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Assessing the Role of Carbon Taxes in Driving Low-Carbon Transformations: A Comparative Analysis of Implementation Policies

Rumanintya Lisaria Putri[1*], Desak Nyoman Sri Werastuti[2], Ni Wayan Rustiarini[3], Agung Sutoto[1], Eko Wahyono[4], Budi Wardono[1], Armen Zulham[1], Amos Lukas[5], Raden Djoko Goenawan[6], Sofia Anita[7], I. Ketut Ardana[1], I. Nyoman Normal[1], Moehar Daniel[1], Lisa Yuniarti[4], Khojin Supriadi[8], Dodi Al Vayed[9]

[1] Research Center for Cooperative, Corporation and People's Economy, National Research and Innovation Agency (BRIN), Jakarta Pusat 10340, Indonesia
[2] Department of Accounting, Universitas Pendidikan Ganesha, Bali 81117, Indonesia
[3] Department of Accounting, Universitas Mahasaraswati, Bali 81117, Indonesia
[4] Research Center for Social Welfare, Village, and Connectivity, National Research and Innovation Agency (BRIN), Research Center for Social Welfare, Village and Connectivity National Research and Innovation Agency, Jakarta Pusat 10340, Indonesia
[5] Research Center for Agroindustry, National Research and Innovation Agency (BRIN), Jakarta 10340, Indonesia
[6] Research Center for Climate and Atmospheri, National Research and Innovation Agency (BRIN), Jakarta 10340, Indonesia
[7] Department of Chemistry, Universitas Riau, Riau 28293, Indonesia
[8] Research Center for Food Crops, Research Organization for Agriculture and Food, National Research and Innovation Agency (BRIN), Jakarta 10340, Indonesia
[9] Master of Government and Administrative Affairs, Jusuf Kalla School of Government, Muhammadiyah University, Yogyakarta 57169, Indonesia

Corresponding Author Email: rumanintya.lisaria.putri@brin.go.id

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ABSTRACT

Innovations in the utilization of alternative energy sources to replace coal and oil-based production methods have a direct impact on the volume of carbon dioxide (CO_2) emissions released into the atmosphere and subsequently contributing to the greenhouse effect. Addressing these negative externalities of greenhouse gas emissions is most effectively achieved through a universal global carbon tax system applied uniformly across all nations. This study seeks to explore the implementation of a carbon tax as an alternative policy for curbing carbon emissions and promoting a transition to a sustainable green economy. The research adopts a qualitative approach with a focus on comparative analysis, examining carbon tax policies across various countries in Europe, America, and Asia. Research data was primarily gathered through an extensive review of relevant literature, with a major data source being the World Bank's reports on the status and trends of carbon pricing. The study's findings underscore the efficacy of a carbon tax as a policy instrument to reduce carbon emissions. Furthermore, it has the potential to induce shifts in both household and industrial decision-making behaviors, leading to reduced energy consumption with high emissions. Ultimately, this policy approach can foster sustainable development and facilitate the transition to a green economy characterized by low-carbon practices, resource efficiency, and social inclusivity. These policies are instrumental in addressing environmental and social challenges, thus safeguarding the well-being of future generations.

1. INTRODUCTION

Innovations in alternative energy use from coal and oil production are impacting increased carbon dioxide (CO_2) emissions into the atmosphere and trapping heat, posing potential threats to the economy and the environment, such as rising sea levels, risks to human health, reduced agricultural productivity, damage to ecosystems and climate change risks [1]. Atmospheric concentrations of greenhouse gas emissions have increased significantly over the past 50 years, from 312 parts per million (ppm) in 1950 to 401 parts per million (ppm) in 2015 [2]. Climate change can cause disastrous consequences for human survival and socio-economic activities that ultimately affect global economic output.

Externalities are the impact of a person's or one party's economic actions on another person or party without being accompanied by a flow of compensation [3]. Negative externalities deserve joint attention considering the importance of air as the main support for human, animal and plant life, as well as its characteristics which are public goods [4]. Efforts to reduce the impact of external diseconomies such as climate change due to production and consumption actions

that are not environmentally friendly within the framework of the concept of sustainable development, can be carried out through three methods; First, through direct regulation, namely setting certain standards that require supervision. Second, through voluntary measures, namely by providing incentives without penalty, while at the same time reducing monitoring costs. The third is market instruments (market economic instruments), namely encouraging efficient behavior based on the dynamics of supply and demand through market price mechanisms, such as taxes [5].

