes. In addition, the carbon emissions trading mechanism is one of three ways to reduce emissions stipulated under the United Nations (UN) climate agreement, the Kyoto Protocol, dated December 11, 1997. Carbon trading consists of a market-based mechanism through buying and selling carbon units. Purchasing and selling permits or certificates to emit a specific quantity of carbon dioxide, or CO2, is known as carbon trading. In the carbon market, what is traded is the right to greenhouse gas emissions in tons of CO2 equivalent. Carbon markets are divided into two types based on their trading mechanisms, namely: (a) trading and (b) crediting. The trading type of carbon market, also known as the emission trading system (ETS) or cap-and-trade, is usually applied in mandatory carbon markets. In this system, market participants, be they organizations, companies, or countries, are required to limit greenhouse gas emissions by setting emission quotas (caps) that must be adhered to. Participants are given emission quotas at the beginning of the period and must deposit the quota according to the amount of emissions they have released. If the emissions produced exceed the quota, participants can buy additional quotas from other parties who have not used their entire quota, resulting in carbon trading. Emitters whose emissions exceed the cap are required to buy quotas from emitters whose emissions are below the cap and make offsets to offset the emissions produced. The implementation scheme of a carbon tax in carbon trading (can be illustrated in the following Figure 2 and Figure 3.

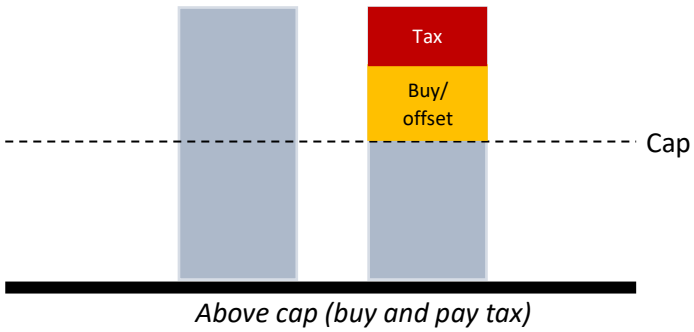


Figure 2 The Implementation Scheme of a Carbon Tax in Carbon Trading

Meanwhile, emitters who produce emissions above the cap but cannot purchase and offset all excess emissions will be subject to tax on the remaining emissions.

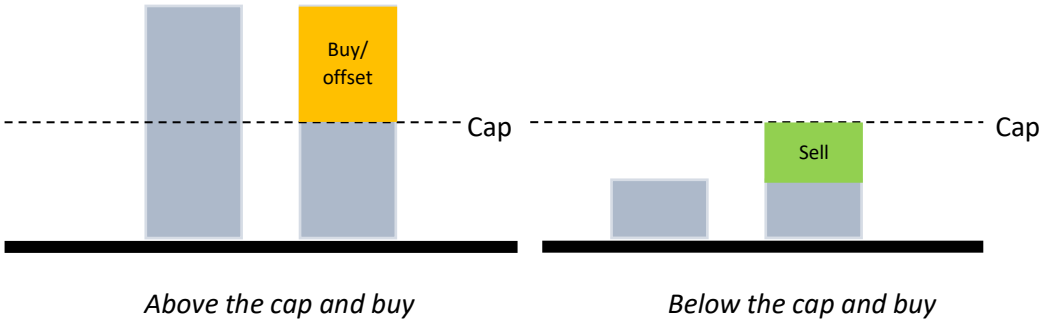


Figure 3 The Implementation Scheme of a Carbon Tax in Carbon Trading

In addition, carbon trading is carried out through two mechanisms, namely: (a) Emission Trading, which involves transactions between business actors with emissions exceeding the set limits, and (b) Greenhouse Gas Emission Offset, which is in the form of reducing emissions to offset emissions released elsewhere. Buyers of carbon credits are generally industries, countries, or companies that produce large emissions, while sellers are parties that can absorb or produce small amounts of CO2 emissions. Traded carbon credits must be certified by international institutions such as Verra or Gold Standard to ensure that the seller is committed to reducing emissions.

