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ECO MASJID: THE FIRST MILESTONE OF SUSTAINABLE MOSQUE IN INDONESIA

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ABSTRACT

On November 11 2017, MUI (Indonesian Council of Ulama), DMI (Indonesian Mosque Council) have launched the national program named eco masjid. Eco masjid is a program of sustainable mosque through efforts to preserve the environment and natural resources oriented to on aspects of idarah (management), imarah (prosperity activities), and ri'ayah (maintenance and facilities) which dominantly related to its building. In Indonesia, sustainable building principles are widely promoted by GBCI (Green Building Council Indonesia) and have been applied in various types of buildings. However, it has been realized that the study on the implementation of sustainable principle in the mosque is very rare. The research was carried out qualitatively by using direct observation on the pilot mosque to capture all implemented sustainable building principle. Based on the questionnaire to 44 participants which reflected 44 DKM (Dewan Kemakmuran Masjid), the result came up that applying water efficient faucet, using the LED lamp and sticker posting are the most achievable sustainable practices in the existing mosques. The authors suggest to all related bodies to determine the standard on how to assess the implementation of eco Masjid program.

KEYWORDS:
Sustainable Mosque; Eco *Masjid*; GBCI; Green Building; Green Mosque

INTRODUCTION

The sustainable terminology is defined as conserving an ecological balance by avoiding depletion of natural resources [1]. In the context of development and environment, the term "sustainable" and "green" is inseparable. Both terms are referring to unchanged and lasting situations [2]. The term "sustainable mosque" is introduced in this research as a major terminology to spread the idea of Muslims effort to involve in promoting environmental conservation by influencing the Muslims movement started from its worship place. Therefore, the sustainable mosque's program named eco Masjid is launched on November 11 2017 for national level by MUI (Indonesian Council of Ulama) and DMI (Indonesian Mosque Council) as a proof in starting the milestone step for the sustainable mosque in Indonesia.

The concept of eco masjid comes from two words: "eco" and "masjid" which each word has different definition. "eco" is derived from the word "ecology" which is a terminology closely related to the ecosystem, which is a system formed by the mutual relationship between living things and their environment. While "masjid" or mosque is a place of prostration. The term mosque according to syara' (codification of Islamic law) is a permanent place provided for prayer and other relevant Islamic rituals [3]. Under this understanding, eco masjid defined as a place of permanent worship that has a concern for the mutually sustainable relationship between living creatures and the environment by focusing on mosque management which is focused in three aspects: idarah (organizing), imarah (prosperity activities), and ri'ayah (maintenance and facilities).

Based on observations and initial interviews of researchers, eco masjid programs aspect have been implemented partially at the pilot mosque, Masjid Azzikra, Sentul, Bogor. Some efforts in applying the concept of green building focusing in ri'ayah aspect have been established, and for the rest aspects, idarah and imarah are still in conceptual review. Considering the mosque has the building side, in term of ri'ayah and sustainable building, the mosque can be treated as same as a general building. It leads to open possibilities to use best practices in the sustainable building to achieve the sustainable mosque.

In relation to the building, researcher has discovered that initial steps for sustainable building requirements have been carried out in Indonesia regulation even for only a regency level [4]. Moreover, there was a significant effort in determining sustainable building principle and its assessment

guideline for a new building, existing building, home, and school [5] [6] [7] [8]. Partial research for the sustainable mosque in building side has been also identified for specific principle such as green technology principle implementation [2], sustainable architecture and its design [9] [10], greywater treatment system application [11], and sustainable material [12]. In other nearest country such as Malaysia, the effort of research has arisen in the proposed concept of GMI (Green Mosque Index) [13].

In Indonesia, efforts to identify the principles of the sustainable building have been established by GBCI (Green Building Council Indonesia). The term "sustainable building" which GBCI refer to is focused on sustainable building itself, sustainable architecture, and sustainable construction. Under these understanding, the sustainable building assessment consist of these principle: appropriate site development (ASD), energy efficiency and conservation (EEC), water conservation (WAC), material resources and cycle (MRC), indoor health and comfort (IHC), building and environmental management (BEM) [14].

