



Energy Transition and Carbon Tax Policy as an Effort to Reduce Carbon Emissions in Realizing Sustainable Development in Indonesia

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Abstract. The article examines the urgency of implementing the energy transition and carbon tax policy to reduce carbon emissions in Indonesia, especially in the energy sector, which is currently focused on implementing the energy transition and carbon tax policy. Climate change is the focus of global problems caused by the excessive use of fossil fuels in daily activities, which produces carbon emissions. Carbon emissions significantly contribute to and can cause significant global warming or greenhouse gases. Energy Transition is a solution to help with the challenge of climate change. It can gradually reduce the use of fossil fuels so that it can produce renewable energy through carbon emission management practices. Another effort made by the government is implementing a carbon tax policy as a form of the government's commitment to reducing carbon emissions for sustainable development. This research uses a data analysis method with a scoping review and content analysis approach in the presentation or appearance of secondary data collected and analyzed previously. The research results include an analysis of the implementation of the energy transition and carbon tax policies in Indonesia, especially in the energy sector, to reduce carbon emissions and realize sustainable development.

Keywords: Carbon Emission, Carbon Tax, Energy Sector, Energy Transition, Sustainable Development.

1 Introduction

Global warming has gained increasing international attention and has significantly impacted climate change in recent years [1]. An ever-increasing consumption of fossil fuels emits enormous amounts of CO₂. [2]. This increase in CO₂ emissions has led to global climate change, resulting in rising global temperatures, extreme weather, and rising world seas. Global climate change is one of humankind's biggest challenges in the 21st century. Therefore, reducing CO₂ emissions and preventing CO₂ is becoming crucial and must be done as soon as possible. According to World Meteorological Organization (WMO) data, 2015-2022 was the warmest eight-year recorded [3]. The

average global warming temperature on the Earth's surface reached 1.14°C and indicates continued warming [4]. Global average surface temperature is shown in Figure 1.

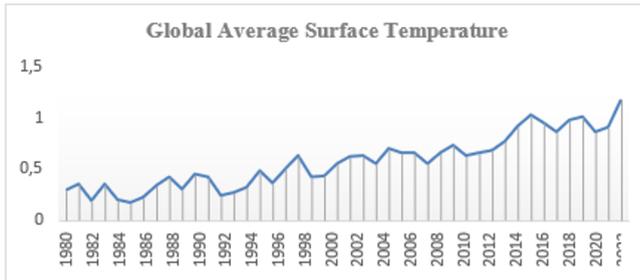


Fig. 1. Global average surface temperature.

An ever-increasing consumption of fossil fuels emits enormous amounts of CO₂ as shown in Figure 2 [2]. This increase in CO₂ emissions has led to global climate change, resulting in rising global temperatures, extreme weather, and rising world seas. Global climate change is one of humankind's most significant challenges in the 21st century. Therefore, CO₂ emission reduction and CO₂ prevention must be done as soon as possible.

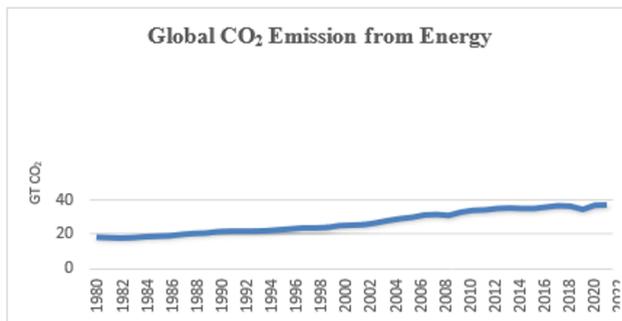


Fig. 2. Carbon dioxide emissions from global energy contribution.

The amount of carbon emissions contributed continues to increase. The countries that produce the largest carbon emitters have large populations and high levels of industrialization [5]. Figure 3 shows the data of the amount of carbon emissions in 2022.

