Building Design and Energy Governance in the Bank Central Asia BSB City Semarang Office Building as an Effort to Overcome Impact of Climate Change

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Abstract: One of the key functions of building design in urban areas is to minimize negative environmental impacts. Promoting environmentally friendly architectural practices is essential to ensure environmental sustainability. This study employs a qualitative method with a descriptive approach, focusing on strategies to mitigate the effects of climate change. The findings highlight the importance of implementing eco-friendly design principles in office buildings, such as using energy-efficient lighting that supports the transition to renewable energy sources, ultimately contributing to the reduction of carbon emissions. Additionally, building construction must consider ecological aspects and the surrounding environment to help maintain natural balance. Community involvement in adopting sustainable design practices reflects growing environmental awareness and plays a significant role in reducing emissions that contribute to climate change.

Keywords: *Building Design*, *Environment*, *Community*, *Effort*, *Climate*

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1. Introduction

Climate change has become one of the greatest environmental challenges facing all of component ecosystems in the 21st century. This phenomenon is attributable to the augmented levels of greenhouse gas emissions, a consequence of anthropogenic activities, such as the use of fossil fuels and deforestation, that has been significantly change in global temperature. Its far-reaching and devastating impacts include rising sea levels, increased intensity of storms, floods, droughts and changes in extreme weather changes. Climate change that occurs around the world has a significant impact on architectural design and construction. The main function of architecture is to create a better living environment by adapting to and defying existing climatic conditions. However, achieving a balance between climate and architecture is a complex challenge, given the many branches of science involved.

Richard Neutra, a renowned architect, in his book "*Survival Through Design*" states that achieving a balance between climate and architecture involves many factors and challenges that must be overcome. Where, the process of designing architecture, the influence of climate is focused on the aspect of human comfort in the building and the implementation of activities in it (Neutra, 1954). To achieve this, several aspects must be considered. Solar radiation must be optimized with proper window placement and the use of shading to make efficient use of sunlight. Then, good air movement should be considered through cross-ventilation or the use of openable windows. In addition, air humidity regulation, rainfall handling, and average air temperature must also be considered (Chandra & Purwanto, 2022).

Climate change is a global challenge that has a significant impact on various sectors, such as infrastructure, roads, buildings, roads, dams, bridges, and transportation systems are becoming vulnerable to extreme weather conditions. Buildings that are not designed for extreme climates poses a risk of structural damage, while roads and bridges are threatened by flooding and erosion. Then, dams also face the risk of drought or excessive rainfall (Chandra & Purwanto, 2022). These conditions have the potential to disrupt access to transportation, clean water supply and other public services. Office buildings are one of the infrastructures that can contribute to increasingly energy consumption and carbon emissions, due to the use of electronic devices, lighting systems, and air conditioning. Given that most of the electrical energy still comes from fossil sources, the issue of energy efficiency and environmentally friendly building design is important to study as an effort to mitigate climate change in the infrastructure sector (Rafi et al., 2023).

Climate change is not only an environmental problem,it also has a serious impact on human life and the infrastructure that supports it, such as office buildings. Office buildings are one type of building that has a large contribution to carbon emissions and high energy use. This is due to daily activities carried out in the building such as electronic equipment, lighting, and air conditioning systems (Rafi et al., 2023). The utilization of substantial electrical energy can serve to augment the carbon emissions that are produced, as activities that necessitate energy will result in the emission of carbon dioxide (CO_2) gas.

Therefore, managing energy utilisation in office buildings efficiently needs to be taken various steps to reduce negative impacts on the environment. The use of environmentally friendly technologies such as energy-efficient lights, efficient cooling systems, and renewable energy can be part of office management to reduce carbon emissions (Rafi et al., 2023). In addition, energy saving programs such as routine

maintenance of buildings, educating employees about the importance of energy saving, and optimizing the use of energy sources can also be carried out.

By managing office buildings more efficiently, it is hoped that it can reduce carbon emissions and large energy use, as well as create a cleaner and healthier environment. However, in building infrastructure, it is also important to pay attention to ecological aspects or the surrounding environment to maintain the balance of nature (Angela, 2023). Unfortunately, there are some individuals who demonstrate a lack of concern for the surrounding environment. This habit consequences could significantly impact the future.

