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Masjid Az-Zikra Sentul: Transformasi dari Eco-Masjid ke Eco-Sosial

Az-Zikra Sentul Mosque: Transformation from Eco-Mosque to Eco-Social

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Abstrak: *Masjid bukan hanya tempat ibadah, tetapi juga berfungsi sebagai pusat pendidikan dan perubahan sosial. Mengingat tantangan lingkungan yang semakin meningkat, masjid memiliki peran penting dalam meningkatkan kesadaran ekologi. Penelitian ini mengkaji implementasi prinsip-prinsip ramah lingkungan di Masjid Az-Zikra di Sentul, Bogor, selama periode kepemimpinan Ketua Yayasan Khotib Kholil (2016-2022), serta peran masjid tersebut dalam mengedukasi masyarakat tentang pelestarian lingkungan. Melalui penelitian kualitatif yang melibatkan wawancara, observasi, dan dokumentasi, studi ini menelusuri berbagai inisiatif ramah lingkungan di masjid tersebut, yang mencakup optimalisasi penggunaan air, desain arsitektur bioklimatik bangunan masjid, pemanfaatan biogas, pengelolaan sampah dengan teknologi insinerasi, pengelolaan ruang hijau perkotaan, dan gerakan sedekah sampah botol plastik. Informan penelitian mencakup*

pengurus masjid, jamaah, relawan, dan masyarakat sekitar. Dengan menggunakan Teori Co-management Sumber Daya Alam (Commons Management) dari Elinor Ostrom, penelitian ini membuktikan bahwa Masjid Az-Zikra tidak hanya berhasil mengimplementasikan praktik-praktik ekologi secara efisien dan sesuai dengan standar eco-mosque dari Green Building Council Indonesia (GBCI), tetapi juga mampu menjadikan kegiatan ekologis di masjid sebagai media edukasi ekologi yang efektif bagi masyarakat lokal dengan melibatkan mereka secara langsung dalam aktivitas peduli lingkungan seperti sedekah botol plastik dan terlibat dalam pembakaran sampah bebas asap menggunakan teknologi insinerasi. Temuan penelitian menunjukkan bahwa masjid mampu menerapkan pendekatan holistik terhadap keberlanjutan dengan mengoptimalkan sumber daya alam, memberikan pendidikan ekologi, serta mengintegrasikan kesadaran lingkungan dengan nilai-nilai spiritual. Rekomendasi penelitian ini meliputi peningkatan kolaborasi antara masjid dan masyarakat, penguatan kemitraan dengan pemerintah dan sektor swasta, mendorong masjid lain untuk mengadopsi praktik ramah lingkungan, pengembangan modul pendidikan agama yang mengintegrasikan kesadaran ekologi, dan penciptaan sistem evaluasi untuk mengukur dampak inisiatif lingkungan masjid secara berkelanjutan.

Kata Kunci: *Masjid Az-Zikra, Eco-Masjid, Eco-Sosial, Ramah Lingkungan*

Abstract: *Mosque is not only place for worship, but also serve as center for education and social change. Given the increasing environmental challenges, mosque has an important role in raising ecological awareness. This study examines the implementation of eco-friendly principles at Az-Zikra Mosque in Sentul, Bogor, during the period of Khotib Kholil Foundation Chairman (2016-2022), as well as its role in educating the community about environmental conservation. Through qualitative research involving interviews, observations, and documentations, this study explores various environmentally friendly initiatives at the mosque, which include maximizing water usage, bioclimatic architectural design of mosque building, utilization of biogas, waste management with incineration technology, urban green space management, and plastic bottle waste alms movement. The research informants include mosque administrators, worshipers, volunteers, and*

the surrounding communities. Using Elinor Ostrom's Theory of Co-management of Natural Resources (Commons Management), this study proves that Az-Zikra Mosque is not only successfully implements the ecological practices efficiently with the evidence of successfully applying the concept of eco-mosque according to Green Building Council Indonesia (GBCI) standards, but also able to make ecological activities at the mosque as an effective medium of ecological education to the local community by involving them directly in environmentally conscious activities such as donating plastic bottles and participating in smokeless waste incineration using incineration technology. This research finds that mosque is able to apply a holistic approach to sustainability by optimizing natural resources, providing ecological education, and integrating environmental awareness with spiritual values. This research recommendations include increasing collaboration between mosques and communities, strengthening partnerships with government and the private sector, encouraging other mosques to adopt environmentally friendly practices, developing religious education modules that integrate ecological awareness, and creating an evaluation system to measure the impact of mosque environmental initiatives on an ongoing basis.