From the above-mentioned research regarding sustainable mosque, it can conclude that previous researchers did not observe the current progress of sustainable mosque in Indonesia and gave more emphasis on the partial sustainable effort and practices based on their own country regulation and their green building standard. This is the gap that this article is addressing.

METHODS

The objective of this research is: (1) to describe sustainable practices in the pilot mosque under the umbrella of sustainable principle from GBCI and (2) to determine the most achievable sustainable practices among the mosques.

The research that this article is referring to is using qualitative research methods. The study to achieve the first objective was carried out using observation on the pilot mosque of eco Masjid program. The questionnaire is the tool to retrieve the data used by the researcher to achieve the second objective. Both of its presentations will bein descriptive approach. Content analysis is used as a data analysis to enrich the study by literature study.

The pilot mosque of eco masjid program is Masjid Azzikra, Sentul, Bogor. It located in Cipambuan Village, Sentul, Babakan Madang District, Bogor Regency, West Java Province. Located within the residential complex of Bukit Az-Zikra, an Islamic housing complex initiated by the head of the Zikra Zikr Council, Ustadz Muhammad Arifin Ilham.

Sustainable building principle from GBCI (Green Building Council Indonesia) will be used for reference to represent all practices observed in the pilot mosque. The questionnaire has been applied to the 44 participants which represent 44 mosques boards or DKM (Dewan Kemakmuran Masjid).

DISCUSSION

Masjid Azzikra has implemented some sustainable principles which generated by GBCI. The implementation has been delivered partially by considering the specific characters from the mosque due to the mosque's building is not only the common building but also the building which related to Islamic requirement.

APPROPRIATE SITE DEVELOPMENT (ASD)

ASD is related to how to build a suitable building, both in terms of function and land use such as green area provision, site selection, accessibility, transportation, microclimate and stormwater management.

Masjid Azzikra with an area of 10,000 m2 dedicated more than 40 % of the area is landscape for basic green area purposes. The existence of a landscape area of vegetation (softscape) was free from structures of buildings and becomes part of the air circulation system, better microclimate regulator, maintenance of continuity of groundwater supply, pollution controller (air, water and soil), and preservation of environmental function along with all the contents of flora and the existing fauna (biological conservation or biodiversity).

a

b

c

Figure 1. (a) Masjid Azzikra in Upper View [15] (b) Masjid Azzikra in Front View [16] (c) Masjid Azzikra Mock-up [17]

Related to the community accessibility, there was accessible public facility around to 2KM such as bank, shop, hospital, sport and gym, parking area, canteen, public garden, and drug store. However, there was no specific pedestrian access which connected the main road through the mosque. There was no public transportation to achieve the mosque. The only way access to the mosque by using personal transportation or using the online transportation. Please see Figure 2.

Figure 2. Access to Masjid Azzikra [18]

ENERGY EFFICIENCY AND CONSERVATION (EEC)

In carrying out all its functions, the mosque requires a lot of electrical energy such as water supply, electricity, and for sound purposes. This fact showed the importance of continuity of electricity supply for mosques. As we already know, more than 80% of national electricity source is still generated using fossil fuels (petroleum, natural gas, and coal). This fossil fuel is limited in number and will run out in the next few decades because it is not renewable.

Another thing to note is that the use of fossil fuels emits carbon dioxide (CO_2) emissions that cause greenhouse gases that have implications for rising earth temperatures and changing the Earth's climate system. This increase in the earth's temperature will cause the weather on earth to be extreme (extreme drought or extraordinary rain) which will ultimately damage the balance of ecosystems as a supporter of human life and the whole earth.