One type of market economy approach to address the external diseconomies of carbon emissions is a carbon tax. A carbon tax is an environmental tax on the consumption of fuels (coal, oil and gas) and is one of the important aspects of environmental accounting. The goal of this carbon tax is to reduce emissions, especially carbon, and eliminate the use of fossil fuels due to human activities in the production process [6].

Debuted in 1991, Sweden implemented one of the world's earliest carbon taxes, second only to Finland's, which was established a year prior. Sweden imposes the highest global carbon tax rate at SEK 1,190 (equivalent to US $126) per metric ton of CO_2. This taxation primarily pertains to fossil fuels utilized for heating and transportation.

In the three decades since the carbon tax was introduced in Sweden, the country has seen carbon emissions fall alongside steady economic growth. Although carbon tax revenues remain significant, they have declined slightly over the past 10 years. It should be noted that Sweden's carbon tax only covers about 40% of total national greenhouse gas emissions due to various exemptions. Some of these exempted industries are subject to the European Union Emissions Trading System (EU ETS), which typically imposes a lower carbon price, while others are not affected by any pricing mechanism Which carbon? Implementing a uniform carbon tax across all sectors could rectify these disparities and potentially result in further emission reductions. It's worth noting that Sweden administers various environmental levies, including the energy tax, aviation tax, and vehicle tax, and also actively participates in the EU ETS [7].

One of the 2018 Nobel Economics recipients, William D. Nordhaus stated that the most efficient remedy for dealing with negative externalities of greenhouse emissions is the global carbon tax scheme which is applied uniformly in all countries [8]. Previously, Fischhoff, a professor of public policy at Carnegie Mellon University, also advocated a carbon tax approach. Fischhoff argues that taxes are simpler, more transparent, and more reliable, and are likely to produce an immediate response to established goals. According to He et al. [9], economists favor carbon prices because they are less technologically prescriptive, easier to administer, and do not use public funds. They like carbon pricing because it gives emitters the flexibility to find their own ways to reduce emissions. It is important to understand that polluters who release greenhouse gases must pay for the impact they have on climate change [10].

The application of a carbon tax directly or indirectly reduces economic activities that pollute the environment and prevents environmental damage by encouraging environmentally friendly production/consumption methods. The implementation of a carbon tax aims to initiate a greener economic transition and reduce future emissions faster. Additionally, carbon taxes are necessary to protect environmental integrity to facilitate sustainable economic growth. This is consistent with the principle of sustainable development, which states that future generations should have economic prospects at least equal to those of the present generation, thereby allowing them to build on their economic well-being. Green economic transformation or green economy means that the economy is not aimed at continuous growth and development but is an economy in stable, socially (human) friendly conditions that are not threatening other species or the planet itself.

In the 2015 Paris Agreement, 196 countries agreed to combat climate change and increase efforts to limit temperature increases to 1.5 degrees Celsius. No fewer than 57 countries have imposed a price on carbon, through the System emissions trading system (ETS) or through the Emissions Trading System (ETS) or by collecting a tax on carbon emissions (carbon tax). A 2015 study of a carbon tax in British Columbia found that the tax reduced greenhouse gas emissions by 5 to 15% [11]. The British Columbia Sustainable Prosperity Report for 2013 shows that since the carbon tax was enacted in 2008, there has been a decrease in fossil fuel consumption of 17.4% per capita and this does not endanger economic growth. A carbon tax survey showed several developed countries such as Finland, Denmark and Sweden showing that these countries were able to reduce emissions ranging from about 1.5% to almost 6% by using carbon taxes. Japan was also able to reduce carbon emission levels by 8.2% from 2013. Likewise, based on the 2018 Carbon Tax Center (CTC), the United Kingdom has succeeded in reducing their carbon emission levels by using carbon taxes. In 2015-2016, the UK's carbon emissions fell from 600 MtCO2e to 374 MtCO2e or around 7%. Overall, from 1990-2016 UK CO_2 emissions have decreased by 37%. There is also Ireland witness a reduction in emissions more than 15% since 2008. Experts say the country's emissions fell by 6.7% in 2011 even though it experienced little economic growth.

Based on the study and the success of other countries in implementing a carbon tax, the researchers wanted to conduct an analysis of how a carbon tax is an alternative policy to address the external economic problem due to carbon emissions and its impact on a green and sustainable economy develop.

2. THEORETICAL REVIEW

2.1 Externality concept

The consideration of external factors, also known as “spillover effects”, originated from a formal investigation by two British economists, namely Henry Sidgwick (1838-1900) and Arthur C. Pigou (1877-1959), who established the concept of external factors externalities. As Duan et al. [12] elaborates, externalities represent either costs that need to be assumed or indirect advantages conferred by a party as a consequence of economic actions. These externalities arise from disparities between the item's marginal cost and marginal benefit [13]. Externalities manifest when the manufacturing and use of a product have a direct impact on enterprises or individuals who are not engaged in the purchase and sale procedures. These effects result from overflow impacts that are not represented in market prices. In the context of natural resources and the environment, the presence of externalities leads to an inefficient and suboptimal allocation and administration of these resources [14].