Based on Figure 3, the region that produces the most carbon emissions are the Asia Pacific region when compared to other areas. Asia Pacific consists of 17 emission-contributing countries, with the total carbon emissions reaching almost 18 billion tons. China, India, and Japan are the three countries that produce carbon dioxide (CO₂) in Asia Pacific. Total emissions from these three countries account for almost half of all emissions in the world [5].

Indonesia is ranked 5th in the largest emission-producing country in the Asia Pacific. The amount of carbon produced by Indonesia throughout 2022 will reach more than

900 million tons annually. Contributors to carbon emissions in Indonesia consist of the Energy sector, IPPU (Industrial Processes and Product Use), Forestry, Agriculture, and Waste [6]. Energy is the largest sector contributing to carbon dioxide (CO₂ emissions) compared to other industries. The reason is that 60% of total CO₂ emissions, which are scattered in the air, come from that sector [7].

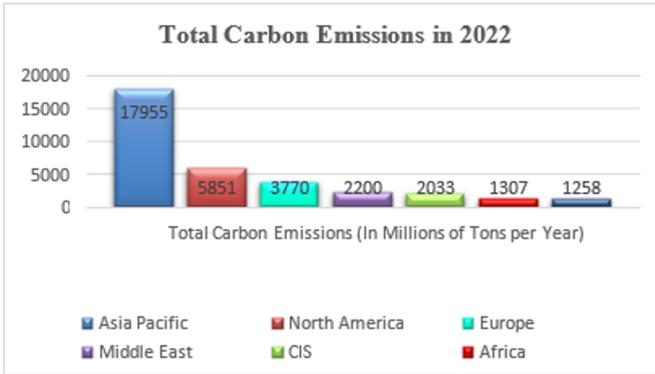


Fig. 3. Total carbon emissions in the world.

The energy sector is one of Indonesia's main sectors that drives economic growth. Still, this growth cannot be separated from the increasingly negative environmental impact, especially concerning carbon emissions [8] and [9]. One crucial issue that requires attention is climate change caused by greenhouse gases, especially gases produced from carbon dioxide (CO₂) emissions from fossil energy consumption. Excessive use of fossil fuels such as coal and petroleum from the energy sector has caused Indonesia to experience an increase in carbon emissions. The Indonesian government is making various efforts to reduce the trend of emissions resulting from the energy sector [10].

The Indonesian government is trying to reduce carbon emissions by signing the Paris Agreement, legally binding regulations regarding climate change [11]. The government is starting to utilize New Renewable Energy (EBT) by issuing schemes related to the transition to a green economy (Green Transition) to reduce the ever-increasing carbon emissions [12]. All countries, including Indonesia, are trying to implement their policy to achieve decarbonization goals by 2060 [13]. Implementing the green transition is very important to impact sustainable economic growth and the stability of fiscal policy instruments [14]. Schemecarbon tax adjusting the economic characteristics and adaptive capabilities of countries facing environmental and climate challenges is an opportunity to make this transition fair and inclusive for everyone [15].

One of the policies pursued by the Government to overcome challenges and to encourage the energy transition is implementing a carbon tax regulated in the Law on Harmonization of Tax Regulations (UU HPP) Number 7 of 2021. A carbon tax is a policy that imposes additional fees on carbon emissions. This results from emissions from economic activities such as the use of fossil fuels with the aim of internalizing environmental costs in energy prices, encouraging the reduction of carbon emissions, and encouraging the use of renewable energy.

1.1 Environmental Management and Sustainability Theory (Theory of Environmental Stewardship)

Climate change and environmental pollution are significant problems. Tax policy is used to improve the economy, increase environmental sustainability, and meet community needs in a sustainable manner. The theory of Environmental Stewardship explains humans' moral responsibility toward the environment in a sustainable manner. This theory answers the question of how individuals, communities, and companies can contribute to reducing carbon emissions and environmental sustainability [16]. The second theory is the theory of sustainable development put forward by the International Union for the Conservation of Nature (IUCN), which provides an understanding of sustainable development by considering the long term and ensuring the needs of future generations can be met. Sustainable development has three main pillars: economy, society, and environment, which can encourage a sustainable environment, health, and a better life for society [16].