Keywords: *Az-Zikra Mosque, Eco-Mosque, Eco-Social, Eco-Friendly*

A. Introduction

Mosques as places of worship have an important role not only in spiritual aspects, but also as centers of education and social change for the community. In the context of increasingly pressing environmental issues, mosques can function as pioneers who educate people about the importance of preserving nature. Islam teaches that protecting the earth is part of man's mandate as a caliph, emphasizing the responsibility to do no damage and maintain the balance of nature.[1]

In various historical literatures, there are explanations regarding the multifaceted functions of mosques during the time of the Prophet Muhammad (peace be upon him). Mosques at that time were not

merely places of worship, such as for prayer, dhikr, and other acts of devotional worship, but also served as centers of education and teaching, where religious and Islamic teachings were conveyed to all members of the Muslim community regardless of their social status. Furthermore, mosques played a pivotal role as centers for resolving legal issues among the community, including disputes, cases of adultery, and other legal matters. They also functioned as hubs for economic empowerment through the management of Baitul Mal, as centers for disseminating Islamic information, as well as venues for training military forces and managing the administrative affairs of the Prophet's governance. These functions demonstrate that, from the very inception of mosque construction by the Prophet, mosques were envisioned not solely as places of worship but as multifunctional institutions central to the development of Islamic civilization.[2]

Az-Zikra Mosque in Sentul, Bogor, is a clear example of implementing this teaching through concrete steps to become an eco-friendly mosque. Az-Zikra Mosque has implemented various eco-friendly principles that reflect its commitment to sustainability.

Based on a survey by the Green Building Council Indonesia (GBCI), the Az-Zikra Mosque was certified as an environmentally friendly place of worship through several indications of eligibility for appropriate site development, energy efficiency and conservation, water conservation, material resources and cycle, indoor health and comfort, and building environment management.[3] In addition to having green building standards, the Az-Zikra Mosque is a medium for ecological education for the community. In accordance with the Decree of the Director General of Bimas Islam Number 463 of 2024 concerning instructions for implementing friendly mosques, this place of worship has applied environmentally friendly standards which include being adaptive to environmental sustainability, energy efficient, and comfortable for the people who live around

it (Ministry of Religion of the Republic of Indonesia, 2024). In 2015, the Indonesian Ulema Council (MUI) in fatwa number 01/ MUNAS-IX/MUI/2015 also stipulated several things to realize the eco-mosque program.[4]

There have been many studies related to the social role of mosques. Letmiros' research (2020) explains the contribution of the Jogjakarta Jogokarian Mosque to community service and empowerment.[5] Then, research by Efiyanti et al (2021) on the Great Attaqwa Mosque in Pancor, East Lombok, found that the mosque's independent economic program can support the social welfare of the community's social welfare in the economic sector.[6] Furthermore, Malawati and Arif examined (2020) the role of the Imadudding Mosque in Bandung in social roles in da'wah, economy, and education.[7] Not much different, research by Zulmaron et al (2017) also examined the social role of the Amal Mosque in Palembang in these three aspects which involved more mosque youth.[8] Next, Kurniawan's study (2015), without the object of a particular mosque, explains the significant social role of mosques in religious moderation values. In contrast to existing studies, the author's study will discuss the role of the Az-Zikra Sentul Mosque, Bogor, in implementing eco-mousque and ecological education in the community.[9]

This study aims to examine the implementation of environmentally friendly principles at the Az-Zikra Mosque and analyze its role as a social instrument in educating the public about the importance of protecting the environment. It will also explore the real impact of the mosque's environmental programs and the challenges it faces in its efforts to become a green pioneer. By raising the Az-Zikra Mosque case study, it is hoped that this research can provide in-depth insight into the mosque's contribution to environmental conservation efforts and provide a model for other mosques to implement similar concepts. In addition, the mosque

is also expected to have a real ecological impact with community involvement as a form of social ecology education.

This study uses a qualitative approach with data collection techniques in the form of interviews, observation, and documentation. Research informants include mosque administrators, worshipers, volunteers, and the surrounding community. Field observations were conducted to directly assess the implementation of the eco-mosque concept. Then this research also uses the Natural Resources Co-management Theory (Commons Management) by Elinor Ostrom. Commons Management is used to analyze the extent to which the Az-Zikra Mosque involves the community in ecological activities and educates them through social-educative ecological work.[10] The primary sources of this research are interviews and direct observation data to the field, while secondary sources include books, articles, and other related data. The research location is Az-Zikra Sentul Mosque, Bogor, West Java, and this research is limited to the leadership period of the Khotib Kholil Foundation Chairperson (2016-2022). During Kholil's leadership, the implementation of the eco-mosque at Az-Zikra Mosque was maximized.