Baharuddin et al. [15] classifies externalities based on their impact into two, namely as follows:

a. Positive Externalities (external economies) occurs when one person's activity benefits another indirectly. Positive externalities provide external advantages that cannot be reflected in market prices [16].
b. Negative Externalities (external diseconomies) occurs when the activities of one person cause harm to another. Negative externalities raise external costs which are costs to third parties that cannot be reflected in market prices [17]. Natural resource and environmental problems include negative externalities (detrimental externalities).

2.2 Global public goods concept

The concept of global public goods is an extension of American economist Paul Samuelson's classic idea of public goods in a globalized economy. Global natural conditions such as a good atmosphere are global public goods. Likewise with environmental elements such as water, air, and others that can be enjoyed by every living thing and it is impossible to prevent someone from consuming these public goods [16].

2.3 Stakeholder theory

The concept of stakeholder theory aims to help companies strengthen relationships with external parties and cultivate competitive advantage. Stakeholder theory involves granting each stakeholder privileged access to information related to corporate actions that can influence corporate decision making. Stakeholders also have the right to choose not to use this information and not to hold a direct position in the company. Disclosure of information related to social and environmental responsibility can effectively engage stakeholders, leading to their support for the company. In turn, this support can affect the sustainability of the business [17].

2.4 Signaling theory

Signaling theory, initially introduced by Spence in his research on the job market signaling, posits that the party possessing the information aims to convey pertinent information to the recipient through signaling. The recipient subsequently adapts their actions based on their interpretation of the signal. Information made public as an announcement serves as a signal in the decision-making process. When the announcement conveys a positive value, it is anticipated that the market will respond upon receiving the announcement [18]. Offering transparent price data regarding carbon tax represents a form of informative signaling since it has the potential to influence the decision-makers' behavior.

2.5 Decision making theory

According to the Big Science Dictionary, decision making is a form of choosing from many different actions that can be chosen, this process goes through a certain mechanism in the hope of making the best decision. Effective decisions are shown by the absence of resistance to implementers and parties directly related to decisions [19].

2.6 Carbon emissions

Carbon emissions are gases resulting from the combustion of compounds containing carbon and hydrogen, which are discharged into the Earth's atmosphere. The primary contributor to carbon emissions is the combustion of fossil fuels, accounting for 67% of global emissions [18].

Carbon emissions, commonly known as greenhouse gases, represent the gases that have the potential to cause global warming [19]. Remarkably, all of these greenhouse gases released into the atmosphere are byproducts of human activities. The escalation of carbon emissions has experienced a substantial surge since the onset of the initial industrial revolution in 1751. This rise in carbon emissions persisted through the second industrial revolution and continues to the present day.

2.7 Carbon tax

The level of carbon content of each fuel will determine the value of the tax. Taxes on fossil fuels will trigger an increase in the price of these fuels. In theory, one would use less fuel when the price went up. In other words, the government can protect the environment by implementing this tax measure [20].

Carbon taxis a type of environmental tax and one of the important aspects of environmental accounting apart from insurance and regulations and external financial information. He et al. [9] stated that environmental taxes are included in monetary environmental accounting. Environmental accounting describes efforts to incorporate environmental benefits and costs into economic decision making. Environmental Management Accounting: Procedures and Principles explains the classification of environmental costs and revenues, in this case output, taxes and costs incurred by companies based on the volume of air emissions.

2.8 Sustainable development and the green economy

Co-published by World Nature (WWF) in 1980. It gained widespread recognition through the report of the World Commission on Environment and Development, titled "The Bruntland Report: Our Common Future ta", published in 1987. Sustainable development is defined as the result of improving current well-being without reducing prospects for future prosperity. In simpler terms, this implies that future generations should benefit from at least the same economic opportunities as the current generation to ensure their own economic well-being [21].

The term “green economy” was first introduced in 1989 when a group of prominent environmental economists, in their report titled “Towards a Green Economy”, presented it with the British government. In a green economy, the emphasis is not on continuous growth but on achieving a stable economy in which human societies coexist harmoniously with other species and government. This crystal, the main goal of the green economy is to improve human well-being, ensure equity, minimize environmental damage and facilitate economic development within the ecological limits of the environment.