In this case, Bank Central Asia (BCA) is one of the financial institutions that has the opportunity to lead change towards sustainable development by adopting environmentally friendly building design and governance (Hidayatulloh & Anisa, 2021). Based on this background, these are the research question of this article, as follows: *First*, how does the architectural design of the Bank Central Asia Office Building in BSB City Semarang affect the energy performance and reduce the impact of climate change? *Second*, which energy management strategies can be implemented in BCA of BSB office buildings to enhance energy efficiency and reduce carbon emissions? *Third*, what are the impacts of implementing building design and energy management on building performance and the surrounding environment?

2. Materials and Method

The research method is a process of collecting data to complete the systematics of the research. In a research, methods have a very important role so that they can achieve the desired research objectives. This research was conducted by a qualitative field research method. Basically, qualitative research provides, explains, and describes critically, in describing a phenomenon, event, or event in social interaction of the community to seek and find some meanings in the real context (natural setting) (Yusuf, 2014). In this qualitative research method, one can start from problem identification to reporting systematics, which is carried out periodically, orderly, orderly, and systematically.

The techniques used by the researcher in collecting data in the research are observation, interviews, and documentation. Observation is a data collection technique carried out through observation accompanied by observation of the state or behaviours of the target object (Herdiansyah, 2019). In this study, the researcher used a non-participatory observation technique, which means that the researcher is only an observer, by performing its function, namely holding an observation. In observers or researchers, in collecting data they are not directly involved in the daily lives of the people being observed, because in this technique the researcher is more focused on making an observation of the object being observed, so as to produce valid data and in accordance with the conditions being observed.

Meanwhile, interviews are one of the data collection techniques. An interview is a face-to-face conversation between the interviewer and the informant source, where the interviewer asks directly about an object that has been researched and has been designed in advance (Yusuf, 2014). This interview process will be conducted by the researcher to the informant directly by visiting the informant's residence. In this case, the researcher will conduct a direct interview with the informant by asking open-ended questions accordance with the purpose of the research conducted. The selection of informants is carried out using a purposive technique, which means that informants are taken based on certain criteria that are considered relevant for

research purposes. In addition, the interview process in this study will be carried out using an unstructured interview method or an in-depth interview. An unstructured interview is an interview that asks different questions to each different interviewee but still has the same benchmark and theme. The questions asked by the interviewer depend on the situation, conditions, and what aspects of the information are needed. With this flexibility, unstructured interviews can make it easier for interviewers to assess the personality, character, and other things of the candidate that cannot be easily seen in a structured interview. Through in-depth interviews, it is expected that researchers can find out more in-depth things that cannot be found through observation.

3. Result and Discussion

Climate change is a situation where weather patterns change significantly due to all ecosystem activities, such as greenhouse gas emissions. This situation causes serious problems that are directly faced by humans such as rising temperatures so that the temperature becomes hotter, for example reaching 40°C, extreme weather changes such as excessive rainfall and also an increase in the volume of seawater. In facing this problem, the Bank Central Asia of BSB City Semarang Office Building is making efforts to deal with this climate change by regulating Building Design and Energy Governance. By applying this method, the design of buildings will take into account important aspects such as efficiency and environmentally friendly materials to reduce global warming. The combination of innovative building design and good energy governance strategies, the Bank Central Asia BSB City Semarang Office Building is proof that the event is in the face of climate change. Based on this, there are several literature review references used by the author to analyze discussions related to the topic to be discussed.

First, "Technology-Based Green Building For Greener Productivity: Benefits And Challenges" by (Widiyati & Al, 2023). In this journal, it discusses the benefits and challenges of technology-based green buildings to increase productivity more sustainably. Green building design aims to reduce environmental pollution, use natural resources efficiently, and improve productivity health. This study uses innovation diffusion theory to understand the spread of innovative ideas and technologies in social systems. Research was conducted in Bay View, a campus that uses renewable energy, and San Francisco as an example of a leader in sustainability practices. The main focus is on energy efficiency as the key to achieving sustainability, with planned consequences including disaster management and environmental balance. Although the initial construction cost of green buildings is higher, the life cycle and maintenance costs tend to be cheaper in the long run.

