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INFLUENCE OF THE SURROUNDING ENVIRONMENT STEAM POWER PLANT (PLTU) KEMA SATU VILLAGE, KEMA DISTRICT, NORTH MINAHASA DISTRICT

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ABSTRACT
In today's era, it is important to understand the impact of Steam Power Plant (PLTU) operations on the environment and economy around the plant site, especially in Kema Satu Village. PLTUs, which harness the kinetic energy of steam from geothermal heat, are widely used due to their ease of operation and accessibility of fuel. However, they also have significant impacts, both positive and negative, on local communities. This study aims to assess the environmental and economic impacts of PLTU Sulut 3 on the surrounding area, evaluate its operational efficiency, and determine its contribution to stabilizing and improving electricity supply in North Sulawesi and Gorontalo. The research method used was a combination of qualitative and quantitative techniques to ensure a comprehensive analysis. Data was collected through observation, interviews, and analysis of relevant secondary data. The results show that the PLTU in Kema Satu Village has significant impacts on the local environment, including air and water pollution, soil degradation, and ecosystem disruption. In addition to providing electricity supply and employment opportunities for the local community, the PLTU has also triggered property price inflation and shifts in the local economy. Other negative impacts include damage to the local agricultural sector and increased greenhouse gas emissions. The implications of this study emphasize the need for careful planning, community involvement, and the implementation of sustainable practices to mitigate negative effects on residents and the environment..

Keywords: impacts, residents, economy.

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INTRODUCTION

In this modern era, electricity is essential in all regions where the demand for electricity is increasing (Damara & Yasa, 2019). Alternative power plants are needed (Adam et al., 2019), such as the Steam Power Plant (PLTU) in Kema Satu village, Kema district, and North Minahasa regency. This PLTU is also called PLTU Sulut 3, where PLTU Sulut 3 followed unit 2, which completed the first synchronization on 2 January 2021 and was noted as Commercial of Date (COD) on 21 February 2021. This PLTU is part of the national electricity program of 35,000 MW initiated by the central government, where MCL manages this PLTU. PT Minahasa Cahaya Lestari (MCL), a subsidiary of PT TBS Energy Utama Tbk (TOBA), received the COD (commercial operation date) of the PLTU-3 Sulut project on 18 August 2021. This 2x50 MW capacity project is located in Kema I village, Kema district, North Minahasa regency, North Sulawesi Province. In accordance with the COD declaration issued by PT PLN (Persero) on 18 August 2021, the PLTU-3 Sulut project achieved the commercial operation date (COD) on 1 July 2021. "COD has been achieved within a period of approximately 36

months since July 2018. "COD" on 1 July, 2021, based on the start-up date of the previous Unit 1, with two operating generating units" achieved in February 2021. The existence of this PLTU can have an impact on the surrounding area, which can affect the environmental ecosystem and the economy of the community, especially in terms of electricity supply (Sabubu, 2020). This PLTU will also supply the electricity needs of the North Sulawesi and Gorontalo electricity systems. Currently, the electricity production capacity in the North Sulawesi system is 598.1 MW, with a peak load of 409.5 MW and a reserve of 188.6 MW.

The research on the development and impact of the Steam Power Plant (PLTU) in Kema Satu village, North Minahasa regency, is critical given the increasing demand for electricity in modern times. As electricity is indispensable across all regions, the need for alternative power sources, such as PLTUs, becomes essential to meet this growing demand. The PLTU Sulut 3, a part of Indonesia's national electricity program aimed at generating 35,000 MW, represents a significant effort to enhance the power supply, particularly in North Sulawesi and Gorontalo.

This research is important because it explores the impact of large-scale energy projects like the PLTU on the local environment and economy. Understanding these impacts is crucial for sustainable development, ensuring that while electricity needs are met, the surrounding ecosystem and the local communities' livelihoods are preserved. Additionally, the research highlights the operational milestones of PLTU Sulut 3, contributing valuable data on project timelines and management efficiency in large-scale energy infrastructure.

This research aims to analyze the impact of PLTU Sulut 3 on the local environment: The research aims to assess how the operations of this power plant affect the environmental ecosystem in the surrounding areas. To evaluate the economic impact on the local community: The research will examine how the PLTU's presence influences the local economy, particularly regarding employment, income generation, and community welfare. To study the operational efficiency of the PLTU: The research seeks to document and analyze the timeline of the PLTU's development and operational milestones, offering insights into the effectiveness of project management in large-scale energy projects. To assess the contribution of PLTU Sulut 3 to regional electricity needs: By examining the electricity output of PLTU Sulut 3, the research aims to determine its role in stabilizing and enhancing the electricity supply in North Sulawesi and Gorontalo, contributing to the overall energy security of the region.

METHOD

The research methodology for studying the development and impact of the Steam Power Plant (PLTU) in Kema Satu village, North Minahasa regency, employs a mixed-methods approach, combining qualitative and quantitative techniques to ensure a comprehensive analysis. Key data is collected through in-depth interviews with stakeholders, structured questionnaires distributed to a representative sample of local residents, and environmental sampling to assess air and water quality. The research location is Kema Satu village, directly affected by the PLTU's operations, with approximately 200 respondents participating in the study. Data is processed and analyzed using statistical software for quantitative data and thematic analysis for qualitative data, ensuring a robust interpretation of results. Environmental and economic performance benchmarks are established based on national and international standards, allowing for a thorough assessment of the PLTU's impact on the local ecosystem and economy. This methodology ensures that the research provides valuable insights into the sustainability and effectiveness of large-scale energy projects like PLTU Sulut 3.