3. RESEARCH METHODS

This research is a qualitative research using a phenomenological research approach comparative analysis, namely an analysis that describes and compares carbon tax policies in several countries. This research was conducted in

10 countries that have successfully implemented carbon taxes in the European, American and Asian continents, which consist of Finland, Sweden, Norway, Denmark, British Columbia, Ireland, Japan, England, Mexico and France. Research data obtained by literature study from various literatures with the main data source being the state and trends of carbon pricing report issued by the World Bank.

4. RESULT AND DISCUSSION

Analysis of Carbon Tax as an Alternative Policy in Reducing Carbon Emission External Diseconomies

a. Carbon Tax Policy Design

Since the carbon tax places a price on every ton of greenhouse gas emitted, it will send price signals that gradually cause market responses throughout the economy, creating incentives and flexibility for emitters to find their own ways of reducing emissions [22].

In implementing carbon tax, the government must decide which fuel or resource to be taxed and whether to place the tax on the upstream or downstream emission sources [23]. Taxing upstream sources of emissions that are less subject to tax can provide an administratively efficient tax collection method, while taxing downstream such as electricity consumption can provide a more direct signal to consumers but may incur greater administrative costs. The following Table 1 relates to the basis for the imposition of carbon tax in various countries based on the emission sources covered and exceptions, as follows:

Table 1. Basic tax imposition in various countries

Country	Type*	Covered Sectors and/or Fuels	Exception
Finland	National	CO_2 Emissions, All Fossil Fuels mainly from the Industry, Transportation and Building sectors	fuel for electricity production, commercial aviation and commercial cruise ships (Partially) exempt from carbon tax. Use of fuel in refineries and CHP or use of coal and natural gas in industrial processes. The carbon tax also does not apply to peat
Sweden	National	CO_2 Emissions, All Fossil Fuels mainly from the Transportation and Building sectors	fossil fuels for generating heat in addition to manufacturing and in combined heat and power generation. Also, certain industries, fuel exports are covered, modes of transportation (rail, shipping, aviation), electricity production, forestry and agriculture.
Norway	National	GHG emissions from all sectors, including liquid and gaseous fossil fuels	Operators covered by the EU ETS, including Agriculture and waste incineration, international flights and international shipping, exports of covered fuels, and the share of biofuels in mineral oil (Partial) are exempt from carbon tax.
Denmark	National	GHG emissions are mainly from the building and transportation sectors, applicable to all fossil fuels	Operators covered by the EU ETS are exempt from carbon taxes
British Columbia	Sub-National	GHG emissions from all sectors, Taxes cover all fossil fuels and tires burned for heat or energy.	Fuel exported, fuel consumption by flights and shipments outside of British Columbia, and colored petrol and colored diesel purchased by farmers.
Ireland	National	CO_2 emissions from all sectors, covering all BBF	Operators in EU ETS in part, Certain industrial processes, covered fuel exports, electricity production, shipping and aviation (in part).
Japan	National	CO_2 emissions from all sectors, covering all BBF	The use of certain fossil fuels in industry, electricity, transportation, agriculture and the forestry sector is exempt from carbon taxes.
English	National	CO_2 emissions from the power sector	Small electric generators, stand-by generators and electricity production in Northern Ireland are exempt from the carbon tax. Also, the electricity consumption of efficient and partially inefficient combined heat and power plants (CHP) is excluded.
Mexico	National	CO_2 emissions for all sectors, including all fossil fuels except natural gas	-
France	National	CO_2 emissions mainly from the industrial, building and transportation sectors, apply to all fossil fuels	Operators covered by EU ETS. Also certain industrial processes (non-combustion use), electricity production, shipping, aviation, public transport and freight transport (partly) are exempt from tax.

Source: Carbon Pricing Dashboard World Bank, 2018; *background note carbon tax.

Table 2. GHG emission rate ($MtCO_2e$), share of covered emissions (MMT %), and price rates in various countries

Jurisdiction / Country	Year	% MMT Covered	Country $MtCO_2e$ (2012)
Japan	2012	68%	1,479
Mexico	2014	46%	663
British Columbia, Canada	2008	70%	61
France	2014	35%	499
Finland	1990	37%	69
Sweden	1991	40%	66
Ireland	2010	49%	62
Denmark	1992	40%	54
Norwegian	1991	62%	64
English (United Kingdom)	2001	23%	586