1.2 Pigouvian Tax

Pigouvian Tax is a tax imposed on economic activities that have a negative impact on the environment and society [17]. Pigouvian taxes are a tax designed so that decision-makers also consider the social costs of negative externalities. Wearable items Pigouvian tax basically, goods that, when produced/consumed, can potentially reduce environmental quality. The government's applying a Pigouvian tax is a strategy to achieve net zero emissions.

1.3 Energy Transition

Energy transition refers to the global shift from traditional fossil-based energy sources such as oil, gas, and coal to renewable energy sources and energy efficiency measures. This transition is critical in addressing increasing greenhouse gas emissions, particularly CO₂ and methane, contributing to global warming and climate change. The main pillars of the energy transition, known as the 4 Ds, include Decarbonization, Decentralization, Digitalization, and Democratization, aiming to revolutionize how energy is produced, consumed, and distributed. By embracing renewable energy sources, implementing energy-saving practices, and leveraging big data technologies, the energy sector can achieve a sustainable and environmentally friendly energy system while promoting autonomy and energy security in Society [18].

1.4 Carbon Tax

One of the kinds of Pigouvian tax is the carbon tax. The carbon tax is imposed on every product producing carbon emissions. The carbon tax is imposed on every economic activity that produces carbon emissions, both production and consumption. From the production side, a carbon tax will be imposed on manufacturers who produce carbon emissions in the manufacturing process, while it will be a tax from the consumption

side. Carbon will be charged for using goods/services that produce carbon emissions [19]. Carbon tax is stipulated in the HPP Law Article 13 paragraphs [6] and [20], which states that the carbon tax rate is set at a minimum of IDR 30 per kilogram of carbon dioxide equivalent (CO₂e) or equivalent unit [21].

1.5 Carbon Emissions

Increasing production and human activities worldwide will increase carbon emissions and cause environmental problems such as air pollution and increasingly severe climate change [22]. The increasing amount of greenhouse gases will mean that more solar heat energy is absorbed and distributed to the earth's surface [19]. The amount of carbon footprint in the atmosphere has now reached a level that is difficult to absorb naturally. Therefore, countries worldwide are committed to reducing and achieving zero carbon emissions by 2060. Human activity has significantly increased the concentration of greenhouse gas emissions in the atmosphere. Burning fossil fuels for energy, such as coal, oil, and natural gas, produce large amounts of CO₂, CH₄, and others. This has caused an increase in the amount of carbon emissions in the last hundred years and has impacted increasing the earth's temperature and changing the world's climate.

2 Methods

This study uses a qualitative method. Qualitative research focuses on an in-depth understanding of phenomena and their meaning. Qualitative research aims to explore views, perceptions, and a deeper understanding of people [23]. In qualitative research, the researcher analyzes and then reports phenomena in an analysis of the research results. In this research, the author researched the main object, namely transition energy, carbon tax, and carbon emissions in the energy sector because this sector produces the most significant amount of carbon emissions compared to other industries. The documentation used in this research uses secondary data sources in the form of Ministry of Environment and Forestry Reports, Ministry of Energy and Mineral Resources Reports, Ministry of Finance Reports, Reports Energy Institute, Report International Energy Agency, books that can be accessed via the internet network, journals or previous research, as well as other supporting articles [24]. This research uses a data analysis method with an approach to scoping review and content analysis to present or display previously collected and analyzed data. The scoping review aims to answer questions from predetermined research topics using various Sources of similar research articles that are then grouped and conclusions drawn [25]. Content analysis is a qualitative research technique emphasizing in-depth discussion of information content, reading symbols, and interpreting interactions [26].