Second, "Analysis of the Impact of the Use of Renewable Energy, Energy Efficiency, and Green Technology on Carbon Emission Reduction in the Tangerang City Manufacturing Industry" by (Judijanto et al., 2023). This study investigates the complex relationship between the use of renewable energy, energy efficiency measures, the adoption of environmentally friendly technologies, and the reduction of carbon emissions in the manufacturing industry in Tangerang City. Quantitative analysis using Structural Equation Modeling (SEM) was carried out on a sample of 150 manufacturing companies. Descriptive statistics, assessment of measurement models, and structural model analysis are used to evaluate the impact of sustainable practices on carbon emissions. The results show a significant positive relationship between the use of renewable energy, energy efficiency, and the adoption of

environmentally friendly technologies, as well as substantial reductions in carbon emissions.

Third, "Green Construction Management in the Context of Civil Engineering" by (Tanubrata & Gunawan, 2016). In the study, it is explained below that there are materials that must be considered in carrying out a development, such as sustainability aspects and the materials used must be environmentally friendly, meaning that they do not cause pollution that can cause damage to the surrounding environment. Furthermore, the energy used in a building to be environmentally friendly must minimize the use of fuel and oil and gas and be replaced with alternative energy, namely solar energy by making solar panels as ventilation or windows of the house.

Fourth, "Green building in sustainable development of energy-saving concept towards green building in Jakarta" by (Widyawati, 2019). This journal explains the role of the government in efforts to implement the concept of development. What things must be considered in the construction of skyscrapers, precisely in the Jakarta Area, to overcome environmental degradation due to the worsening conditions in Jakarta due to the construction of many high-rise buildings. There are several concepts that must be considered in building skyscrapers, especially in Jakarta, among others, namely: Land Use Suitability (ASD), Energy Efficiency and Conservation (EEC), Water Conservation (WAC), Material Sources and Cycles (MRC), Air Quality and Space Comfort (IHC), and Building Environmental Management (BEM).

Fifth, "The Impact of Climate Change on the Economic and Transportation Sectors" by (Kurniasih & Dewi, 2023). This journal explains related to the effects caused by climate change on the economic and transportation sectors. Starting from an increase in the earth's temperature, rising sea levels, extreme weather changes, and others. This study uses a narrative qualitative method, which is a type of qualitative research method, where to obtain research data, the researcher conducts a study individually or in a group. The purpose of choosing this method is to prepare a systematic study of problems and facts by analyzing data and facts, then developing hypotheses and conclusions based on the research conducted. The results of this study find out the sectors that contribute the largest carbon emissions, the comparison of the need and availability of fossil fuels, and information on the impact of climate change on the world of transportation (Kurniasih & Dewi, 2023).

Sixth, "Challenges in Efforts to Overcome the Impact of Climate Change and Support Sustainable Economic Development: A Review" by (Malihah, 2022). The discussion in this journal is related to various challenges in overcoming climate change and supporting sustainable development. These efforts and policies are by applying the concept of circular economy, which is considered anti-synthesis of linear economic activities, reducing the use of fossil fuels to carbon tax policies. However, all of these policies must also be understood and supported by all parties. Not only the government but must involve all elements in the private sector, entrepreneurs and also the community. Awareness and participation of all parties are needed so that the impact of climate change can be overcome, and sustainable development can be implemented. This effort is not only for the current generation but for future generations (Malihah, 2022).

Seventh, "A Study of Sustainable Architecture Principles in Office Buildings (Case Study of Menara BCA Jakarta)" by (Hidayatulloh & Anisa, 2021). In this journal, it is explained about sustainable architecture creating environmentally friendly buildings

that focus on a more efficient and economical quality of life by reducing the use of natural resources, thereby protecting the environment for the sustainability of current and future generations. The research method used in this study is qualitative descriptive. The purpose of this study is to understand the principles in the concept of Sustainable Architecture and how to apply the concept of Sustainable Architecture to office buildings (Hidayatulloh & Anisa, 2021).

Eighth, "Green Infrastructure Framework: A National Green Infrastructure Development Strategy" by (Heryana & Firmansyah, 2024). The purpose of this study is to review the extent to which the potential application of the green infrastructure framework can be used as an internal strategy for green infrastructure development in Indonesia. This research was conducted using a qualitative approach to synthesize various studies on the impact of infrastructure development in Indonesia related to the principles and standards contained in the green infrastructure framework to reduce this impact. The results of the study show that the implementation of the Green Infrastructure Framework can be a government strategy in an effort to develop national green infrastructure to reduce the negative impact of infrastructure development on the environment by adopting the framework, this is covered in various infrastructure development policies or regulations (Heryana & Firmansyah, 2024).

