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Impact of Climate Change on Greenhouse Gas Emission Reduction Policies in Bogor Regency

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A B S T R A C T

This article discusses the impact of climate change on greenhouse gas (GHG) emission policies in Bogor District, with a focus on the application of Air Quality Monitoring System (AQMS) technology as one of the emission reduction efforts. Analysis of local climate trends shows an increase in temperature and changes in rainfall patterns that have an impact on the agricultural sector, public health, and infrastructure. The Bogor District Government is responding to this challenge through various mitigation policies, including GHG emission limitation regulations, afforestation programs, renewable energy promotion, and implementation of AQMS to monitor air quality in real-time. The use of AQMS allows for more accurate identification of pollution sources, supporting data-driven decision-making in emission reduction. However, policy implementation still faces obstacles such as budget constraints and low public awareness. This article recommends the need for collaboration between local governments, the private sector and communities to strengthen the effectiveness of GHG emission reduction efforts through public education and green technology innovation. The main findings emphasize the importance of evidence-based policy adaptation to increase the region's resilience to climate change impacts while supporting the national target of reducing greenhouse gas emissions.

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INTRODUCTION

Climate change is now a pressing issue around the world, and its impacts are being felt in various sectors including health, ecosystems and agriculture. In Indonesia, climate change is causing an increase in temperature, changes in rainfall patterns, and an increase in the frequency of natural disasters. Bogor Regency, located in West Java, is no exception to these impacts. According to the Indonesian Meteorology, Climatology and Geophysics Agency (BMKG), the average temperature in Indonesia increased by about 0.75^0C during the period 1901-2000 and is expected to continue to increase. (Team, 2013). (https://www.bmkg.go.id/siaran-pers/suhu-udara-terik-apakah-dipicu-pemanasan-global, n.d.)

Climate change is one of the biggest challenges facing the world today, threatening the sustainability of ecosystems, economies, and human life. (Rahman, 2024). The increasingly evident impacts of climate change, such as increased global temperatures, changes in rainfall patterns, and the frequency of natural disasters, are issues that need to be addressed comprehensively. In Indonesia, especially in urban areas and densely populated areas such as Bogor Regency, the impacts of climate change have a direct impact on the quality of life of the community and the environment. (Susilawati, 2021) Bogor Regency, located in West Java province, is known as one of the fertile areas with high agricultural potential, but is also faced with the challenge of pollution and greenhouse gas emissions that continue to increase.

Sumber : Indonesiabaik.id

Picture 1. Climate Change Causes & Impacts

Reducing greenhouse gas (GHG) emissions is an important step in climate change mitigation (Maulida, Febrianti, & Kamal, 2024). Effective policies to reduce GHG emissions are not only needed to fulfill national and international commitments, but also to protect communities and conservation ecosystems in Bogor District. In this context, understanding the impacts of climate change on the policies implemented in the region is crucial. Implemented policies must be able to respond to changing environmental conditions, as well as consider the social, economic and cultural aspects of local communities.

In response to this challenge, the local government of Bogor District has formulated various policies to reduce greenhouse gas emissions. One significant policy is the implementation of the Air Quality Monitoring System (AQMS), which is an innovative technology to monitor air quality in real-time. With the Air Quality Monitoring System (AQMS), the government can identify emission sources and take necessary measures to reduce air pollution. This is especially important given that poor air quality can negatively impact public health and overall quality of life. (https://ppid.menlhk.go.id/berita/siaran-pers/5850/melalui-ispu-masyarakat-dapat-mengetahui-kualitas-udara, n.d.)

Therefore, this article aims to analyze the impact of climate change on GHG emission reduction policies (Hulu, Nau, & Seba, 2024) in Bogor Regency by exploring the interaction between climate change and environmental policies. This research is expected to provide in-depth insight into the strategic steps that need to be taken by the local government, as well as the importance of community participation in supporting these policies. Through a data-driven approach and case studies, we hope to provide recommendations that can help decision-making in environmental management in an increasingly complex era of climate change. (Gustiawan, 2024).

LITERATURE REVIEW

Climate change is referred to as the phenomenon of global warming, where there is an increase in greenhouse gases in the atmospheric layer and lasts for a certain period of time (Saidal Siburian & Mar, 2020). The causes of climate change and global warming consist of a variety of different factors and have an impact on human life. The climate changes continuously due to interactions between its components and external factors such as volcanoes, variations in sunlight, and factors caused by human activities such as land use change and fossil fuel use. Based on the data received, there are several factors that cause climate change, including the following:

1. Greenhouse gas effect
2. Global Warming
3. Ozone Layer Damage
4. Forest Function Damage
5. Uncontrolled use of Chloro Fluoro Carbon (CFC)
6. Industrial Exhaust Gas

The impacts on society include:

1. High rainfall

2. Prolonged dry season
3. Increased water volume due to melting polar ice caps
4. Occurrence of natural disasters such as tornadoes
5. Reduction of water sources

Sumber : Kominfo Jawa Timur

Picture 2. Ilustration Of Climate Change Global Impact

Climate change and greenhouse gas emission reduction policies have been studied by many experts. According to the IPCC (Intergovernmental Panel on Climate Change), the energy and transportation sectors are the largest contributors to global emissions, and therefore reducing emissions in these sectors is critical to achieving greenhouse gas reduction targets (Adittya & Applied, 2024). In Indonesia, efforts to reduce greenhouse gas emissions are also in line with international commitments, such as the Paris Agreement.