B. Result And Discussion

1. Eco-Mosque Concept

The concept of "eco-mosque" derives from two words: "eco" and "mosque." "Eco" comes from the term "ecology," which is closely related to ecosystems—systems formed by the reciprocal relationships between diverse forms of life and their habitats. Meanwhile, "mosque" in the context of Islamic law (syara') refers to a place for prayer and the execution of Islamic rituals. From this concept, it can be understood that an "eco-mosque" is a place of worship that emphasizes the sustainability of relationships between all components of life and their environment, focusing on the management

of the mosque through three main aspects: idārah (management), imārah (prosperity activities), and ri'āyah (maintenance and facilities).[11] Thus, an eco-mosque serves as a multifunctional community center that is strategically located, easily accessible, environmentally friendly, supports local businesses, and enhances social interaction and knowledge exploration.[12]

An eco-mosque, or environmentally friendly mosque, emphasizes the monitoring and preservation of the environment. This mosque takes local microclimate into account in its architectural design, utilizes local materials, respects the surrounding environment, reduces negative impacts on quality of life and the environment, and provides a comfortable atmosphere for its users. It is characterized by environmentally friendly features or sustainability aspects, reflecting the management responsibilities entrusted by Allah. More specifically, an eco-mosque refers to a condition in which implemented practices can minimize or avoid environmental damage. Therefore, mosques that adhere to the eco-mosque concept are built in safe environments while prioritizing ecological and environmental protection aspects to ensure environmental sustainability.[13]

Several initiatives for implementing the eco-mosque (green mosque) concept need to be undertaken within a country. First, in the construction of new mosques, architectural plans should be designed by professional architects and approved by the authorities. To ensure an environmentally friendly environment, the construction of mosques must consider the interests of all parties, including congregants and the surrounding community. One of the main characteristics of green buildings or ecological buildings is that they do not disrupt ecological balance. It has been found that numerous anthropogenic factors currently disrupt ecological and environmental balance. Therefore, awareness of the importance of constructing buildings with environmentally friendly de-

signs is essential. This aims for mosque buildings to benefit not only the environment but also humanity. Green buildings refer to structures and processes that are environmentally responsible and resource-efficient throughout the building's lifecycle, starting from design planning, construction, operation, maintenance, renovation, to deconstruction. Generally, ecological buildings that fall under sustainable architecture are constructed from materials that can generate energy independently, use natural and renewable energy sources, and contain fewer toxic materials or are made from recycled materials. The main feature of such buildings is their minimal impact on the environment, thanks to the use of technological facilities.[14]

Second, several aspects such as the design of the roof, doors, and windows of the mosque need to be carefully planned to ensure the utilization of natural light during the day, thereby reducing the use of electricity and other energy sources. The installation of solar panels in mosques should also be considered to reduce electricity consumption. Such designs aim to achieve low carbon emissions. Furthermore, to ensure an environmentally friendly environment, greening activities are essential. Suitable and beneficial green trees can be planted on the mosque complex's roof, in the front yard, in window alcoves, and in other areas around the mosque. This can create a beautiful and inviting environment while representing the Islamic concept of gardens in paradise.[15] The Quran mentions:

اِنَّ الَّذِيْنَ اٰمَنُوْا وَعَمِلُوا الصّٰلِحٰتِ كَانَتْ لَهُمْ جَنّٰتُ الْفِرْدَوْسِ نُزُلًا ۙ خٰلِدِيْنَ فِيْهَا لَا يَبْغُوْنَ عَنْهَا حِوَلًا ۝١٠٨

"Indeed, those who have believed and done righteous deeds will have gardens of Paradise as a lodging. They will abide therein eternally, they will not desire from it any other place."

This is further emphasized in the hadith of Prophet Muhammad:

مَا مِنْ مُسْلِمٍ يَغْرِسُ غَرْسًا۞ أَوْ يَزْرَعُ زَرْعًا۞ فَيَأْكُلُ مِنْهُ طَيْرٌ أَوْ إِنْسَانٌ أَوْ بَهِيمَةٌ۞ إِلاَّ كَانَ لَهُ بِهِ صَدَقَةٌ[17]

"There is none amongst the Muslims who plants a tree or sows seeds, and then a bird, or a person or an animal eats from it, but is regarded as a charitable gift for him.

2. Social Ecology Concept

Social ecology is a theoretical framework that integrates ecological and social perspectives to comprehend the complex interactions between humans and the environment. This approach emphasizes the importance of considering both ecological and social aspects simultaneously when analyzing environmental issues and striving for sustainability. One relevant branch of thought within social ecology is ecofeminism, which highlights the connection between human domination over nature and the domination of women. This perspective underscores the importance of fighting against all forms of domination, both towards nature and towards humans.[18]

Beyond ecofeminism, there are several other theories and approaches related to social ecology. Social metabolism theory, for example, portrays the relationship between humans and the environment as a system in which humans utilize natural resources to meet their needs and dispose of waste into the environment. Political ecology, on the other hand, studies the interactions between power, economy, and the environment, and highlights the inequalities and conflicts that arise in the management of natural resources. Everyday life ecology emphasizes the importance of understanding how the daily environment shapes human behavior and decisions related to the environment. This approach highlights how daily practices can contribute to either environmental sustainability or degradation. Meanwhile, green social ecology combines the concepts of social ecology with the sustainability agenda, em-

phasizing the importance of ecological solutions in addressing social and environmental problems.[19]