Study of income tax for both individual taxpayers and corporate taxpayers in general to analyze taxpayer compliance in carrying out their obligations. As taxpayer compliance increases, state revenues will increase. To increase taxpayer compliance, the government continues to strive to improve services by improving the tax administration system and changing regulations that provide legal certainty to make it simple for taxpayers to meet their tax duties and to make them feel secure and at ease doing so. The carbon tax on carbon emissions promulgated in the Tax Harmonization law is the newest mechanism that has not yet been implemented because the government made a policy to postpone its implementation until 2025, which should have been implemented on April 1, 2022. Several previous research findings, among others, were carried out by Budi & Suparman (2013). Results demonstrate that producing 1700 MW of power annually using SPPC Banten, Indramayu, and Rembang will result in the production of 16 thousand kTons of CO2. In contrast, replacing the power generation with two 1000 MWe PLTN units will result in a 16 thousand kTon reduction in CO2. Research conducted by Irama (2019) shows that there is a potential carbon tax revenue of at least IDR 3.03 trillion per year originating from carbon emissions.

In addition, research by Dilasari et al. (2022) indicates that reduced GDP, real consumption, and employment are projected; if policies are enacted without any follow-up action, all macroeconomic indicators will be negatively impacted. According to Marron & Toder (2014), carbon taxes offer numerous possible advantages in tackling climate change. However, designing and implementing a carbon tax requires aligning incentives appropriately, and compromises are required. Economists advance policy discussions not only by adopting carbon prices in theory but also by guiding legislators on how to deal

with their real-world effects. In addition, according to Hájek et al. (2019), carbon taxes in environmentally efficient energy industries, reducing the use of fossil fuels statistically considerably affects the production of greenhouse gases, and an increase in the carbon price of one euro per ton can reduce annual per capita emissions by 11.58 kg. Research conducted by Ratnawati (2016) shows that a carbon tax can be implemented in Indonesia. There is still a need for behavioral effects on the readiness of Indonesian society to carry out the carbon tax and for a thorough computation of the suggested tax rates.

According to Kumala et al. (2024), the Medium Term Development Plan 2020–2024 of Indonesia states that the carbon price is the best way to both protect the environment and boost the country's economy. In addition, according to Lolo et al. (2022), with transparency through digitalization of the carbon tax, society's checks and balances towards the Government will be realized following Indonesia's low carbon development goals. Law number 32 of 2009 concerning the environment explains that a project must minimize adverse impacts on the environment. However, AMDAL (Environmental Impact Assessment) focuses more on local environmental pollution and does not pay attention to environmental pollution caused by greenhouse gases.

The existing literature shows that carbon tax can reduce emissions, combat climate change, protect the earth, and many other benefits. Although the government has made policies to overcome the problem of carbon emissions by imposing carbon taxes and rolling out carbon trading alternatives, a definite mechanism has not been formulated for taxpayers to pay carbon taxes. Therefore, this study aims to choose a carbon tax imposition scheme and or carbon tax trading (Cap and tax and Cap and trade) with the object of researching the coal-fired power plant sub-sector company registered on the IDX as a trial of the implementation of the newly rolled outlaw.

Research Method

This study employed a qualitative methodology and a descriptive research design. Creswell (2013) stated that researchers use a qualitative approach to explore and understand the meaning of a problem. The data used in this research was obtained by reviewing literature and carbon emission disclosure reports by SPPC companies registered on the IDX between 2020 and 2022. Data analysis was carried out by projecting the potential for carbon tax using minimum rates as regulated by the provisions that apply in Indonesia as the first scenario. Estimation of the possible carbon tax focused on the tax that will be paid in case of exceeding carbon emission limits. The potential imposition of a carbon tax is calculated by the excess of the minimum limit for carbon emissions produced multiplied by the carbon tax rate. The second scenario calculated the cost of purchasing a Carbon Emission Certificate if applied to a carbon exchange. Finally, review the scheme that will be profitable by determining whether the scenario is paying a carbon tax or the scenario of choosing to buy a Carbon Emission Certificate on the carbon market.

To achieve the research objectives as described previously, this study used a literature review with descriptive qualitative data analysis techniques and data sources obtained

through secondary data. This study uses a qualitative approach with descriptive research type and data sources obtained through secondary data. Secondary data in qualitative research takes the form of documents, other sources, and surveys (Saunders et al., 2009). The data used in the research was secondary data obtained through national journals, international journals, books, internet sites, news in national and international media, and carbon emission reports on SPPC companies registered on the IDX in 2020-2022.