The results of the analysis of key categories of GHG in West Java province, the main contributor to GHG emissions in West Java province is the energy sector with the transportation sub-sector. The five (5) largest GHG sub-categories include emissions from transportation, construction and manufacturing industries, emission absorption on forest land, emissions from settlements, and rice paddy cultivation. The results can be used as a guide in implementing the Regional Action Plan (RAD) through subsectors that are the top priority in reducing GHG emissions.

In the context of Bogor District, the use of Air Quality Monitoring System (AQMS) as a tool to monitor air quality has shown significant results. According to data from (Hidup, 2013), the implementation of Air Quality Monitoring System (AQMS) in several major cities in Indonesia, including Bogor District, has successfully reduced particulate emissions and increased public awareness about the importance of maintaining air quality. In addition, research by (Apriliyanti & Rizki, 2023) revealed that emission reduction policies that involve the community tend to be more effective than policies that are only set by the government.

One form of climate change mitigation is through the establishment of the Climate Village Program, namely by increasing community involvement to strengthen adaptive capacity to the impacts of climate change and reduce GHG emissions and provide recognition for climate change efforts that have been carried out by the community in a location. This has been confirmed by the Governor of West Java through the Circular Letter of the Governor of West Java Number: 08 / GUB / DLH / 2018 that the Regent / Mayor must encourage the formation of Proklim (Climate Village Program) in collaboration with the business world and educational institutions and to those responsible for business activities to support Proklim through their Corporate Social Responsibility (CSR).

As we know, the challenge of global development is now the triple planetary crisis: climate change, pollution and environmental damage, loss of biodiversity. The emergence of the Triple Planetary Crisis can threaten the continuity of development and the livelihoods of millions of people around the world are threatened, with implications for the achievement of Indonesia's development targets. The first is the average increase in global temperature in 2023 of 1.45^0C above the average of 1850-1900. Second, that 2023 is the hottest year on record, due to long-term climate change and the impact of El-Nino 2023/2024. And third, the ocean absorbs about 90% of the energy from the climate system, which causes the highest warming in 2023.

Then what is the climate change control scheme? So far, climate change mitigation and adaptation have been carried out in Indonesia, starting from planning, implementation, and monitoring and evaluation.

METHODOLOGY

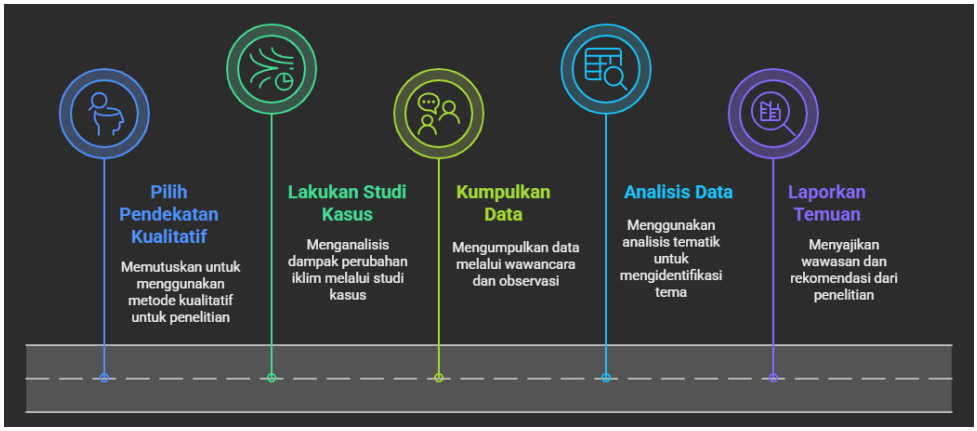
This research uses a qualitative approach with a case study method to analyze the impact of climate change on greenhouse gas (GHG) emission reduction policies in Bogor Regency. The qualitative approach was chosen because it allows researchers to delve into the context and gain a comprehensive understanding of this complex phenomenon. Through case studies, researchers can explore the experiences, perceptions and responses of various stakeholders, including local governments, communities and industry players, involved in making policies related to GHG emissions.

The data collection process was conducted through in-depth interviews with key informants, as well as field observations to understand how emission reduction policies are implemented in the social and environmental context of Bogor District. Key informants were selected based on certain criteria, such as involvement in environmental policy planning and implementation, and substantial understanding of climate change issues. Field observations were conducted in several representative strategic locations, including agricultural areas, urban areas, and public spaces, so that researchers could directly observe the impacts and community responses to the implemented policies.