In addition, there are approaches that emphasize the need to change social structures, economic systems, and cultural values to achieve ecological sustainability. The social-ecological resilience approach, for example, focuses on the capacity of social-ecological systems to cope with changes and disturbances. This approach highlights the importance of adaptation, learning, and cooperation in addressing ecological challenges. Various approaches and theories in social ecology contribute to a more holistic understanding of the dynamics of interactions between humans and the environment. They promote sustainable policies and actions in environmental management and the achievement of sustainability.[20]

The concept of social ecology can also be studied at various scales or levels. Social ecological scale refers to the level or scope at which social ecological phenomena and processes can be observed and analyzed. This scale can encompass various levels of organization, ranging from the individual to the global level. The individual scale involves the analysis of individual interactions with the environment and the individual's role in decision-making related to the environment. The group and community scale involves the analysis of interactions and social dynamics among groups and human communities. The regional or territorial scale involves the analysis of patterns of social interaction and human-environment relationships in a larger geographic area. The national scale involves the analysis of national policies, environmental laws, political dynamics, and natural resource management practices at the national level.[21]

The global scale involves the analysis of global connections and interactions within the context of social ecology. Studies at this scale encompass issues such as climate change, international trade, migration, and global environmental policies. These global issues

have a significant impact on the environment and societies worldwide, thus necessitating a global approach to their management. Understanding the scale of social ecology is crucial for recognizing the complexity of human-environment relationships at various levels of organization. This aids in formulating appropriate policies and management strategies to maintain ecological balance and sustainability at suitable levels. By comprehending how social ecological processes operate at different scales, we can develop more effective solutions to address complex environmental and social problems.[22]

Az-Zikra Sentul Mosque is a place of worship that has successfully implemented the concept of an eco-friendly mosque. Through various programs, such as plastic bottle collection and waste processing using incineration technology, the mosque involves the active participation of the surrounding community. These activities demonstrate the application of ecological principles at the group level, where mosque administrators, congregants, and the community collaborate to protect the environment.

3. Az-Zikra Mosque Profile

Initially, Az-Zikra was a gathering of various majlis taklim (Islamic study groups) in the Mampang area, Depok, conducting activities at the Al-Amru Bittaqwa Mosque. Previously, this mosque was a park used by local residents as a recreational space. Due to the lack of worship facilities in the area, the community agreed to convert the park into a mosque, serving as a place of worship and a center for Islamic propagation. Thus, in 1995, Al-Amru Bittaqwa Mosque was established, named after one of Arifin Ilham's teachers, Irfan Amara Bittaqwa. Arifin Ilham subsequently assumed leadership of the mosque. Arifin Ilham began organizing zikir (Islamic remembrance) gatherings, initially conducted independently. Gradually, these gatherings attracted followers. In response to the congregation's suggestion to expand these

gatherings into a broader medium for Islamic outreach, Arifin Ilham founded the Az-Zikra majlis zikir. Over time, Az-Zikra evolved beyond a simple majlis zikir. Under Arifin Ilham's leadership, Az-Zikra began offering manasik (hajj and umrah pilgrimage) programs in collaboration with several travel agencies, and it grew into a foundation providing family and youth counseling services, as well as managing an orphanage.[23]

According to the website simas.kemenag.go.id, the Az-Zikra Foundation was established in 2005. At that time, the foundation received a 5-hectare land grant from PT Cigede Griya Permai, the developer of the Bukit Az-Zikra Sentul housing complex. This land was allocated for an Islamic Center, including a mosque and an pesantren (Islamic boarding school), intended to serve as a center for worship and Islamic outreach. To realize this vision, an Islamic Center construction team was formed under the leadership of Arifin Ilham and architect Achmad Fanani. The team was responsible for designing the complex and raising funds for its development. Through their efforts, they successfully secured funding from the World Islamic Call Society, an international Islamic missionary organization based in Tripoli, Libya, which agreed to cover the construction costs. As a result, this religious, educational, and social activity center was named the Qaddafy Islamic Center, while the mosque was named Muammar Qaddafy Mosque after the Libyan leader at that time.[24]

The mosque construction began on July 22, 2007, marked by a cornerstone-laying ceremony accompanied by a grand zikir led by Arifin Ilham. On August 10, 2008, a "topping off" ceremony was held, involving the placement of the main dome's ornamental peak, and the building was completed on February 16, 2009. The Muammar Qaddafy Mosque consists of three main structures covering a total area of 12,600 m^2 and features a 57-meter-high minaret on its northern side. The main structure can accommodate around 6,700

worshipers for prayers and 10,400 for zikir gatherings.[25]