The first step involved calculating the possible amount of carbon tax that the SPPC company might have to pay. This was done by multiplying the excess emissions over the emission limit by the carbon tax rate, which was IDR 30 per kilogram of CO2e. The formula for calculating carbon tax was:

Carbon tax = IDR 30 per kg CO2e x excess emission limit (This excess emission is the basis for tax imposition or tax basis .....(1)

Or it can be calculated using the equation:

Potential Carbon Tax = Y1 x Tax Rate.....(2)
Y1 = E-(FxGHG).....(3)

Where Y1 is the Basis for Imposing Carbon Tax, E is Total Greenhouse Gases Emissions, F is Greenhouse Gases emission limit, G is Gross electricity product (Mwh), Emission limit to Greenhouse Gas x Electricity Production, Tax Basis to Total Emissions - Emission Limits, Carbon Tax to Tax Basis x Carbon Tax Rate.

The second is to calculate the costs incurred to purchase an Emission Permit, referred to as cap and trade. If a company produces carbon dioxide (CO2) that exceeds the cap (limit), it can purchase an emission permit certificate from a generator that produces emissions below the stamp (limitation). According to Purnomo (2013), reducing the industrial carbon target by 30% from initial emissions can be done in stages. To identify the most advantageous course of action for the organization, the last stage is to compare the computation of the possible carbon tax that would need to be paid with the prospective expenses associated with buying carbon emission certificates. In the carbon tax imposition mechanism in Indonesia, companies can use carbon certificates purchased on the carbon market to reduce their carbon tax obligations. Therefore, entities or entrepreneurs can consider the amount of efficient expenditure between these alternatives, whether paying taxes or providing emission letters on carbon market trading, by considering various efficiencies.

Result and Discussion

The implementation of the carbon tax, which will be imposed for the first time on companies operating in the coal steam power plant sector with a cap and tax scheme that is in line with the implementation of the existing carbon market, has begun running in the coal power plant sector, will take effect on April 1, 2022, as per Law Number 7 of 2021

concerning Harmonization of Tax Regulations, Article 13. The use of an emission-based tax mechanism (cap and tax) in the power generation sector is confined to coal power plants (SPPCs). The following is a list of emission contributors by sector, which can be seen in Figure 4 below, which shows that the largest contributor to emissions is the electricity sector. Therefore, logically, the SPPC industrial sector is the primary driver behind the carbon tax's implementation.