The process of scoping review applied in this review is as follows:

1. Identify the Research Question. At this stage, the researcher identifies the research questions used as a reference in searching for articles;
2. Identify relevant literature sources. The literature sources used by researchers

were obtained using search engines from several sources. Based on the keywords used in search engines, researchers found Google Scholar as many as 44 articles, Springer as many as four articles, Official Website from the Ministry of Environment and Forestry as many as two guidelines, the Official Website from ESDM as many as two guides, Official Websites from the Ministry of Finance as many as one guide, Official Websites from PB Tax and as much as one guide, Official Websites from Energy Institutes as many as one guide, Official Websites from World Meteorological Organization as many as one guide, Official Websites from International Energy Agency as many as one guide, and Official Websites from Institute for Essential Services Reform as many as one guide as well as services from several online libraries via the Publish and Perish application which searches for information on 12 articles;

3. Carry out literature selection. Researchers selected literature from search engines from several sources based on keywords that researchers determined. The literature obtained will be chosen according to the research inclusion and exclusion categories. The articles reviewed are published in the last 5 years, namely the 2020-2024. After further screening, articles and two guides were obtained that could be analyzed further;
4. Carry out mapping and collect the literature used. The researcher carried out the steps in preparing the research protocol by presenting it in the form of a table matrix;
5. Consult with competent parties. At the final scoping review stage, the researcher;
6. Conduct consultation as the final stage. Researchers consulted with experts in the field of taxation to provide input and suggestions in the selection of literature and the preparation process for the scoping review.

3 Results and Discussion

A summary of the content analysis carried out by researchers can be represented in detail from the five sources, which focus on the implementation of energy transition and carbon tax policies in reducing carbon emissions for realizing sustainable development as shown in Table 1.

Table 1. Content analysis summary

No.	Author	Title	Component of Transition Energi, Carbon Tax, Emission Carbon
1	[27]	Impact of Environmental Tax Collection on CO ₂ Emission in Vietnam	<ol style="list-style-type: none"> 1. Environmental taxes 2. Amount of CO₂ 3. Reduction of Carbon Emission

			<ol style="list-style-type: none"> 4. Climate change 5. Potential Environmental 6. Tax Revenue
2	[28]	Impact of Carbon Tax and Carbon Emission Trading on Wind Power in China: Based on the Evolutionary Game Theory	<ol style="list-style-type: none"> 1. Global Climate Problems 2. Carbon Emissions 3. Fossil Energy 4. Renewable Energy 5. Carbon Tax Policy and Carbon Emissions Trading
3	[29]	The Distributional Effect of A Carbon Tax on Income in Taiwan	<ol style="list-style-type: none"> 1. Environmental Problems 2. Carbon Emissions 3. Carbon Tax 4. Internalization of External Costs of Pollution 5. Carbon Tax Revenue 6. Green Tax Reform 7. Economic Improvement, Environment and Income Distribution
4	[30]	The role of green innovations, environmental policies, and carbon taxes in achieving the sustainable development goals of carbon neutrality	<ol style="list-style-type: none"> 1. Environmentally friendly innovation and environmental policy 2. Energy consumption 3. Greenhouse gases 4. Establishment of a carbon tax 5. Carbon Mitigation 6. Objectives of Sustainability Development Goals (SDGs)
5	[31]	Implementasi Pajak Karbon Di Indonesia: Potensi Penerimaan Negara Dan Penurunan Jumlah Emisi Karbon	<ol style="list-style-type: none"> 1. Climate Change 2. Reducing The Amount of Carbon Emissions 3. Negative Externalities 4. Carbon Tax 5. Carbon Tax Revenue Renewable Energy
6	[32]	Peta Jalan Transisi Energi Indonesia Menuju Sistem Energi Rendah Karbon	<ol style="list-style-type: none"> 1. Road map for energy transition in the country 2. Reality and development of energy mix projections renewable 3. Potential negative impacts of the energy transition 4. Four main typologies of energy transitions 5. Deep framework builds a roadmap energy transition 6. Ideal policy and regulatory settings to support the

			process transformation
			7. An ideal investment and funding climate to raise funds for the energy transition
7	[33]	Konsep Komitmen Indonesia Menuju Netral Karbon melalui Transisi Energi	<ol style="list-style-type: none"> 1. Paris Agreement and energy sector commitment 2. Trends in GHG emissions inventory in the energy sector 3. NDC achievements in the Indonesian energy sector 4. Challenges in the Indonesian energy sector 5. Energy supply and demand profile Indonesia 6. Projection of transition energy Grand energy strategy