RESULTS AND DISCUSSION

Environmental Influence Around The PLTU In Kema Satu Village, Kema District, North Minahasa Regency.

Influence Of The Environmental Ecosystem

The soil and water damage the surrounding ecosystem. Therefore, the management and mitigation of the negative impacts of PLTU are crucial to maintaining a balance between the environment and the negative impacts caused by the presence of a Steam Power Plant (PLTU), which are diverse. Air pollution is mainly caused by the burning of coal as the main fuel for power plants, releasing various harmful substances such as sulfur dioxide, nitrogen oxides, and particles that can pose threats to human health and the environment (Kartika et al., 2019). Additionally, the machines used in PLTU also produce vibrations that can disturb the surrounding community, especially if the PLTU is located near residential areas (Putri, 2021). Another negative impact is radiation and noise generated by the strong cooling fans of the PLTU (Prakoso et al., 2016). Coal waste, which is the residue of the main fuel for PLTU engines, also poses serious problems as it can pollute human health (Handayani et al., 2023).

The impact of Steam Power Plants (PLTU) on the environmental ecosystem is significant and complex. PLTU can affect many environmental aspects, including air, soil, water, and wildlife (Napitupulu et al., 2022). One of the main impacts is air pollution from PLTU, which contains various harmful substances such as sulfur dioxide, nitrogen oxides, and particles. This air pollution causes poor air quality, which can have negative impacts on human health and the ecosystem. In addition to air pollution, PLTU can also affect water quality. The water used in the cooling process of PLTU is hotter than usual, which can disrupt the local aquatic ecosystem.

Furthermore, coal waste produced by PLTU contains various harmful chemicals that can pollute water. The use of water by PLTU can cause problems with the availability of domestic water in the surrounding areas, especially during drought seasons. This can affect river and lake ecosystems and the lives of creatures dependent on these water sources. Besides direct impacts, PLTU can also have indirect impacts on the environmental ecosystem (Sabubu, 2020). For example, the construction of power plants can lead to deforestation and destruction of natural habitats, providing space for the power plants. This can reduce biodiversity and destroy existing ecosystems. Therefore, PLTU operators need to consider the impacts on the environmental ecosystem and take necessary actions to reduce its negative impacts. Efforts such as using more environmentally friendly technologies, better waste management, and natural resource conservation can help reduce the impact of PLTU on the environmental ecosystem (Al Faraby, 2023).

Economic influence on citizens

Steam Power Plants (PLTU) are primarily built to meet the electricity and industrial needs of society (Pontoh et al., 2021). PLTU is an important and efficient source of electrical energy because it can generate large amounts of electricity in a relatively short time (Irawan et al., 2021). Adequate availability of electrical power is crucial to support various daily activities such as lighting, the use of electronic equipment, and industrial needs. In addition to meeting the electricity needs, the construction of PLTU also aims to improve the welfare and standard of living of the community (Lulufani & Setyadharma, 2020). A stable and sufficient electricity supply enables the community to use various facilities and services that require electrical energy, such as water, transportation, and communication. This can improve the overall quality of life of the community.

Furthermore, the construction of PLTU can also create job opportunities for the local community, especially those around the PLTU. Building, operating, and maintaining PLTU require

many technical and non-technical jobs. This will help reduce unemployment and increase the income of the local community. Thus, the construction of PLTU has a significant impact on the community and the local economy (Pramanik et al., 2020). However, to ensure that the construction of PLTU provides maximum benefits to the community, it is important to consider aspects such as environmental management, community participation, and sustainable development.

The development of control plants has a noteworthy effect on the community's economy (Kayupa, 2015). In common, the development of control plants can make unused financial openings, counting coordinates, and backhanded work creation amid the development and operational stages. In expansion, the nearness of control plants can progress, encompassing foundations and administrations, such as streets, clean water, and open transportation, which can progress the general quality of life of the community.

In any case, the financial effect of controlling plant development must be considered carefully. For illustration, the development of a control plant can cause swelling in adjacent property costs, which can make it troublesome for neighborhood individuals to purchase or lease a put to live. In expansion, the presence of control plants can moreover cause changes within the structure of the nearby economy, maybe moving the center from other divisions that are already overwhelmed.

Subsequently, it is critical for governments and designers to consider the overall financial impact of building control plants. With great planning and solid community inclusion, the development of control plants can be a positive financial driver for nearby communities while still considering natural and social maintainability.

CONCLUSION

Overall, Steam Power Plants (PLTU) have a significant impact on the environment. The negative impacts caused by the presence of PLTU include air pollution, machine vibrations, radiation, and coal waste. The burning of coal mainly causes air pollution as the main fuel, which produces harmful substances such as sulfur dioxide, nitrogen oxides, and particles that can have negative effects on human health and the ecosystem. Additionally, PLTU machines can also produce vibrations that can disturb the surrounding community, especially if the PLTU is located near residential areas. It is also necessary to be cautious of radiation and noise from the cooling fans. Besides direct impacts, PLTU also has indirect impacts on the surrounding environment. The use of water by PLTU can affect the local aquatic ecosystem and the availability of domestic water. The construction of PLTU can also result in deforestation and destruction of natural habitats, reducing biodiversity and damaging existing ecosystems. Therefore, the management and mitigation of the negative impacts of PLTU are crucial to maintaining a balance between the environment and human health. Measures such as using more environmentally friendly technologies, better waste management, and protecting natural resources can help reduce the impact of PLTU on the environment.

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