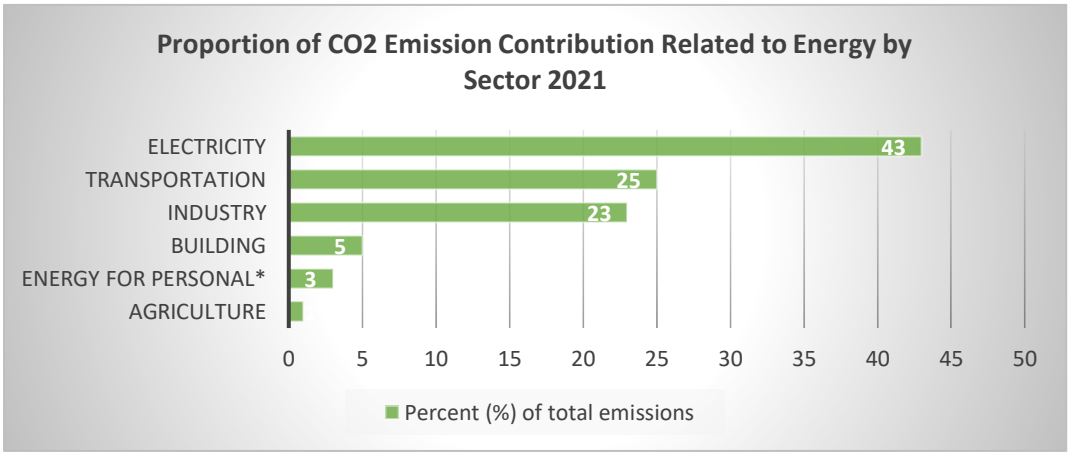


Figure 4 Carbon Emission Growth Graph
Source: Katadata.co.id

The development of infrastructure and the framework for its execution are based on Presidential Regulation 98/2021 about the Economic Value of Carbon (Perpres Nomor 98 Tahun 2021). In response to Article 6 of the Paris Agreement, which permits parties to sell carbon to reduce emissions, the Economic Value of Carbon regulation was created. Among the instruments provided by this law are results-based payments, carbon trading, and a carbon tax—which has been postponed twice and is expected to come into action in 2025. The implementation of a carbon tax can be completed using a fuel approach, a direct emissions approach, or a combination of these two approaches depending on the sector that will be the subject of taxation (Sutartib & Purwana, 2021). Meanwhile, for the electricity sector, it would be more acceptable to utilize a direct emissions strategy because there are clear incentives, namely the polluter pays, can utilize existing reporting, measurement, and verification systems, and the possibility of building new, more complicated instruments and finally switching to an emissions trading scheme; permits to include non-fuel combustion emissions (Durant et al., 2021). Besides that, a direct emissions approach will look fairer because apart from being able to cover the carbon emissions caused, it can also cover carbon emissions from industrial processes and other greenhouse gasses emissions.

Coal SPPC companies in Indonesia have a variety of generators based on their capacity, ranging from a capacity of 7 Mega Watt (MW) to 1,000 MW. The application of technology is one of the considerations for implementing a carbon tax at SPPCs. The Mineral Resources and Energy Ministry uses three categories to determine the carbon tax for coal-fired steam power plants (SPPC). First is a SPPC with a capacity of more than 400

megawatts. The maximum amount of CO2 emissions per megawatt-hour (MWh) is 0.918 tons. The second position is SPPC, which has a capacity of 100 to 400 MW and an emission limit of 1,013 tons of CO2 per MWh. In third place is the 100-400 MW Mine Mouth Power Plant, with a limit value of 1.94 tons of CO2 per MWh. However, since SPPCs with capacities less than 100 MW continue to be the mainstay of the electricity system outside of Java and Sumatra, they are not yet eligible to apply cap, trade, and tax. In this discussion, the SPPCs analyzed are included in group 1, with a larger capacity of 100-400 MW.

Based on data collected via the IDX Web, data on 45 coal-fired SPPC companies was obtained. Twenty-three companies publish carbon emissions data that exceed the upper emission limit, and 22 companies produce emissions below the emission limit. Companies that produce emissions that are still below the threshold are subject to carbon tax. The system in Indonesia adheres to cap and tax, so if it is still below the threshold, then it is not subject to tax.

Potential Carbon Tax Due

Based on data analysis of SPPC companies that have complete carbon emissions reports and consist of 3 companies respectively. The results of the potential carbon tax calculation for emissions produced by SPPC electricity companies for the 3 years 2020, 2021, and 2022, based on the formula = (Rp. 30 per kg CO2e X excess emission limit), are as presented in Table 2.

According to notes from the Mineral Resources and Energy Ministry posted on the CNBC Indonesia website, coal-fired steam power plants (SPPC) will be classified into three types in 2022 to determine their carbon tax. First is a SPPC with a capacity of more than 400 megawatts. The limit of emissions has been established with 0.918 tons of CO2 per megawatt-hour. The second position is SPPC, which has a capacity of 100-400 MW and a limit on CO2 emissions of 1,013 tons per MWh. Third place goes to the 100-400 MW Mine Mouth Power Plant, which has a CO2 limit of 1.94 tons per MWh. However, since SPPCs with capacities less than 100 MW continue to be the mainstay of the electricity system outside of Java and Sumatra, they are not yet eligible to apply cap, trade, and tax.

Table 2 Potential Carbon Tax

SPPC with complete data for 2020-2022				
SPPC Unit	Owner/Manager	2020	2021	2022
Paiton Unit 1 Paiton Unit 2	PT PLN Nusantara Power UP Paiton	IDR 15,954,460,495.80	IDR 21,459,069,163.20	IDR 22,684,279,160.40
Paiton Unit 9	PT PLN Nusantara Power UP Paiton	IDR 15,503,019,447.00	IDR 15,587,058,120.00	IDR 15,820,871,837.40
South Kalimantan 1 Unit 1 South Kalimantan 1 2×100 MW unit 2	PT Tanjung Power Indonesia	0	0	0