The mosque's architectural design combines universal Islamic architectural characteristics with local tropical architectural elements. Islamic features are represented by the dome, portals, arches, minaret, eight-pointed star ornaments, and calligraphy, while local tropical elements are embodied in the pyramid-shaped roof, large overhangs, and four supporting columns. The mosque also holds various symbolic meanings. For instance, its seven-floor levels represent the seven daily practices encouraged for zikir practitioners, symbolizing a believer's closeness to the Creator. The prayer rows are spaced 1.1 meters apart, based on a 3.3-meter module, which symbolizes the 33-count wirid repetitions (for takbir, tahmid, and tasbih recitations).[26]

The mosque's dominant white color symbolizes purity of spirit, mirroring Arifin Ilham's simplicity, who frequently dressed in white attire. On the northern terrace, there are two large, mechanically operated retractable umbrellas, known as "Nabawi Umbrellas," as they replicate similar structures in the Prophet's Mosque in Medina. Currently, two umbrellas have been installed, with plans to increase to six, symbolizing the six pillars of faith.[27]

Figure 1. Masjid Az-Zikra, Sentul. (Source: instagram enjoybogor)

Az-Zikra Sentul Mosque regularly organizes a variety of religious activities aimed at enhancing the faith and piety of its congregation. Some of the primary activities held on a regular basis include: (1) Halaqah Subuh, a daily Islamic study session conducted immediately after the Subuh prayer. Halaqah Subuh serves as a platform for the congregation to delve deeply into various aspects of Islamic teachings; (2) Kajian Duha, a religious study session held on the fourth Sunday of every month. This session features lectures from ustads of the Az-Zikra Islamic Boarding School and national and international preachers, presenting studies relevant to contemporary issues; (3) Kajian Muslimah, specifically designed for women, held every Wednesday and Thursday. This session is led by ustazah from the Az-Zikra Islamic Boarding School, focusing on thematic discussions relevant to the spiritual needs of women; and (4) Zikir Akbar, a monthly program held on the first Sunday of every month. This program involves the entire congregation of Masjid Az-Zikra in collective remembrance and prayer, creating a spiritually solemn atmosphere. These activities demonstrate Masjid Az-Zikra Sentul's commitment to providing comprehensive religious services to the community. With a diverse range of activities, the mosque successfully accommodates the spiritual needs of various groups, both men and women, and presents studies relevant to the changing times.[28]

4. Implementation of Eco-Mosque at Az-Zikra Mosque

Hayu Prabowo, as the initiator of eco-mosque at Az-Zikra Mosque, said that one of the main factors of ecological disasters is the moral decay of the perpetrators. This means that morality is important in caring for and preserving the environment. Therefore, as a spiritual centre and moral development of the Muslim community, the mosque must become a role model that encourages, implements, and continues to educate the community on the importance of creating and protecting the surrounding

environment. For this reason, Prabowo, with the help of all Az-Zikra Mosque administrators, tried to apply the principle of sustainable ecology at least through several things, namely maximizing the use of water, bioclimatic architectural design, utilizing biogas, incineration technology, managing urban green spaces, and the plastic pot alms movement.[29] Hayu Prabowo completed his doctoral studies at the Institute for Qur'anic Studies (Perguruan Tinggi Ilmu Qur'an, PTIQ), specializing in the field of Qur'anic exegesis. He has made significant contributions to various areas related to environmental sustainability and conservation. Since 2010, he has served as the Chair of the Environmental and Natural Resource Stewardship Division at the Indonesian Council of Ulama (Majelis Ulama Indonesia, MUI). Under his leadership, the division has been actively involved in formulating policies and initiatives that promote environmental preservation and sustainable management of natural resources in Indonesia.[30]

Hayu Prabowo also serves as the National Facilitator for the Interfaith Rainforest Initiative (IRI) in Indonesia. In collaboration with the International IRI and the United Nations Environment Programme (UNEP), he contributes to efforts to protect the world's tropical rainforests. IRI focuses on five countries that host 70% of the world's remaining tropical rainforests: Indonesia, the Congo, Colombia, Peru, and Brazil.[31] His involvement in designing the eco-mosque concept for Az-Zikra in Sentul has established this place of worship as a practical model for environmentally friendly religious spaces.

All ecological applications also involve the community as a form of environmental awareness education. The Chairman of the Az-Zikra Mosque Foundation 2016-2022, Khotib Kholil, also emphasized that the efforts to implement an environmentally friendly mosque are to motivate the community regarding the importance of protecting the environment and give them a positive

impression that Islam is very concerned with the environment.[32] Khotib Kholil is a native of Samarinda, East Kalimantan, who pursued his education at the National Hotel Institute Bandung in 1989. His expertise lies in the field of housekeeping. Kholil has served as a housekeeping consultant at Hotel Selyca Mulia Samarinda (2013) and as the Group Housekeeper Coordinator at Mall Taman Anggrek (2002–2011).[33] Although his professional background is unrelated to ecology, his skills have enabled him to collaborate with Hayu Prabowo in establishing an environmentally friendly mosque at Az-Zikra Sentul.