Masjid Azzikra has aware about the energy conservation and energy saving. Some practices have been implemented such as promotion to use electricity as needed, using a gravity system for supplying ablution water, maximize the natural ventilation and has implemented the renewable energy as an alternative using biogas as per figure 2.

a b

Figure 3. (a) Biogas during construction (b) Using the energy resulted from Biogas [19]

In term of ventilation, as aware, the largest consumption of electrical energy is from air conditioning systems intended to create comfort for users of the mosque. Usually, the main area of concern for thermal comfort is the main area for praying. Masjid Azzikra has constructed the high ceiling and open ventilation for the main area of the mosque to achieve the comfort temperature and air circulation without consuming big electricity for the air conditioner. Please see Figure 4.

Figure 4. High Ceiling at Masjid Azzikra [18]

In the stair area and corridor, there was no additional effort for ventilation except natural ventilation. Usually, the user of the mosque only visits about 3-5 times a day and not settled long in the area. For such conditions, for the tropical community will be easy to apply adaptive comfort.

WATER CONSERVATION (WAC)

The major usage of water in the mosques is for ablution. As already aware that some major sustainable principle in water conservation is effective consumption of water and the use of alternative water [13]. In line with this concern, MUI (Indonesia Council of Ulema) has issued a fatwa regarding a recycled water which can be used for ablution [20]. Based on observation in Masjid Azzikra, most of the mosque visitor use water taps for ablution purpose (97 %). Only some of them use a pail and dipper in the toilet for ablution due to other need in the toilet. On which there are any circumstances that the water need is more than water supply, Masjid Azzikra has installed water recycling system to recycle the used water from ablution. Please see figure 5.

Figure 5. Recycling Water System from Used Ablution Water [21]

The dominant approach which is Masjid Azzikra focused in term of water management by constructing rainwater harvesting system or "panen air hujan (PAH)". PAH is a groundwater conservation system

through rainwater storage and utilization to meet water needs for sanitation. This system has many benefits, including reducing the use of groundwater and reduce emissions thereby reducing the impact of climate change and global warming [21]. Please see figure 6.

a b

Figure 6. (a) Rain Water Harvesting System [22] (b) Rain Harvesting System in Masjid Azzikra [23]

Another creative approach to water conservation which implemented in Masjid Azzikra is tap water controller made from sandals. This water tap controller has been installed for almost 300 waters tap in the mosque and its boarding school. The tap water flow controller can be made by making ½ inch spheres of rubber sandals. Rubber spheres are then perforated and inserted a glass mineral water straw as a water flow restriction (orifice). This Orifice can be mounted on various ½ inch water taps on the market. Observation tests show that water usage savings can reach up to 70% [25]. Please see figure 7.

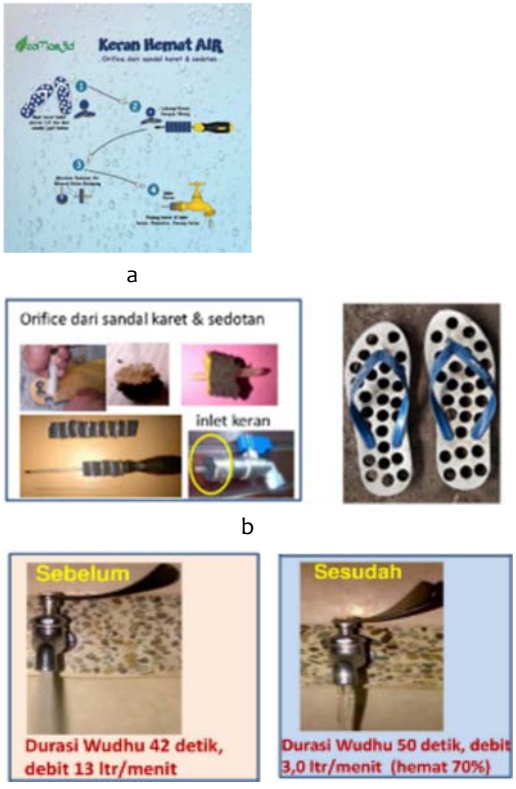

Figure 7. (a) Step for developing efficient water tap [24] (b) Process for making efficient water tap at Masjid Azzikra [25] (c) Observation result between usual water tap and efficient water tap [26]

MATERIAL RESOURCES AND CYCLE (MRC)

The sustainable building as fair as sustainable mosque cannot be separated from environmental materials. The material is an element of passive design. As an element of passive design, the material is linked to its ability to support building performance efficiently and effectively to meet the needs of its users. This is directly related to the characteristics of the material in responding to the environmental issues on the building.