3.1 Carbon Emission Consumption in the Energy Sector

Based on data from the Energy Institute, carbon emissions from the energy sector continue to increase rapidly, reaching a record high in 2022 of 39.3 billion tons of carbon, or the equivalent of a 0.8% increase in dioxide compared to 2021. Emissions from energy consumption contribute amounting to 87% of total global emissions. An increase in the amount of carbon emissions occurred, especially in the Asia Pacific Region, which increased energy and mineral prices sharply in 2022 [34]. This can be seen in Figure 4.

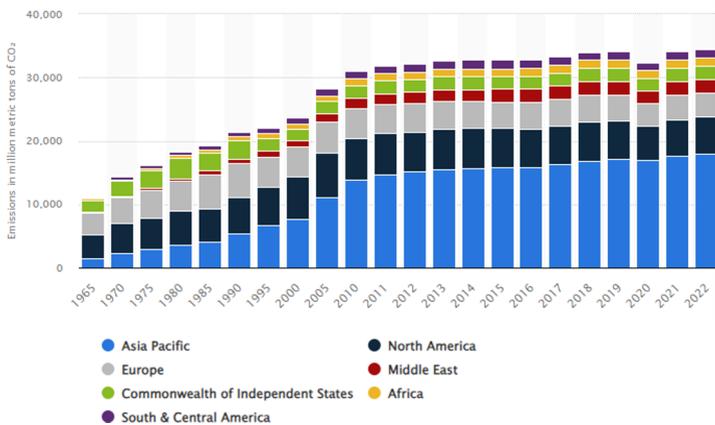


Fig. 4. Highest carbon emissions record.

Consumption of carbon dioxide produced from the energy sector for the 2012-2022 period in the Asia Pacific region, especially Indonesia, can be seen in Figure 5.

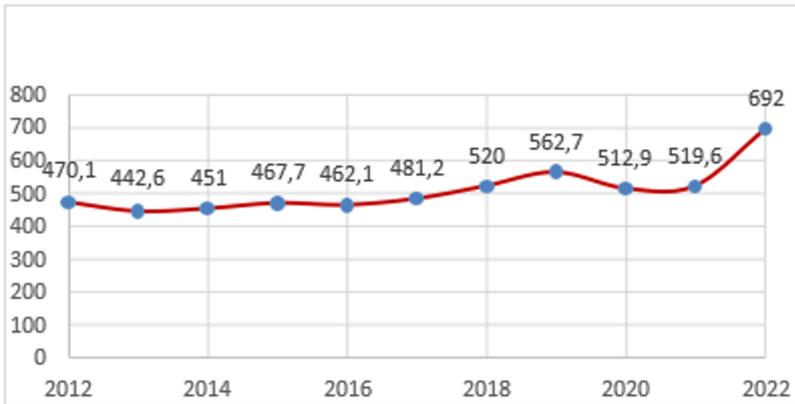


Fig. 5. Total CO emissions energy sector in Indonesia period 2012-2022.

Based on Figure 5, the quantity of carbon dioxide emissions that Indonesia produces for the 2012-2022 period experienced an average growth trend of 3.9%. The average growth per year 2022 will increase by 33.2% when compared to the amount of CO₂ carbon emissions in 2021. This is in line with the increasing activity of burning carbon-containing compounds, burning fossil fuels in manufacturing, heating and transportation.