3.1. Comparison of Energy Consumption Data Before and After the Implementation of Energy Governance Strategies

In the implementation of the energy governance strategy, the Bank Central Asia BSB City Semarang Office Building can be used as an example of the success of this strategy. Prior to the innovation in the procurement of energy governance strategies, the Bank Central Asia BSB City Semarang Office Building was one of the buildings with an energy consumption of around 1000 kWh/month. Since climate change is quite significant, of course, this large energy consumption has begun to become a serious problem. Employees complained about poor air circulation and discomfort at work. In addition to having an impact on employee comfort, excessive energy consumption makes operational costs overrun and also affects dependence on coal and petroleum, which are non-renewable resources. Therefore, this is a discussed to find a solution, i.e. the implementation of an energy governance strategy.

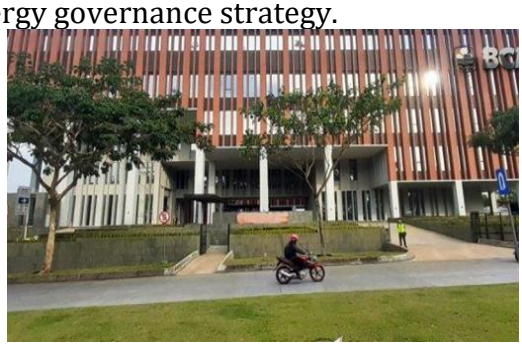

Figure 1. BCA of BSB Office Building

After implementing an energy governance strategy, the data shows that there is a significant change in the building's energy consumption. It is shown that the implementation of this strategy has succeeded in reducing 200 kWh so that the energy consumption of the Bank Central Asia BSB City Semarang Office Building is 800 kWh/month.

"Yes, I think this building is quite comfortable with additions such as plants in the office area that make the atmosphere supportive in doing work. I also sometimes take overtime in the office to complete my work, it is not a problem at all to melt because of the comfort that this building has,"

(an employee of BCA of BSB City Office)

This decrease in energy consumption has a very good impact on the comfort of workers in the building. In addition to saving expenses on operational costs, the implementation of this strategy also has a good impact on the curve in reducing carbon emissions and is an effective way to deal with climate change that is quite extreme. These rare steps not only lead to sustainable operations in economic efficiency but also make a positive contribution to the global role of protecting the environment and reducing carbon emissions.

3.2. Factors Affecting a Building's Energy Performance and the Effectiveness of an Energy Governance Strategy

Energy management is the proactive and systematic monitoring, control, and optimization of an organization's energy consumption to save on usage and reduce energy costs. Energy management includes small actions such as monitoring monthly energy bills and switching to energy-efficient light bulbs. This could mean broader improvements such as adding insulation, installing reflective roof coverings or upgrading HVAC (heating and cooling) equipment to optimize energy performance.

Figure 2. BCA of BSB Inner Building

More advanced energy management programs utilize technology. For example, utility tracking software predicts future energy use and plans energy budgets, which helps a company's strategic decision-makers to ensure its energy management strategy is correlated with financial goals and planning. Enterprise management software uses IoT, advanced connectivity, and big data, which allows companies to leverage energy data analytics for better facility management, and helps address energy consumption and energy management challenges.

"In the implementation of the energy governance strategy, of course, it is inseparable from the factors that support the smooth running of this strategy,"

(an employee of BCA of BSB City Office)

Based on the results of the interview, the building's energy performance and the effectiveness of the energy governance strategy are related. Thus, according to the informant, several factors that affect the energy performance of the building and the effectiveness of the energy governance strategy in the Bank Central Asia BSB City