Source: World Bank Carbon Pricing Dashboard, 2018

Table 3. Global carbon tax revenue system

Carbon Tax System	Annual Revenue (Millions)	Income per Capital	Share of GDP	Green Shopping	General Fund	Revenue Recycling	Government Revenue 2018 (Millions)*
Sweden	$3,680	$381	0.67%	0%	50%	50%	$2,572
Norway	$1,580	$307	0.31%	30%	40%	30%	$1,644
English	$1,530	$24	0.09%	0%	85%	0%	$1,091
British Columbia	$1,100	$239	0.49%	0%	0%	102%	$1,056
Denmark	$1,000	$177	0.29%	8%	47%	45%	$543
Mexico	$870	$7	0.06%	0%	100%	0%	$306
Finland	$800	$146	0.29%	0%	50%	50%	$1,459
Ireland	$510	$111	0.03%	13%	88%	0%	$489
Japan	$490	$4	0.01%	100%	0%	0%	$2,361
France	$452	$7	0.02%	100%	0%	0%	$8,142

Source: Carl and Fedor, 2016; *Carbon Pricing Dashboard World Bank, 2018.

It is important to recognize the potential impacts of upstream and downstream sources when designing a carbon tax. The tax should be applied to upstream coal suppliers, natural gas processing facilities and refineries, rather than to electric utilities or industries, households and vehicles uses a lot of energy. According to research, if tariffs are placed "upstream" in the energy chain, there will in principle be many different market options for responding to price signals. Additionally, monitoring costs can be relatively low because many resources can be used.

1) Tax Rates

Theoretically, tax rates are applied to fuels that contain carbon or are related to CO_2 emissions from industry or domestic consumers [24]. This theory also suggests that tax rates will increase as the rate of increase in marginal damages from emissions increases. In practice, carbon tax rates vary across countries depending on the theoretical regulations, functions, and objectives the tax needs to achieve [25]. Higher carbon tax rates can provide a stronger signal of changing people's behavior, while lower tax rates are less likely to change behavior but can provide funding for programs Carbon taxes aim to reduce carbon emissions. The government has an objective in determining tax rates, namely to maximize social welfare or minimize the total amount of pollution [26]. In the Inter-Agency Panel on the Social Cost of Carbon (2010), tax rates were determined by estimating the social cost of carbon. By using the social cost of carbon to determine the initial tax rate, tax rates can be set at a relatively low level and increased over time to minimize economic disruption. Carbon pricing tariff programs are implemented at the country, region, state, or even city level with varying rates (see Table 2).

Border Adjustment Rates, Prohibitions, and Exception Rates: Several policies have been proposed to address the problem of competitive disadvantage resulting from one country adopting a carbon tax while another does not [27]. Proposed policies to encourage countries to implement carbon taxes include adjusting border taxes, trade tariffs and trade bans. Adjusting border tax rates according to Shen et al. [28] shows that in this case exports will be tax refunded, while imports will be taxed according to the national carbon tax rate. Schultes et al. [29] also revealed that, to accommodate the carbon tax for domestic use, fuel imports would be taxed and exports would be eligible for a tax credit refund.

A tax exemption or exemption would reduce tax rates for certain fuels or sectors, reducing the economic effectiveness of the carbon tax and leading to increased tax rates for other sectors in order to achieve the target reduce emissions. Research shows that the costs associated with exemptions or exclusions can be so significant that even if the industry's market share were fully released, economic activity would reduce emissions carbon to a small extent. However, eliminating tax exemption rates could be relatively costly for industries that benefit from these exemptions.

2) Income Distribution

Carbon tax revenue is targeted in a variety of ways. Managing the revenue generated by a carbon tax is an important factor in increasing the acceptability and possibly even the cost-effectiveness of other instruments. Fiscal neutrality aims to change people's behavior while reducing other taxes. Greater savings can also be achieved when tax revenues are repaid through deductions from other distorted taxes (such as income taxes) rather than when they are repaid as cash or used for other public expenditures. These results have been proven by economic theory and supported by numerical simulations [30]. Research results show that revenue from a global carbon pricing system is used for various purposes. Below is Table 3 regarding the global carbon tax revenue system with additional government revenue values in 2018, as follows:

3) Impact on Consumers

A carbon tax might be more easily accepted if the revenues were used to promote other social concerns. In this case, the impact on low-income households is considered due to concerns about the regressive nature of a carbon tax, specifically the disproportionate negative impact on low-income households. low income. One of the main obstacles to a carbon tax is that the burden will fall more heavily on the poor (low-income consumers). Low-income consumers tend to spend more than their income to meet basic needs (such as heating and electricity) and lack options to replace these needs [31].