3.2 Implementation of Energy Transition to Reduce Carbon Emissions

The energy transition cannot be separated from its relationship with the amount of energy consumption, population size, energy consumption per capita, emissions produced, and economic growth all have linearity and complex relationships with one another. When the population both globally and regionally in a particular region or country increases, basic human needs in that region or country will also increase in order to support their living needs, resulting in a growth in energy consumption [35]. Based on United Nations Population Funds data in 2023, the human population will increase rapidly from 2.5 billion people in 1950 to more than 8 billion people in 2020.

In Indonesia, the government has provided various policy instruments to provide space regarding carbon trading which has been enacted by the Indonesian Government such as Law (UU) no. 32/2009 concerning environmental protection and management, Government Regulation (PP) no. 46/2017 concerning environmental economic instruments, Presidential Regulation (Perpres) no. 77/2018 concerning environmental fund management, and Presidential Decree no. 98/2021 concerning the implementation of the economic value of carbon. This regulation can ensure systems and opportunities for industrial players to establish themselves in preparing carbon capture technology in their respective fields. These policies include setting emissions reduction targets,

implementing renewable energy incentives, encouraging energy efficiency measures, and supporting sustainable practices. The goal is to transition to a low-carbon economy and reduce dependence on fossil fuels, which are a major contributor to greenhouse gas emissions. Table 2 shows the countries that have made an energy transition to reduce carbon emissions.

Table 2. Countries that have made an energy transition to reduce carbon emissions.

No.	Country	Energy Transition Implemented in Reducing Emission Carbon
1	United States	The US has rejoined the Paris Agreement and implemented aggressive climate policies, including promoting green energy, investing in electric vehicles and setting ambitious emissions reduction targets.
2	China	China has committed to achieving carbon neutrality by 2060 and is investing heavily in renewable energy, electric vehicles and carbon capture technology.
3	Japan	Japan has set a goal of achieving carbon neutrality by 2050 and is focusing on expanding renewable energy, hydrogen technology and improving energy efficiency.
4	Indonesia	Indonesia is committed to contributing to reducing emissions to United Nations Framework Convention on Climate Change (UNFCCC) in the document Enhanced Nationally Determined Commitment (ENDC). ENDC sets business-as-usual (BaU) to determine emission reduction targets. Method BaU calculates a 2030 emissions reduction target relative to BaU's projected 2030 emissions levels.
5	England	The imposition of a carbon tax had an impact on substantially reducing carbon emissions by 38.6 million tCO ₂ during 2013 – 2015.
6	Canada	The imposition of a carbon tax reduces carbon emissions by 19% from the transportation sector in the long term. Several provinces in Canada, such as British Columbia, Alberta, and Quebec, have implemented carbon taxes at different rates. Canada's carbon tax has provided incentives for consumers and companies to switch to clean energy sources. In addition, revenue from the carbon tax is also used to finance clean energy research and development programs and initiatives.
7	Singapore	The imposition of a carbon tax in 2019 showed a marginal reduction of 0.29 million tCO ₂ .
8	Sweden	The implementation of a carbon tax has reduced carbon emissions in the energy and transportation sectors. In addition, carbon taxes have also stimulated investment in renewable energy, such as wind and biomass power plants. Sweden managed to reduce carbon emissions by 25% between 1990 and 2017, while the country's economy grew significantly.

9	Norway	The carbon tax in Norway applies to the energy and transportation sectors. The country also has an emissions trading system that covers certain industrial sectors. The carbon tax in Norway is used to strengthen clean energy policies and reduce dependence on fossil fuels. This country has succeeded in increasing the use of renewable energy, such as hydroelectric energy and geothermal energy. The carbon tax in Norway has contributed to reducing carbon emissions and increasing the use of clean energy sources.
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3.3 Application of Carbon Tax in Reducing Carbon Emissions

The imposition of carbon tax is not only applied to developed countries, but several developing countries such as Malaysia and China also implement carbon tax. According to studies conducted in a number of nations, enacting a carbon price will significantly lower carbon emissions. The implementation of a carbon price encourages corporate operators and the general public to switch to alternative products in addition to reducing social externalities in the form of carbon emissions. The application of a carbon tax is directly linked to raising the cost of producing carbon and lowering the quantity of carbon emissions in circulation, which causes a shift in the economic equilibrium. Thus, this promotes the use of EBT by economic actors.