In term of this principle, no major effort has been found in Masjid Azzikra except for regional material component which is part of this principle based on GBCI standard. Based on the interview, during the construction phase, the primary raw material originates is located within a radius of 1000 km from the project and factories located within the territory of the Republic of Indonesia which has been absorbed to 80% of the total material cost

INDOOR HEALTH AND COMFORT (MRC)

Mosque as a place of worship is very sensitive to health issues, cleanliness and comfort. Generally, the health requirement in the mosque can be indicated by adequate light ventilation and the adequate air circulation in accordance with the mosque size. Cleanliness in the mosque is the condition of the mosque that frees from najis (everything which considered can void the pure condition after ablution) especially ablution place, the corridor and the connected access to the main room of the mosque, and the main room. Comfort condition associated with the creation of a peaceful feeling in worship and feel united with the surrounding area. In term of comfort, it is determined by visual comfort, thermal comfort, and acoustic level.

To optimize the level of artificial lighting there are two strategies that can be applied: First is to ensure ambient lighting and combine with the table lamp in the specific area such as for Quran recitation area. Second, the position of any area for recitation can be slotted anywhere with the consequence of the room lighting level should be sufficient wherever it be. Thermal comfort is the result of a person's state of mind in expressing a satisfaction with the thermal environment in which the person spends his or her time. The variety of variations that affect a person's preference such as physical and mental condition, making thermal comfort is very subjective. Some surveys in building the show that the operating temperature considered to be convenient for building users is about 26.7 ° C [27].

In term of the acoustic level, the mosque will face the noise, especially internal noise. The moderate noise might become from unappropriated acoustic and sound system arrangement during azan, Quran recitation, and khutbah or other activities. DMI (Dewan Masjid Indonesia) has conducted the research which concluded that most of Mosque sound system has been installed in an unappropriated way and these lead to the poor quality of acoustic system [28]. Based on the questionnaire to masjid Azzikra visitor, indoor

health and comfort have come up with several results as stated in table 1.

Table 1. Indoor Health and Comfort Result Based on30 Random Visitors Perception at Masjid Azzikra[29]

Component	Result
Light Ventilation	Very Comfort (12 %) Comfort (80 %), Not so comfort (10 %)
Adequate Air Circulation	Very Comfort (20 %) Comfort (60 %) Not so comfort (10 %)
Cleanliness and Free of *Najis*	Very Clean (1 %) Clean (80 %) Not so clean (19 %)
Visual Comfort	Very Comfort (8 %) Comfort (90 %) Not so comfort (2 %)
Thermal Comfort	Very Comfort (12 %) Comfort (70 %) Not so comfort (18 %)
Acoustic Level Comfort	Very Comfort (12 %) Comfort (75 %) Not so comfort (13 %)

BUILDING ENVIRONMENT MANAGEMENT (BEM)

In the operation of a green building, it is necessary to have a planned management standard to direct the actions of the building operators in building management to demonstrate green performance. This effort will be an act in same treatment in the eco masjid. Based on in a deep interview with the expert, the major component for the mosque in term of building environment management is basic and advanced waste management. To strengthen this effort, MUI has released the fatwa regarding waste management to minimize environmental degradation [30].

In ideal approach, to obey and maximize the implementation of the mentioned MUI fatwa above, the first step of handling waste is by sorting from the initial stage, the recycling process will start faster so that the TPA load can be reduced. The role of various stakeholders is needed in reducing the volume of municipal waste. Stakeholders, from both the private and the government sectors, have the same responsibility in controlling environmental impacts through the management of waste generated. The initial step of waste management in the mosque can be approached by providing the separate garbage disposal facility between organic and inorganic waste bins to facilitate the processing of waste then referring to the concept of 3R (Reduce, Recycle, Reuse).