Several policies, including income tax cuts and credits for low-income households, could be used to alleviate these concerns. For example, British Columbia offers a climate action tax credit (a 5% tax reduction on the first two personal income tax rates) and proposes to give northern and rural property owners a subsidy, grants of up to 200 Canadian dollars (CAD) to the people, the most vulnerable, and high-income households (Ministry of Finance, British Columbia, 2008). Similarly, in France, the country proposed a plan to return all income to households and businesses through tax deductions [32].

Carbon taxes also have an impact on businesses. Companies may choose carbon taxes for their carbon mitigation policies because they provide a long-term price signal and are therefore more relevant and easier to incorporate into carbon spending

forecasts. To address concerns about the impact of a carbon tax on businesses, certain regulations allow businesses to reduce tax rates. Sweden cut tax rates for businesses by 0.8%, while in Denmark, about 40% of tax revenue is used for environmental subsidies and 60% is allocated to industry.

4) Ensuring Emissions Reduction

Ensure emissions reductions can be achieved by earmarking carbon tax revenue to fund climate change mitigation. According to Semieniuk et al. [33], voters want to allocate tax revenue and use it to further reduce greenhouse gas emissions. Governments can help by providing effective information on emissions trends, distributional impacts of taxes and co-benefits. An example is the French carbon tax introduced in 2014: in the first year, 100% of revenues were earmarked for the green transition plan, but the allocation decreased over time, to 44% in in 2015 and 38% in 2016, with the remaining percentage of tax revenue going to the general fund. In this case, governments remain committed to spending a certain amount of money to reduce emissions, although there may be competition between actual spending needs and increased revenue. Some countries also occasionally increase carbon tax rates, but no country has implemented a policy of automatically increasing tax rates if emissions reduction goals are not met. For example, British Columbia's carbon tax is expected to be phased in over four years, and the government has said it will revise the tax over time to meet carbon emissions targets. However, no efforts have been made to change tax rates [34].

b. Carbon Tax Policy Design

Based on the policy design given earlier, it shows that carbon tax provides certainty in terms of the marginal costs faced by emitters per tCO_2e. Carbon tax is applied through a tax that is added to the selling price of a product or service according to the amount of greenhouse gas emissions contained (emitted during production and/or use). There is much agreement among economists, financial experts, and climate experts that carbon taxes are the most efficient and effective way to curb climate change, with the least detrimental impact on the economy [35]. In former research, how accountants support carbon tax due to the positive impact it has on the environment.

Several studies revealed that compared to reducing fuel subsidies in terms of costs, with the same amount of budget, the implementation of carbon taxes produces better value and impacts on income inequality and poverty, as well as being faster and more effective in reducing emissions. carbon dioxide (CO_2).

Other approaches often focus on specific emission sources such as electricity, heating or transport. In contrast, a carbon tax could be applied to all fossil fuels, thereby covering the major sources of emissions. Second, carbon taxes provide a distinct price signal to businesses and households, allowing them to make more informed choices in their purchases and investments. Thaller et al.'s [36] research shows that when provided with transparent detailed information on carbon pricing, consumers and businesses are more likely to take energy-saving measures and increase investments in technologies energy saving. Therefore, carbon taxes can increase their influence on consumer behavior by providing accurate price signals. Additionally, a carbon tax could generate two economic benefits. One benefit is minimizing the harmful side effects of fossil fuels. This implies that additional benefits of a carbon tax will arise when the revenue generated by the tax offsets other tax revenues. This benefit is often referred to as the "double dividend" and is an important feature of carbon taxes [37]. Carbon taxes can maximize their impact on consumer behavior by providing clear price indications. Ultimately, a carbon tax could generate two economic benefits. One of these benefits comes from reducing harmful side effects associated with fossil fuels. This implies that additional benefits of a carbon tax will arise when the revenue generated by the carbon tax offsets other tax revenues. This aspect is often called the "double dividend" and is an important feature of carbon taxes [38].

Since the carbon tax places a price on each tonne of greenhouse gas emitted, it will send price signals that gradually cause a market response. Indeed, the imposition of a carbon tax in a country can cause polemics because of the potential for a tradeoff between the economy and carbon levels. Like the application of taxes in general, carbon taxes can reduce economic distortions. There are even studies which state that carbon taxes can reduce economic growth, reduce welfare, and undermine industrial competitiveness [39]. Therefore, before making a decision, it is important to study and understand the design/implications of implementing carbon tax in the target sectors (World Bank, 2017).

Even though it looks quite simply, the implementation of this carbon tax really requires strong regulations and a complete database. In many cases, the implementation of carbon tax faces major obstacles in the field of regulation, where challenges usually come from industry players and other emission sources as tax objects. In some cases, carbon taxes were developed in preparation for the full implementation of the Emission Trading System.