Setting the carbon tax in Indonesia through the HPP Law will trigger business actors and the public to switch to low-carbon, green economic activities and increase the use of EBT. The effect of reducing carbon emissions by a significant amount due to the imposition of carbon taxes that have been implemented in other countries provides a big signal and opportunity for Indonesia to be able to reduce carbon emissions by implementing a carbon tax. Apart from that, the Government can achieve optimal reduction in carbon emissions by synergizing between Ministries/ Agencies in implementation road map as well as action plans for carbon emission reduction strategies contained in the targets nationally determined contributions (NDC), new renewable energy development plans, as well as alignment with other regulations [31].

3.4 The Impact of the Energy Transition to Achieve Sustainable Development

Energy security is an important factor in the sustainability of a country's life. Energy is not only an important production factor for economic activity and growth, but is also a strategic commodity that can threaten economic activity during crisis conditions, especially when price conditions are low. uncontrolled due to limited supply. The escalating climate emergency, the ongoing energy crisis, and increasing political uncertainty around the world must be a turning point for accelerating the energy transition. 73% of global greenhouse emissions come from the energy sector and \$4 trillion is needed to achieve net zero emissions by 2050 indicating that annual green energy investment worldwide must more than triple by 2030. 30 million jobs are possible through energy transitions.

The energy sector, as one of the activities that contributes most to the production of carbon emissions, is one of the main objects in efforts to reduce emissions [2]. Energy

transition and sustainable development are two concepts that are increasingly important in production activities. The energy transition is fundamental to realizing the Sustainable Development Goals (TPB). Four SDGs indicators regarding access to energy, clean, low-carbon and renewable energy so that it can reduce emissions and energy efficiency. In terms of the energy transition, it is not just about transitioning towards clean energy, but how to realize a transition and energy supply that is just, inclusive and sustainable. Low carbon emissions resulting from renewable energy consumption, this energy transition is an important step that must be taken to mitigate the impact of climate change to create a greener future.

Climate change, population growth and increased consumption of environmentally friendly and sustainable alternative energy. Energy is one of the important factors in achieving sustainable development [36]. In 2022, at the G-20 Bali Summit, the issue of energy transition became one of the priorities that resulted in an agreement to achieve zero carbon emissions by 2060 and achieve SDGs 7, namely achieving stability, transparency and affordability of energy for all society. The energy transition towards sustainable development is a significant driver for achieving carbon neutrality and reducing the impacts of human-caused climate change stemming from the decarbonization of the energy sector [18].

3.5 Benefits and Challenges of Implementing Energy Transition and Carbon Tax Policies in Reducing Carbon Emissions

Energy needs continue to increase along with economic and population growth. On the other hand, the use of fossil energy resources, which have been the main energy source, has a negative impact on the environment and climate. The government's policy of reducing emissions by building a national energy security system is actually at stake in saving natural resources, the environment and the lives of people in the nation and homeland. A successful energy transition that reduces net carbon emissions to zero by mid-century will ensure significant benefits to the environment, economy and quality of life for people around the world, for generations to come. Apart from these benefits, an energy transition based on renewable energy is also important because it provides benefits beyond just solving the climate crisis, including:

1. Creating new jobs: according to UNDP, the energy transition could create 30 million new jobs;
2. Underlying sustainable development;
3. Improve health by reducing pollution;
4. Generating economic growth;
5. Creating new 'green technology' investment opportunities;
6. Support the conservation of natural resources, thereby protecting the biodiversity that supports life on the planet as we know it;
7. Reducing exposure to fluctuations in fossil fuel prices due to geopolitics, resulting in a more reliable energy supply at prices, helps businesses and families plan for the future.