The collected data was then analyzed using thematic analysis method, where researchers identified, analyzed, and reported themes that emerged from the data. The analysis process involved coding the data, categorizing the

information, and establishing relationships between the identified themes to understand the dynamics of the interaction between climate change and emission reduction policies. With this methodology, the research is expected to provide in-depth insights and useful recommendations for the development of more effective policies in facing the challenges of climate change in Bogor District.

The flow of the research methodology is presented in diagram form as follows:



Sumber : Ilustrasi Penulis

Picture 3. The flow of the research methodology

RESEARCH RESULT

The results showed that the implementation of the Air Quality Monitoring System (AQMS) in Bogor District has had a positive impact on reducing greenhouse gas emissions (Gobel, et al., 2023). Data from the Bogor District Environmental Agency shows that after the implementation of the Air Quality Monitoring System (AQMS), air quality in Bogor District is in the good/medium category, where previously there was poor air quality. This decrease is also expected in areas that previously had high levels of pollution, such as industrial areas and city centers.

In addition, the use of the Air Quality Monitoring System (AQMS) has also increased public awareness about the importance of maintaining air quality. A survey conducted by the University of Indonesia in 2023 showed that 70% of respondents realized an improvement in air quality after the use of the Air Quality Monitoring System (AQMS). This shows that technology does not only function as a monitoring tool, but also as a means of education for the community.

However, challenges in implementation remain. Some of the obstacles include limited budget for the maintenance of Air Quality Monitoring System (AQMS) equipment and lack of training for officers responsible for its operation. According to research by (Gobel, et al., 2023), officers involved in operating the Air Quality Monitoring System (AQMS) have not received adequate training, hindering the effectiveness of the system.

In the context of broader emission reduction policies, Bogor District has also launched other programs, such as reducing the use of motor vehicles and

increasing the use of renewable energy. These programs aim to reduce dependence on fossil fuels, which are one of the main causes of greenhouse gas emissions. This is in accordance with the Presidential Instruction of the Republic of Indonesia Number 7 of 2022 concerning the Use of Battery Electric Vehicles as Operational Service Vehicles and / or Individual Service Vehicles for Central and Local Government Agencies. Other renewable energy-related policies have been implemented such as one of them at Taman Safari, Cisarua, Bogor Regency (Dewi & Nathalia, 2024).

Overall, the results show that while progress has been made in reducing greenhouse gas emissions in Bogor District, greater efforts are needed to address the challenges and ensure the sustainability of the policies that have been implemented.

DISCUSSION

From the research results obtained, it can be concluded that the impact of climate change on greenhouse gas emission reduction policies in Bogor District is very significant. The implementation of AQMS as one of the technological innovations contributes positively to emission reduction, but challenges in system implementation and maintenance still need to be overcome. This is in line with experts' opinions that the success of environmental policies depends not only on technology, but also on community participation and support from various stakeholders (Annisa & Fadli, 2024).

Comprehensive and integrated policies are essential in dealing with climate change. Bogor Regency needs to involve the community in every stage of policy planning and implementation. According to research by (Riyanto & Kovalenko, 2023), community participation can increase the effectiveness of environmental policies, because people will feel more ownership and responsibility for their environment. Therefore, there needs to be more intensive education and socialization programs to increase public awareness about the importance of reducing greenhouse gas emissions.

In addition, support from the central government is also crucial in supporting local emission reduction policies. Programs funded by the central government can help Bogor District to overcome budget constraints and improve human resource capacity. According to a report from the Ministry of Environment and Forestry (2023), the allocation of funds for emission reduction programs in areas vulnerable to climate change needs to be increased so that policies can be implemented effectively.

In the global context, Bogor District also needs to consider the impact of its emission reduction policies. Policies implemented at the local level must be in line with international commitments, such as the emission reduction targets set in the Paris Agreement. By doing so, Bogor District not only contributes to emission reduction at the local level, but also plays a role in global efforts to address climate change.

Overall, the discussion showed that while progress has been made on greenhouse gas emission reduction policies in Bogor District, more needs to be done to ensure the sustainability and effectiveness of these policies. With a

comprehensive approach and involving all stakeholders, Bogor District can serve as an example for other regions in facing the challenges of climate change.

CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis conducted, it can be concluded that the impact of climate change on greenhouse gas emission reduction policies in Bogor District is very significant. The implementation of AQMS as a technological innovation has had a positive impact on monitoring and reducing greenhouse gas emissions. However, challenges in system implementation and maintenance still need to be addressed to ensure the sustainability of the policies that have been implemented.

Recommendations for Bogor District include additional Air Quality Monitoring System (AQMS) deployment points, increased training for officers operating AQMS, strengthening education and socialization programs for the community, and increased support from the central government in the form of funds and resources. In addition, it is important for Bogor District to continue to adapt to technological developments and global policies in dealing with climate change.

ADVANCED RESEARCH

Further research is needed to explore the long-term impacts of greenhouse gas emission reduction policies in Bogor District. This research could include a more in-depth analysis of the effectiveness of AQMS in reducing emissions, as well as the influence of community participation on the success of environmental policies. In addition, studies on the application of new technologies in emission reduction also need to be conducted to ensure that Bogor District remains at the forefront of climate change mitigation efforts.

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