Semarang Office Building include the following. *First*, an understanding of the Energy Management System. Parties who do understand the energy management system are needed before implementing an energy governance strategy. By involving potential parties, this implementation will consider the plus-minus aspects of this strategy. The design of the building will be considered more such as the management of space and the materials used in its construction. It can also be considered whether this reduction in energy consumption influences the Bank's performance? Does this decrease in energy consumption have a good effect on the environment? How does the application compare and not implemented? *Second*, the use of low-energy equipment. In the selection of equipment and systems in the building, consideration is needed regarding the impact of their use, such as lighting and energy control systems, which are very influential in ensuring optimal energy performance. *Third*, local climate considerations. In addition to an understanding of energy management systems and equipment selection, local climate is an important consideration. In addition to reducing energy consumption, it is also necessary to adjust to the local climate at the location of the building. *Fourth*, the awareness from the workers. In order to implement an energy governance strategy in the Bank Central Asia of BSB City Office Building, awareness is needed from all people who work in it. Although efforts have been made to reduce energy consumption, if the workers are not willing to cooperate, the implementation will result nothing. Awareness from workers can contribute greatly to reduce energy consumption such as turning off lights or air conditioners when these instruments are not in use. *Fifth*, government regulations and policies. In addition to the involvement of related parties in the implementation of the energy governance strategy, the government also has an important role in the long-term implementation of energy governance strategy. By issuing strict regulations and policies regarding strict energy efficiency standards, this strategy will be sustainable.

3.3. The Impact of The Implementation of Building Design and Energy Governance on The Performance of The Building and The Surrounding Environment

The implementation of building design and energy governance has a very good impact on the performance of the building, namely, the Bank Central Asia of BSB City Semarang Office. The building is a more comfortable and environmentally friendly working environment and produces better air quality and has an impact on customer's comfort so that it can also add benefits to the company. Meanwhile, the use of renewable equipment and energy adds to the efficiency of the building's performance. It is also a form of saving on natural resources such as fossil fuels. The implementation of this energy governance strategy is also a support for sustainable development goals such as sustainability, environmental comfort and energy poverty reduction.

Figure 3. Central of BCA of BSB City Building

The implementation of building design and good energy governance has a significant impact on the performance of the building and the surrounding environment. The following are the significant impacts that occur regarding the implementation of building design and energy governance on the performance of the building and the surrounding environment. *First* is the impact on building performance such as energy efficiency design, such as the use of good insulation materials, natural lighting systems, and optimal ventilation that can reduce energy consumption. This not only lowers operational costs but also reduces the load on the energy system. Then in terms of resident comfort, a design that considers aspects of thermal comfort, air quality, and natural lighting can increase the comfort and productivity of building residents. A comfortable and healthy environment contributes to the well-being of building users. Reduction of operational costs by efficient energy management which lead to costs minimization for heating, cooling, and lighting. In addition, the implementation of smart technology to control energy usage can further optimize spending. The durability and longevity of the building is obtained by a high-quality and sustainable design. By such design, the durability of BCA building in BSB city will be increased that it can stands against extreme weather conditions and risk of damage, thereby extending the life of the building and reducing maintenance costs. *The second* is impact is the impact on the environment around the BCA of BSB City office building. It can reduce carbon emissions, because the use of renewable energy sources such as solar panels or earth heating technology that can reduces dependence on fossil fuels, reduces carbon emissions and hence negative impacts on climate change. *The third* is impact on the conservation of natural resources. By a design that uses environmentally friendly materials and recycling, the conservation of natural resources could be optimized. In addition, efficient water management can reduce water consumption and minimize excessive waste. Other impacts include a reduction in *the Urban Heat Island Effect* by implementing green spaces, roofs with wide lighting displays, and green walls in building design. The urban *heat island* effect often leads to an increase in temperature in urban areas. Its reduction will helps improving air quality. Improving the quality of life of humans around the building designed by environmental sustainability contributes to improving the quality of life of the surrounding community. Therefore, green spaces and inclusive design can create a healthier and more enjoyable environment, especially for life, work, and activities inside and outside the building.

4. Conclusions

The architectural design and energy management strategies implemented at the Bank Central Asia BSB City Semarang Office Building reflect the company's commitment to addressing climate change and promote environmental sustainability. These efforts have dual impacts of reducing carbon emissions and enhancing air quality, so it can create more comfortable environment for employees and visitors, which in turn increases satisfaction and productivity.

Effective energy governance contributes to building performance by increasing energy efficiency and occupant comfort, also positively impacting the surrounding environment. The success of this initiative shows the potential for environmentally friendly architectural building design to support ecological conservation and business performance. It is expected to inspire similar practices in future building developments as part of climate change mitigation efforts.

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