Although Masjid Az-Zikra applies several eco-mosque principles, there are notable concerns regarding their implementation. First, while the mosque's main prayer hall avoids the use of air conditioning, it still employs several electric fans in various corners of the space. This indicates that the use of natural cooling systems through architectural design has not been optimized. Additionally, even though the mosque itself does not use air conditioning, adjacent spaces such as offices and secretariat rooms continue to rely entirely on AC units. Another critical issue pertains to the leadership regeneration within the Az-Zikra Foundation. Since Khotib Kholil stepped down as chairman of the foundation in 2022, the ecological initiatives have become less effective. For instance, the smoke-free waste incinerator technology is no longer operational, the green spaces around the mosque are increasingly neglected, and the community-based initiative to collect plastic bottles as donations has diminished.

These observations highlight the importance of ensuring that successive leadership maintains a consistent vision with their predecessors. Such alignment is crucial for sustaining and optimizing positive programs like the eco-mosque initiative over the long term.

a. Water Use Maximization

As a ubiquitous building in Indonesia, mosques contribute to water wastage, especially given the large number of worshippers and the frequency of water use for ablution. Recognizing this, Az-Zikra Mosque implements three strategic programs to optimize more sustainable water use. First, Water Conservation. This program involves the collection of rainwater through special gutters that drain water into ten holding tanks (toren), each with a capacity of 4,100 liters. To prevent overflow, the torens are equipped with overflow channels that channel excess water to infiltration wells. This system helps increase groundwater infiltration and prevents rainwater wastage. Second, Water Recycling (Water Sanitation). Used ablution water is collected and filtered for reuse in various needs, such as watering plants and washing vehicles. This program is very effective, especially during the dry season, when the water supply is limited. Water saving is also applied to wudu water, minimizing the tap hole through simple modifications using sandals and small pipes. This innovation reduced water use per person from 14 liters to only 4 liters per wudu. Third, Protection of Water Sources. Az-Zikra Mosque is committed to maintaining the cleanliness of rivers and ponds around the mosque environment so that they are not polluted. One of the steps taken is to install warning boards to prevent littering in water bodies, helping to preserve local water quality.[34]

In Islam, water conservation is considered a significant teaching as a way to avoid wastefulness. A hadith narrates:

كَانَ النَّبِيُّ صَلَّى اللهُ عَلَيْهِ وَسَلَّمَ يَتَوَضَّأُ بِالْمُدِّ۞ وَيَغْتَسِلُ بِالصَّاعِ۞ إِلَى خَمْسَةِ أَمْدَادٍ

«The Prophet Muhammad (peace be upon him) performed ablution with one mud (of water) and took a bath with one sa› to five muds (of water).»[35]

This hadith indicates that the Prophet used a specific amount of water for both ablution and bathing. One mud is equivalent to approximately 0.688 liters. Thus, the Prophet Muhammad performed ablution with 0.688 liters of water and took a bath with 2.752 to 3.44 liters of water.[36]

Figure 2. Rainwater storage (toren) (Source: Youtube Here's TV)

b. Bioclimatic Architecture Design

Az-Zikra Sentul Mosque applies a bioclimatic architectural design that natural light and keeps the room temperature cool without air conditioning.[37] The design maximizes natural airflow with a high roof and large dome, which creates space for hot air to rise and escape through vents at the top. This air circulation helps maintain a comfortable temperature inside the mosque, while reducing reliance on artificial cooling devices. In addition, cross ventilation is implemented by placing large windows on the sides of the building, allowing fresh breeze from outside to flow freely across the room. These windows also allow daylight to enter, creating a bright atmosphere inside the mosque without needing electric lighting during the day. This utilization of natural lighting effectively reduces energy consumption for lighting.[38]

In addition to environmentally friendly architectural design, Az-Zikra Mosque also saves electrical energy by using LED lights.[39] LED lights are known to be energy-efficient and have a long

lifespan, making them more efficient compared to conventional lights. LED lights in this mosque allow optimal lighting when needed, especially at night, with much lower power consumption. Combining bioclimatic architecture and LED lights creates a cool, bright and energy-efficient worship environment. This not only reduces operational costs, but also supports environmental conservation efforts by significantly reducing carbon emissions and electricity usage.[40]