The combined capacity of SPPC Paiton Units 1 and 2 is 800MW. The 660MW SPPC Paiton unit 9 is located in the same area. Since both have a capacity of more than 400 MW, a carbon tax rate of IDR 30,000/tCO2 and an upper greenhouse gases limit of 0.918 have been set. South Kalimantan SPPC Units 1 and 2 are mine-mouth SPPCs with a total capacity of 200MW. A limit of 1.94 tons of CO2 per MW will apply to Mine Mouth SPPC 100-400 MW, with a carbon tax cost of IDR 30,000/tCO2. According to the results of the carbon tax computation above, SPPC Paiton units 1&2 suffer an increase each year. In 2020-2021, there was an increase of IDR 5,504,608,667.40, and in 2021-2022, there was an increase again of IDR 1,225,209,997.20. The same thing also happened to SPPC Paiton unit 9, which continued to increase. In 2020-2021, the increase was IDR 84,038,673, and in 2021-2022, there was an increase of IDR. 233,813,717.40. It can be calculated to estimate that the three-year average of the carbon tax that must be paid by SPPC Paiton units 1 & 2 is IDR 20,032,602,939.80, and for unit 9, it is IDR 15,636,983,134.80. At South Kalimantan SPPC units 1 & 2 during 2020, 2021, and 2022, there is no need to pay carbon tax because emission production is below the threshold. The system in Indonesia adheres to cap and tax, so if it is still below the threshold, then it is not subject to tax. The results of this calculation also show that the South Kalimantan SPPC unit 1&2, managed by PT Tanjung Power Indonesia, can reduce the emissions produced. Evidence of emission reduction is the achievement of several awards in the fields of environment and energy efficiency. Meanwhile, the flow of documentation and administration of records in implementing a carbon tax using a direct emissions approach is depicted in Figure 5.

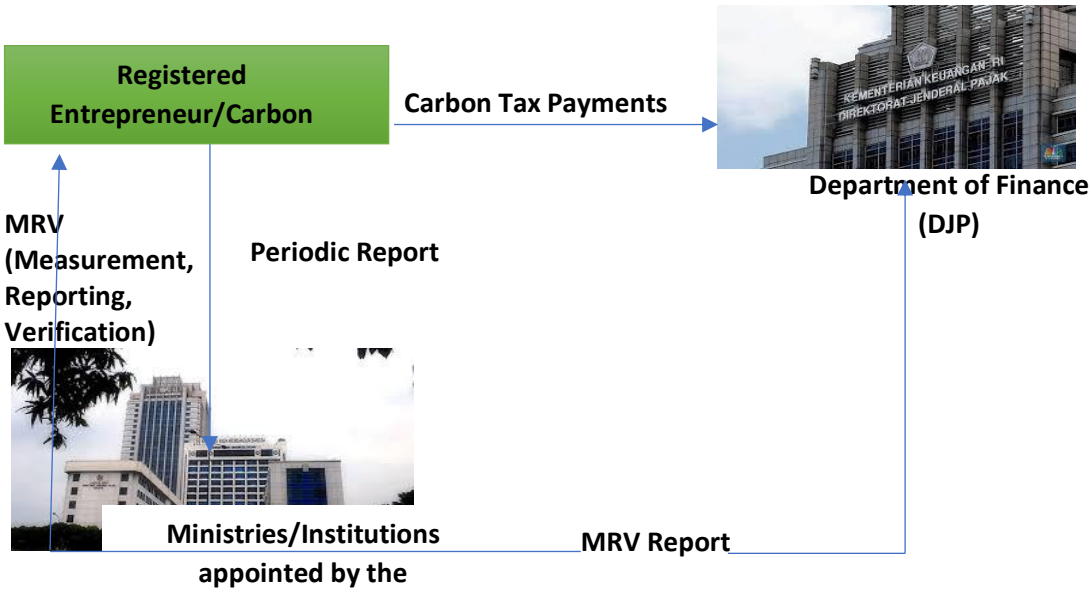


Figure 5 The flow of documentation and administration of records in implementing carbon tax

Fees incurred when purchasing an Emission Permit

The cap-and-trade system, generally also called the Emissions Trading System (ETS), is a mandatory carbon market that is formed based on a policy of limiting or reducing greenhouse gas emissions. The implementation of the ETS, as well as the carbon market in general, aims to reduce greenhouse gas emissions as cost-efficiently as possible. This can happen because the carbon market will encourage as much implementation of low-cost climate change mitigation activities as possible before carrying out higher-cost mitigation activities. On the other hand, if carbon markets are not allowed to implement emission reduction policies, then there is a possibility that high-cost mitigation activities will have to be carried out while the potential for low-cost mitigation has not been utilized optimally.