Waste segregation as a part of waste management can maximize the process of identification of recyclable and reusable waste and make waste as a resource, such as reducing the cost of purchasing new materials by using waste that is still reusable or recyclable results or can sell the waste to the party in to generate additional revenue. Mosque user also should be encouraged to have the attitude, awareness to reduce and manage the generated waste, so that it is not only the responsibility of mosque management but also every user of the mosque that produces waste. The involvement of everyone to create a togetherness to improve the quality of the environment through waste management is a part of Islamic thought and doctrine.

At Masjid Azzikra, most of the amount of waste generated from the household waste type which comprises solid waste and liquid waste. There come from around mosque area such as garden, canteen, ablution area, and bathroom. The good effort has been implemented by segregating solid waste into organic waste, inorganic waste, and hazardous waste. Waste containers are placed around the mosque area, canteen, ablution area, and bathroom are intended to accommodate the waste generated by visitors of this mosque and the student of its boarding school. Please see figure 8.

Figure 8.Waste Bins Sample [18]

THE COMMON SUSTAINABLE PRACTICES IN MOSQUES

Five sustainable principles generated by GBCI are supposed to be adaptable for any building including mosques. However, the practices on each principle in mosques should be determined in advance. On this study, the researcher proposed 17 sustainable practices based on GBCI sub-component principle and eco masjid raw programs which could be achieved by any existing mosque. The practices are:

1. Bio pore and absorption well
2. Water efficient faucet
3. Water harvesting system
4. Shower system and ablution pool for ablution alternative method
5. Double flushing for toilet
6. Ablution reused water system
7. Tree plantation and gardening
8. Biogas or solar panels installation
9. Open wall and open ventilation
10. Environment awareness in khutbah, and stickers posting for water, energy and other sustainable practices campaign
11. LED/CFL lamp usage
12. Natural ventilation optimizing without the air conditioner
13. Organic and an-organic segregation
14. Burning stove for garbage incineration
15. Carpet usage minimalization
16. Sound system adjustment for adzan and Quran recitation

17. Waste dumping for sacrificial animals

Based on questionnaire result, the most 3 achievable sustainable practices in the mosques are water efficient faucet (93.2 %), LED/CFL lamp usage (84.1 %), environmental awareness in khutbah and sticker posting for water, energy and another campaign (75 %) [31]. Making water efficient faucet by following Masjid Azzikra's and eco masjid approach (using the used sandals) are only born small and low cost. Besides that reason, the installation process is easy, and can be conducted in a massive way. Replacing the existing lamp with LED lamp is might be born high cost in advance. However, in the long term, a LED lamp will result in more achievement in term of energy efficiency. The last, campaigning the environmental awareness and also posting the sticker is the easiest way in term of the redundant campaign for water conservation, energy efficiency and other sustainable principles.

CONCLUSION

Based on a fragment that has been described, Masjid Azzikra, in term of GBCI principle, has applied several sustainable practices in term of appropriate site development (ASD), energy efficiency and conservation (EEC), water conservation (WAC), material resource and cycle (MRC), indoor health and comfort (IHC), and building environment management (BEM).

The most dominant principle in Masjid Azzikra was in water conservation by demonstrating more sustainable practices effort rather than other GBCI principles such as water tap usage for ablution, water recycling installation for ablution, rainwater harvesting system implementation and efficient water tap installation using the used sandals.

The principles which considered by researcher subject to be improved at Masjid Azzikra are material resource and cycle (MRC). Material resource and cycle best practices should be subject as a major consideration during building maintenance sometime in the future such as using the green material.

Other mosques can consider the three most achievable sustainable practices to start the mosque become eco masjid: installing the efficient water faucet, considering using the a LED lamp, and starting to campaign the environmental awareness in every khutbah and also posting the sticker in the strategic area for sustainable effort campaign.

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