Figure 3. Main room of the Az-Zikra Mosque
(Source: kontraktor kubah masjid)

c. Biogas Utilization

Az-Zikra Sentul Mosque implements biogas technology as part of its sustainability practices. Biogas is produced from faecal waste treatment in the mosque's septic tank, which is then used as kitchen fuel in several canteens within the mosque. The process involves the breakdown of organic matter (such as feces) by microorganisms under anaerobic conditions (without oxygen), producing methane gas that can be used as an energy source. At Az-Zikra Mosque, feces from septic tanks are collected and fed into a biodigester system, where microorganisms break down organic matter into methane gas. This gas is then drained and utilized as an

alternative fuel for cooking in the mosque's canteen kitchen. This technology is not only environmentally friendly but also offers a cheap and renewable source of energy.[41]

The use of biogas in these mosques is particularly important as it can help reduce dependence on non-renewable and often expensive fossil fuels. By utilizing human waste as an energy source, the mosque reduces operational costs and carbon emissions, which aligns with global efforts to reduce the impact of climate change. The main benefits of using biogas at Az-Zikra Mosque are energy and cost savings. Locally produced biogas reduces the need for commercial LPG gas. In addition, this process supports more efficient waste management, reducing the risk of environmental pollution due to uncontrolled waste disposal. It also provides education to the surrounding community on the importance of sustainability and productive utilization of waste. With this practice, Az-Zikra Mosque demonstrates how places of worship can play an active role in environmental conservation and resource saving.[42]

Figure 4. Biogas stove. (Source: Youtube Ecomasjid.id)

d. Incineration Technology

Az-Zikra Sentul Mosque implements an environmentally friendly waste management system using incineration technology. This technology is designed to burn waste at high temperatures and minimize the environmental impact of combustion. The workings of this system include: (1) High temperature burning. Waste is burned at very high temperatures, reaching between 800°C and 1000°C. This temperature ensures that the organic matter in the waste burns completely, reducing the formation of harmful gases and solid particles that can cause air pollution. (2) Flue gas cleaning. Combustion gases go through a sophisticated cleaning system. Scrubbers absorb acidic gases, such as sulfur dioxide and nitrogen oxides, while electrostatic filters and fabric filters capture solid particles and fly ash. This ensures that the gases released into the atmosphere meet stringent environmental standards. (3) Dioxin and Nox reduction. Exhaust gas is processed through a deNOx system to reduce nitrogen oxides and a dioxin capture system to decompose harmful substances into safer forms before release. (4). Energy Utilization. The heat generated from the combustion process generates energy or heating, making it a useful resource and reducing dependence on fossil energy.[43]

Figure 5. Environmentally friendly waste-burning device.
(Source: personal document)

e. Urban Green Space Management

Tree planting is a critical restorative measure in mitigating climate change and conserving the environment. Trees serve as significant carbon dioxide sinks, a primary greenhouse gas contributing to global warming. Through photosynthesis, trees convert carbon dioxide into oxygen, thereby improving air quality.[44] Moreover, forests, dominated by trees, function as habitats for a diverse range of flora and fauna, safeguarding biodiversity and ecological balance. From a hydrological perspective, trees play a role in the hydrological cycle by absorbing rainwater through their roots and releasing it back into the atmosphere through transpiration. This process helps prevent soil erosion, reduces the risk of floods, and maintains groundwater availability. Trees also play a crucial role in maintaining soil fertility through the decomposition of leaves and branches, which serve as natural fertilizers.[45]

Socioeconomically, trees provide invaluable benefits. Forests offer various products such as timber, rattan, and fruits, which can increase people's income. Additionally, the presence of forests supports the development of sustainable ecotourism, thereby improving the well-being of local communities. In the context of human health, trees offer significant benefits. Trees help reduce air pollution, improve air quality, and provide a cooler and more comfortable environment. Research shows that the presence of trees in the surrounding environment can improve mental and physical health.[46] One approach to urban greening is the implementation of an Urban Green Space Management System.

Az-Zikra Mosque, with a land area of 12,600 m^2, implemented an Urban Green Space Management System to improve the sustainability of the surrounding environment. The system includes planting trees, shrubs, and ground cover plants throughout the mosque area.[47] The system involves several key components: (1)

Vegetation planting by selecting and planting local plant species suitable for the climate and soil conditions. These plants serve as ecological buffers, absorb pollutants, and produce oxygen; (2) Stormwater management, which uses vegetation to improve stormwater infiltration and reduce runoff. This technique includes the creation of rain gardens and bioswales to manage rainwater effectively; (3) Ecosystem maintenance by ensuring vegetation sustainability through regular maintenance, including watering, fertilizing, and pruning.[48]

Reforestation is strongly encouraged in Islam. Several hadiths of the Prophet emphasize this. In one narration, the Prophet is reported to have said, "No Muslim plants a tree unless whatever it produces, whether eaten or stolen, is considered as charity for him. And no one diminishes its fruit except that it will be considered as charity for the planter until the Day of Judgment."[49] This hadith encourages people to continually plant trees as a form of environmental stewardship. In fact, the Prophet Muhammad promised that the reward for planting trees will continue to flow even after the planter has passed away.