The Indonesian Stock Exchange (IDX) has formally taken on the role of organizer of the carbon exchange, according to Financial Services Authority Regulation, Carbon Exchange Number 14 of 2023 and Circular Letter of the Financial Services Authority of the Republic of Indonesia Number 12/SEOJK.04/2023 about procedures for organizing carbon trading through the carbon exchange. Under the auspices of PT Bursa Efek Indonesia (IDX) as a driver, Indonesia has its carbon exchange, namely IDX Carbon. Carbon trading using the ETS or cap-and-trade system is carried out in stages, starting from the coal power plant (SPPC) sector, which is initially required to participate in carbon trading. To use IDX Carbon services, agencies register by filling out the form available on the official IDX Carbon website, namely www.idxcarbon.co.id. During the initial phase of carbon trading, 99 SPPCs, or 86% of Indonesia's coal-fired power plants, took part in the cap and trade program.

According to the Financial Services Authority's (OJK) September 18, 2023, Decree number KEP-77/D.04/2023, the organizer of this trading is the Indonesian Stock Exchange (IDX). Meanwhile, Table 3 below explains the carbon credit rates.

Table 3 Carbon Credit Rates

No.	Fee Type	Rates
1.	Transaction Fees	0.11%
2.	Withdrawal Fees	IDR 25,000/withdrawal
3.	Additional Training Fees	IDR 1,000,000
4.	Other taxes collected by the Carbon Exchange Market (PBK)	Not set yet

Source: KEP-77/D.04/2023 OJK

After calculating the costs incurred by SPPC in purchasing emission permits in the form of Greenhouse Gas Emission Reduction Certificates, the costs incurred are shown in Table 4, namely the total cost of purchasing emission permits.

The government, through the Ministry of the Environment, implements climate change adaptation and mitigation actions, and Economic Value of Carbon and climate change resources are recorded on the NRS CCC (National Registration System for Climate Change

Control). NRS CCC is a web-based system for managing and providing data and information about actions and resources for mitigation and adaptation to Climate Change and Economic Value of Carbon in Indonesia as regulated in Presidential Regulation No. 98 of 2021. The aim is for the government to have data on Greenhouse Gas Emissions and Climate Resilience. This national, sector, and subsector data then becomes a national and international reference. The following goal is to document the execution of Economic Value of Carbon, specifically the reduction of Greenhouse Gas Emissions and technical approvals, as well as transactions for technical approvals and performance for emissions trading technical agreements. If the calculated Greenhouse Gas Emissions reduction is to be traded, it must be converted into an Emission Reduction Certificate (ERC) through a certification process.

Table 4 Total EPS Purchase Costs

SPPC with complete data for 2020-2022				
Unit SPPC	Owner/Manager	2020	2021	2022
Paiton Unit 1 Paiton Unit 2	PT PLN Nusantara Power UP Paiton	IDR 42,545,227,988.80	IDR 57,224,184,435.20	IDR 60,491,411,094.40
Paiton Unit 9	PT PLN Nusantara Power UP Paiton	IDR 41,341,385,192.00	IDR 41,565,488,320.00	IDR 42,188,991,566.40
South Kalimantan 1 Unit 1 South-Kal 1 2×100 MW unit 2	PT Tanjung Power Indonesia	0	0	0

The stages of registering the NRS (National Registry System) are until the GHG-ERC (Greenhouse Gas Emission Reduction Certificate) is finally issued. First, you have to register and fill in general data. Second, the documents for the Mitigation Action Detailed List and Mitigation Action Achievement Report should be prepared. Third, the team's final review. If the conditions are met, GHG-ERC will be published in the SRN Carbon Registry. Based on the comparison between paying carbon tax and buying ERC, the costs incurred by SPPC in paying carbon tax are an option compared to buying ERC. In addition to SPPC already being a taxpayer, in running tax administration, choosing to pay carbon tax will save more administration compared to buying ERC which is quite complicated in administration because it starts from the beginning. In addition, the price of ERC on the carbon exchange is uncertain so it takes time to predict. If paying Carbon Tax, the rate has been set by the government so it is easy to calculate.