Impact of Implementing Carbon Tax as an Alternative Policy in Sustainable Development and Green Economy

Sustainable development includes many different elements that are classified into three main aspects, namely environmental, economic and social aspects or also known as the triple bottom line (TBL). Carbon taxes encourage individuals to use less fossil fuels and seek new energy sources by increasing the cost of fossil fuel use, leading to a reduction in carbon dioxide emissions through the price mechanism. Carbon taxes thus allow for the internalization of negative externalities caused by fossil fuel consumption [40]. The existence of a market instrument-based carbon tax by creating direct costs for emissions and taxing the carbon fuel content, has supported the concept of sustainability [41].

The proper design of a carbon tax is actually significant as a cost-effective instrument for reducing emissions. The application of a carbon tax serves to initiate a "greener" transformation of the economy and reduce emissions more quickly in the future [42]. In line with this, the application of a carbon tax will not only mitigate environmental externality diseconomies due to carbon emissions, but also the results of the carbon tax can be used strategically to provide long-term and stable assistance in research and development efforts for energy sources, energy use, and mitigation [43].

The Organization for Economic Cooperation and Development (2001) shows that carbon taxes can be an attractive policy option for maintaining environmental quality in sustainable economic development. There are three main indicators in sustainable development namely Environment, Economy, and Social. Former research evaluated the design of a carbon tax related to the impact on consumers. This refers to social indicators on sustainable development.

a. Impact on Consumers

When designing a carbon tax, it is important to plan from

the outset how much the tax should be set, how the tax might change over time, and its impact on consumers. A carbon tax may be more easily accepted if the revenue is used to promote other social concerns [44]. As in the previous discussion, the principle used to determine the appropriate tax rate is equivalent to the marginal social damage cost of one additional ton of CO_2 and the marginal social benefit of one ton of CO_2 reduction [45]. Higher carbon tax rates can send a stronger signal of changing people's behavior, while lower tax rates are less likely to change behavior but can provide funding for tax programs carbon to reduce carbon emissions.

Several policies, including income tax cuts and credits for low-income households, could be used to alleviate concerns about the regressive nature of carbon taxes. To make incremental progress through recycling carbon tax revenues, make: 4,444 one-time transfers distributed among households in equal proportions (per capita) and one-time transfers Eligible for an amount determined on an equitable scale, Low Carbon subsidy/subsidy for low-income households, income earner, households and public transport use [46].

b. Impact on Consumers

Economic Impact (Accounting) for the Use of Tax Revenue Primary costs. A carbon tax would increase the price of fossil fuels proportional to its carbon content. Rising fuel prices will lead to higher production costs and ultimately higher prices for goods and services across the economy. The main underlying costs of a carbon tax include two types of economic consequences: 4,444 production effects and substitution effects. The production effect occurs when rising fossil fuel prices reduce real wages and returns on investment, resulting in less total economic output than needed. The substitution effect occurs when changes in the composition of goods and services consumed and in the way they are produced change the relative demand for labor and physical capital (such as housing) heavy machinery and equipment used to produce electricity).

Tax interaction costs are the consequences of a carbon tax adding to the economic costs associated with existing taxes, such as personal and corporate income taxes. The interaction costs of a carbon tax can be significant relative to the baseline costs of a carbon tax.

Burden on specific groups. The carbon tax burden, i.e., the hardship caused by rising fossil fuel prices and emissions-intensive goods and services as well as falling wages and investment returns, will significantly affect some parties, specifically can be low-income households, workers and investors in high-emission industries and people living in areas of the country that depend on high-emission industries for their livelihoods or who use the most emissions-intensive fuels to produce electricity production [47].

Previous research evaluated the design of carbon taxes related to economic impacts, of which there are two, namely competitiveness and distribution. To achieve sustainable development related to economic indicators (competitiveness and distribution impact). In more detail, it is explained as follows:

1) Impact of Competitiveness

On a corporate level, competitiveness pertains to the capacity of a company to uphold or enhance its market share and financial performance, whether on the global or domestic stage. A company's competitive standing is subject to various influences, including cost considerations, product quality, branding, service provisions, logistical networks, as well as micro and macro elements, such as currency exchange rates and trade regulations [48]. The influence of the carbon tax is discernible in the company's cost framework, making it just one of the determinants that impact competitiveness. The main choice in designing a carbon tax on competitiveness issues so that it can be considered reduced is to pay attention to the level of taxation, border tax adjustments, recycling of carbon tax fiscal revenues, and high exclusions in certain sectors.