These systems are essential to reduce the urban heat island effect as vegetation helps to lower ambient temperatures by providing shade and increasing evapotranspiration. It can also manage water runoff as it reduces the risk of flooding by increasing rainwater infiltration and reducing the load on urban drainage systems. It also conserves habitat as it provides a place for local species of flora and fauna, which helps maintain biodiversity in urban areas. The benefits of implementing this system are improved air quality around the mosque, increased comfort for visitors and space for social and recreational activities, and reduced carbon emissions as vegetation absorbs carbon dioxide and helps mitigate climate change.[50]

Figure 6. The mosque area looks full of plants.
(Source: personal document)

f. Plastic Bottle Alms Movement

The plastic bottle alms program at Az-Zikra Sentul Mosque is an innovative example of applying ecological principles that focus on sustainable resource management and environmental impact reduction. This program invites the community to donate their plastic bottle waste to special bins provided within the mosque. This approach educates the community on the importance of recycling and reduces the volume of plastic waste that can pollute the environment. The collected plastic bottles are then sold, and the proceeds are used to support community needs. This approach serves as an incentive for people to actively participate in their waste management and provides direct benefits to the community. By selling the recycled plastic bottles, the mosque not only reduces the waste burden but also turns waste into a useful economic resource.[51]

From an ecological perspective, the program adheres to the principle of sustainable management of natural resources. The program reduces the ecological footprint and promotes the circular economy principle by minimizing the use of new materials and

reducing the amount of waste going into landfills. In addition, the use of proceeds for the benefit of the community reflects social responsibility, where the economic proceeds from waste management are used to improve the community's welfare. Overall, the plastic bottle alms program at Az-Zikra Mosque not only serves as a practical solution in plastic waste management but also acts as a model of environmental education that encourages community participation in maintaining ecological sustainability.[52]

Figure 7. Plastic bottle waste charity place.
(Source: personal document)

C. Conclusion

Az-Zikra Sentul Mosque demonstrates a strong commitment to ecomasjid and eco-social principles in implementing various environmentally friendly initiatives. The emphasis on morality as the main factor in caring for the environment reflects the view that spiritual awareness plays an important role in ecological preservation. This aligns with the idea that mosques should be role models in implementing sustainability principles. The programs implemented include saving electricity resources, maximizing water use, managing organic waste into biogas, bioclimatic

architecture, and incineration waste management systems. These demonstrate a systematic and comprehensive effort to create a greener and more sustainable environment. Optimal water use with conservation, recycling, and protection of water sources demonstrates a holistic approach to water resource management. The bioclimatic architectural design that reduces the need for air conditioning and electric lighting highlights the application of energy efficiency principles in line with the eco-mosque principles. Using biogas as kitchen fuel demonstrates productive utilization of waste, supports energy sustainability, and reduces dependence on fossil fuels. The incineration system adopted demonstrates an attempt at cleaner waste management, although this requires further evaluation to ensure minimal environmental impact.

The application of the eco-mosque principle in Az-Zikra Mosque is very appropriate. The bioclimatic architectural design and the use of LED lights reflect a commitment to energy saving and carbon footprint reduction. Water conservation and recycling efforts also support the principle of sustainable resource management. From an eco-social perspective, the Az-Zikra Mosque initiative shows that positive social impacts accompany environmental conservation efforts. The plastic bottle alms program links waste management with community welfare. At the same time, the biogas system and urban green space management also involve the community in the education and resource management process. In addition, the eco-social principle is also evident in the educational orientation and ecological motto targeted at the mosque's congregation.

Incineration technology, while innovative, must ensure that the combustion process meets strict emission standards to minimize the impact of air pollution. In addition, documentation and transparency on how this technology affects the overall environment are important for long-term sustainability evaluation. The plastic bottle charity program is very positive. However, it needs to

be ensured that the collection and sale process does not cause negative social impacts, such as pollution or health issues related to plastic waste management. Public education on waste reduction and recycling should be ongoing and cover various aspects of waste management to increase its effectiveness. Overall, Az-Zikra Mosque demonstrates a strong commitment to sustainability and social responsibility through its various initiatives. However, continuous evaluation and attention to the long-term impacts of the technologies used would further strengthen the eco-mosque and eco-social principles implemented. Finally, the structural regeneration of the mosque management also needs attention. Based on the researchers' observations, after Kholil Khotib's leadership period, the number of the above ecological applications has decreased compared to the previous management period. Because, since Khotib Kholil stepped down as chairman of the foundation in 2022, the ecological initiatives have become less effective. For instance, the smoke-free waste incinerator technology is no longer operational, the green spaces around the mosque are increasingly neglected, and the community-based initiative to collect plastic bottles as donations has diminished. These observations highlight the importance of ensuring that successive leadership maintains a consistent vision with their predecessors. Such alignment is crucial for sustaining and optimizing positive programs like the eco-mosque initiative over the long term.

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