Conclusion

Based on data analysis, several things can be concluded. First, a carbon tax is a climate management tool used to achieve long-term economic growth based on the concept of polluter pay. From an environmental perspective, the carbon tax can help Indonesia achieve the national RAN-GRK target of 29 percent by 2030. Furthermore, it is believed that the carbon price will help promote the use of greener, more efficient energy sources,

lessen reliance on fossil fuels, and promote the transition to a green economy, specifically a resource-efficient, low-carbon, and socially inclusive economic system.

Second, with the opening of the carbon exchange in Indonesia, seen from the perspective of the taxation system, both the government as fiscus and companies as taxpayers, the following impacts will emerge: (1) Providing carbon tax incentives to encourage companies to participate in emission reduction programs in Indonesia. Indonesian Carbon Exchange, the government can offer tax incentives, such as tax breaks or reduced tax rates. With these tax incentives, companies are expected to take proactive steps to reduce their carbon footprint; (2) implementing environmental taxes, which are taxes set by the government and related to environmental problems. The implementation of this environmental tax is a special government effort to overcome the existing problem of environmental damage. Trading Emission Reduction Certificate (ERC) through the Indonesian Carbon Exchange is a concrete manifestation of the commitment to achieve Net-Zero Emissions; (3) the Indonesian Carbon Exchange requires companies to measure and report the emissions produced so that tax authorities can use this data to assess the feasibility of tax incentives or the application of additional taxes based on the company's carbon emissions; (4) by selling carbon and collecting registration fees, Indonesian carbon trading could bring in more money for the country's government. This revenue can be used to support other environmental initiatives or improve tax infrastructure. In line with international standards: With the existence of the Indonesian Carbon Trading Agency, the green sector, which focuses on clean technology and renewable energy, can develop more quickly. The government can offer special tax incentives to companies operating in the industrial sector, which can encourage sustainable economic growth.

Third, the calculated greenhouse gases emission reduction will be traded. It must be converted into an Emission Reduction Certificate (ERC) through a certification process and must be registered with the National Registry System institution until, finally, an GHG-ERC (Greenhouse Gas Emission Reduction Certificate) is issued. Carbon credits cannot be traded immediately. Traded carbon credits must be certified by international certification bodies, such as Verra and Gold Standard. The purpose of certification is to ensure that carbon credit sellers are committed to reducing emissions from sales. Fourth, the data obtained was from only 3 companies that had complete emissions reports from 2020 to 2022. One of the companies reported that their carbon emission products were below the cap, so they did not need to pay carbon tax or purchase ERC. Even though the data used is only 3 companies, it can reflect the choice for SPPCs whether to pay carbon tax or buy ERC. Fifth, paying for carbon is the right choice for SPPC because the cash spent is lower than buying ERC, so it is seen as more efficient. Lastly, the tax administration that already exists at SPPC makes it easier to carry out the obligation to pay carbon tax compared to buying ERC on the Carbon Exchange, which has never been done before, so it becomes quite complicated in the recording system on the National Registration System for Climate Change Control.

This research has several limitations. First, based on Law Number 7 of 2021 concerning Harmonization of Tax Regulations, the carbon tax is expected to come into effect on April 1, 2022, and will be introduced initially by coal-fired power plant companies. However,

the implementation of the law was postponed because the roadmap prepared was not yet final so implementation will begin in 2025 (https://www.cnbcindonesia.com/news). The carbon roadmap still requires provisions on which sectors are burdened with carbon taxes and limits or caps on carbon emissions for each sector. The dynamics of carbon trading in Indonesia will be enhanced by the introduction of a carbon tax since corporate actors will have the best option between paying the tax and purchasing carbon credits on the carbon exchange. So, choosing to pay carbon tax is a plan and an alternative if the carbon tax rate does not change, namely IDR 30 per kg CO2e. Second, the data obtained was from only 3 companies that had complete emissions reports from 2020 to 2022, but even though only 3 companies were able to reflect the choice of whether to pay carbon tax or buy ERC.

For future research, if the carbon tax has been implemented, it is necessary to study other alternatives, namely SPPC companies making technological breakthroughs and innovations as a company commitment to preserving the environment by using environmentally friendly raw materials. One effort that needs to be made is to increase the new renewable energy, mix by developing a Co-Firing program, namely the use of biomass, which is renewable energy as a mixture of coal for SPPC fuel. If this effort is realized, it is necessary to study the most efficient alternative to choose from, whether paying a carbon tax, purchasing an Emission Reduction Certificate (ERC), or replacing environmentally friendly raw materials.

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