The implementation of the energy transition has also experienced several challenges and obstacles, namely. Growing the renewable energy industry and raising the share of

renewable energy in Indonesia's overall energy supply have not historically been top priorities for the country. Rather, the nation's energy demands are mostly met by coal, gas, and oil resources. As a result, less than 10% of Indonesia's energy comes from renewable sources. Indonesia faces many obstacles in its transition to a greener energy system, particularly because of its long-standing, non-renovative energy sector.

Carbon Tax has benefits in realizing sustainable development, namely [37]:

1. **Reduce Carbon Emissions:** A carbon tax creates an economic incentive to reduce carbon emissions by making carbon-based fuels more expensive. This encourages reductions in carbon emissions from the energy, transportation and industrial sectors.
2. **Encourage the Use of Clean Energy Sources:** carbon taxes can have different distributional effects on different groups of society. There is a possibility that if the tax burden imposed is greater on stakeholders and entities, it will have an impact and be felt most strongly by weaker economic groups who are more dependent on fossil fuels where it is difficult for them to have easy access to clean energy alternatives.
3. **Innovation and Technological Development:** A carbon tax can encourage innovation in low-carbon technologies and renewable energy. With economic incentives to reduce carbon emissions, companies and individuals will look for new and efficient solutions to reduce their emissions. This can spur the development of more environmentally friendly technology.
4. **Revenue for Investment and Development:** Revenue from carbon taxes can be allocated for investment and development in sustainable infrastructure and technology. These revenues can be used to support renewable energy research and development, energy efficiency programs, or assistance to affected sectors.

Implementing a carbon tax also faces several challenges that need to be overcome. Some of the main challenges are [38]:

1. **Inequality and Social Impact:** Carbon taxes can place a heavier burden on low-income industries. This could create inequality in the distribution of the carbon tax burden. Therefore, there is a need for supporting policies that pay attention to social aspects and provide compensation to groups who are vulnerable to rising energy prices.
2. **Effective Rate Determination and Design:** The industry's determination of appropriate carbon tax rates and effective design is a crucial challenge. Carbon tax rates must be high enough to create significant incentives to reduce carbon emissions, but must also take into account the economic impact and industry competitiveness.
3. **International Coordination:** Carbon taxes often face international coordination challenges, especially in terms of industry competitiveness in global markets. When only a few countries implement a carbon tax, this can create inequities and shift emissions (carbon leakage), where carbon-intensive production is moved

to countries with weaker environmental policies. Therefore, international cooperation and global agreements are essential in mitigating these challenges.

4 Conclusions

In this article, we have discussed the role of energy transition and carbon taxes as policy instruments in reducing carbon emissions as an effort to realize sustainable development. Based on the literature study carried out, several important findings were found that need to be considered, namely implementation. An optimal energy transition can reduce net carbon emissions to zero so that it will have a significant impact on the environment, economy and quality of life of people throughout the world, for future generations. Apart from these benefits, an energy transition based on renewable energy is also important because it provides benefits beyond just solving the climate crisis. The policies implemented are by setting emission reduction targets, implementing renewable energy incentives, encouraging energy efficiency measures, and supporting sustainable practices. Reducing reliance on fossil fuels, which are a significant source of greenhouse gas emissions, and moving towards a low-carbon economy are the objectives. Significant obstacles stand in the way of Indonesia's transition to a greener energy system, including the need for large capital investments in renewable energy infrastructure, the costs of closing coal power plants too soon, the possibility of job and income loss, the possibility of higher electricity costs due to the country's newest power generation, the expense of necessary institutional changes, the risk of asset entrapment, and potential tax revenue reductions.

Another effort made by the government to reduce carbon emissions is by implementing a carbon tax policy which can have a positive impact in reducing carbon emissions and encouraging the use of clean energy sources. By increasing the price of carbon-based fuels, carbon taxes encourage efficiency resource use, low-carbon technological innovation, and investment in sustainable sectors. Implementation of a carbon tax is faced with challenges, such as uneven social impacts and international coordination. Supporting policies are needed that pay attention to social aspects and compensation for vulnerable groups, as well as international cooperation to overcome the shift in emissions.

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