2) Distribution Impact

Distribution considerations pose a significant challenge within the context of implementing carbon taxes within a political framework. Research on fiscal policy highlights substantial opposition to the introduction of taxes targeting households with lower incomes. The impact of carbon taxation on distribution can be assessed from various perspectives, including the distribution among households with differing income levels, various household types, rural and urban households, and disparities across generations. Most of the research conducted to date has concentrated on examining the distributional consequences concerning varying income groups [49].

According to Schultes et al. [29], there are four factors impacting the distribution of carbon tax, which are as follows:

i. The structure of household spending includes direct energy purchases (oil, coal, natural gas, motor fuel) as well as purchases of goods from production that require large quantities of fossil fuels for the production process.
ii. Who is effective in shouldering the tax burden, i.e., will the carbon tax be passed entirely on to consumers through higher prices for energy and used products or will fuel producers and workers Will fossil fuel use in turn bear the brunt of falling incomes and wages?
iii. Distribution benefits from better environmental quality. A carbon tax has two environmental benefits: first, CO_2 emissions are reduced, thereby reducing damage caused by climate change. Second, the environmental benefits of reducing fossil fuel consumption, can improve air quality, by reducing emissions of air pollutants.
iv. Using tax revenue generated from a carbon tax could reduce the regressive impact.

3) Impact on the Environment

The main reason for implementing a carbon tax is the possibility of achieving environmental goals, especially overcoming the external economic situation and reducing carbon dioxide emissions, while increasing economic efficiency. For example, price signals provided by taxes can be taken into account in future investment decisions when they are replaced by new technologies. The environmental effectiveness of a carbon tax will also depend on at least two other factors, namely:

i. Use revenue from carbon tax. In terms of environmental efficiency, two main options can be considered. First, carbon tax revenues could be used to subsidize renewable energy. In the second option, tax revenues could be used to invest in energy efficiency and research and development.
ii. Basis for applying carbon tax. If tariffs were placed upstream in the energy chain, there would in principle be many market options for responding to price signals. Additionally, monitoring costs can be relatively low due to the many transmission sources.

Benefits and Costs of Carbon Tax

Regarding the realm of accounting, it is essential to

recognize the costs and advantages associated with environmental and social matters and, where applicable, undertake the measurement and quantification of these aspects [45]. Financial reporting concerning carbon tax adheres to the guidelines outlined in the International Financial Reporting Standards (IFRS) as promulgated by the International Accounting Standards Board (IASB). The specifications for acknowledging and quantifying carbon tax-related account entries, including income, inventory, and liabilities, are in compliance with the guidelines articulated in IAS 37.

In principle, in the absence of other taxes, there is no spillage of emissions to other areas, and there are no benefits or costs unrelated to CO_2 (beyond the net environmental costs reflected in the social costs of carbon and the primary economic costs of carbon taxes as elucidated. If there is no uncertainty regarding the Social Cost of Carbon (SCC), setting an identical carbon tax rate for the SCC would be considered "efficient" from a global economic perspective. However, in reality, the economically efficient carbon tax rate is contingent on how policymakers utilize tax revenues, the extent of emissions leakage, and the additional benefits and costs stemming from taxation [46].

5. CONCLUSION

Based on the research results obtained, it can be concluded as follows:

1. Carbon Taxis the right policy in overcoming external diseconomies (negative externalities) to the environment due to carbon dioxide (CO_2) emissions resulting from human activities (Production and Consumption) through the burning of fossil fuels (petroleum, natural gas, and coal). The principle is that whoever produces the emission must pay for each equivalent ton of CO_2 emitted (expressed per tCO_2e). In addition to being able to reduce emissions, Carbon tax also generates additional benefits but depends on how to recycle fiscal revenues such as offsetting other tax revenues for example income tax. This additional benefit is called a double dividend. This double dividend then has a positive impact on economic growth, creating new jobs, and developing technology.
2. Implementing a carbon tax has emerged as an appealing policy choice to safeguard environmental integrity during the transition towards a green economy and sustainable economic progress. The adoption of a carbon tax is grounded in its classification as an environmental tax and its utilization as a market-driven instrument, facilitated by price mechanisms. Consequently, this approach bears consequences on factors such as competitiveness, distributional effects, and environmental outcomes. The study's findings reveal that sustainable development entails creating a society characterized by high social standards, economic viability, the preservation of life-sustaining ecosystems on a long-term basis, and the ability to ensure the well-being of future generations. Furthermore, the transition to a green economy denotes a shift towards development that is both low in carbon emissions, efficient in resource utilization, and socially inclusive. This transformation is envisioned to serve as a public policy to rectify misallocation of resources and address environmental and societal concerns.

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