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Training on Sustainable House Design Based on the Utilization of Natural Lighting in Nyogan Village

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ABSTRACT

The development of housing has become a government focus, particularly with the introduction of subsidized housing. However, current residential construction often prioritizes financing and aesthetics, neglecting other critical aspects such as environmental conditions and climate factors, including natural lighting and air circulation. Limited public knowledge about these issues contributes to the lack of consideration for natural lighting in home construction. This aspect is vital for creating environmentally friendly homes, as utilizing sunlight can reduce electricity consumption, leading to cost efficiency and environmental sustainability. Therefore, training and outreach are necessary for the community in Nyogan Village, Mestong District, Muaro Jambi Regency, focusing on the use of natural lighting in eco-friendly home design. The existing conditions in Nyogan often result in power outages lasting up to two days, highlighting the need for natural lighting during the day and evening. The training involved local infrastructure officials, carpenters, and community members, providing them with pocket guides on eco-friendly home construction emphasizing natural light utilization. This community service activity has enhanced public knowledge about sustainable housing and increased interest in building environmentally friendly homes.

Keywords: Community Training; Eco-Friendly Housing; Muaro Jambi; Natural Lighting; Sustainable Development

INTRODUCTION

A residential house is a basic human need that serves not only as a shelter but also as a space for daily life. In the modern context, housing is no longer viewed solely in terms of aesthetics and construction costs; environmental aspects have increasingly gained significance (Cetintahra & Cubukcu, 2014; Wibowo, 2017; Maskur, 2022). An environmentally friendly home does not necessarily mean it is luxurious or expensive (Kapferer et al., 2013; Fuerst & Shimizu, 2016); rather, it refers to a building that is responsive to its surrounding environment, in terms of building materials, layout, and lighting systems (Tanuwidjaja et al., 2013; Romano et al., 2018).

Unfortunately, in current construction practices, many developers and communities still prioritize financial and visual considerations without paying adequate attention to energy efficiency and environmental impacts (Klein & Coffey, 2016; Mazur et al., 2022). In fact, environmentally friendly homes can enhance occupant comfort, reduce electricity consumption, and contribute to environmental preservation (Roufechaei et al, 2013; Geng et al., 2018; Šujanová et al., 2019).

One of the key aspects of green housing is the use of natural lighting (Maachi et al., 2019; Kwong, 2020). Harnessing natural light can significantly reduce dependence on electrical energy, which is especially beneficial in areas prone to power outages, such as Nyogan Village in Muaro Jambi Regency. According to data from the Central Statistics Agency (BPS) of Jambi Province, this region has an average annual sunlight exposure of 45.31%, indicating a substantial potential for natural lighting utilization.

According to Frick (as cited in Gago et al., 2014; Jatmiko & Setiadarma, 2017), natural lighting in indoor spaces typically enters from above (via the roof) or the side (via windows). The placement of these openings must consider the shape and orientation of the building to optimize light penetration without causing glare that disturbs visual comfort (Hashemloo et al., 2015; Moazzeni & Ghiabaklou, 2016; Palarino & Piderit, 2020). State that well-designed facades and openings significantly affect the quality of natural lighting (Aflaki et al., 2015; Majid, 2022).

Beyond energy efficiency, natural lighting also promotes user health and comfort (Keyvanfar et al., 2014; Dewantoro et al., 2019; Rahim et al., 2019). Horr et al, (2016) and Hong et al, (2021) found that spaces with good natural lighting create more effective and productive learning environments.

Currently, many communities lack sufficient awareness regarding the benefits of natural lighting, especially in terms of energy efficiency and environmental sustainability (Kaygusuz, 2011; GhaffarianHoseini et al., 2013; Amani, 2017). Therefore, educational initiatives through training and outreach are essential to raise awareness, as demonstrated in the training program conducted in Nyogan Village.

Through participatory and locally based approaches, the use of natural lighting as part of sustainable housing practices can be widely adopted, especially in areas with high solar exposure. Thus, residential houses can serve not only as shelters but also as part of the solution to energy and environmental sustainability.

METHODS

The community service activity in the form of training and outreach on the use of natural lighting in the design of environmentally friendly residential houses was carried out in the residential area of Nyogan Village, Mestong Subdistrict, Muaro Jambi Regency. Based on field surveys, Nyogan Village was deemed highly suitable for this training due to the frequent power outages that can last up to 48 hours. This condition underscores the importance of educating the community on how to optimize sunlight in their home designs, so that daily activities can still be comfortably carried out from morning to evening using natural light. The training was conducted directly at the village office in Selapik Hamlet, Nyogan Village as shown in Figure 1.

Figure 1. Training Location at the Village Office, Selapik Halet, Nyogan Village

The training session was attended by various village officials, including the Village Head, Deputy Village Head, infrastructure staff, members of the general public, and local construction workers. The stages of activities carried out to support the training and outreach for the Nyogan Village community are presented in Table 1.

Table 1. Activity Stages Supporting the Training and Outreach for the Nyogan Village Community

No.	Date	Type of Activity	Number of Participants	Day	Time
1.	July 5, 2020	Initial survey to observe field conditions	1	1	5
2.	July 7, 2020	Discussion and coordination of planned	3	1	1

		activities			
3.	August 31, 2020	Training and outreach on the use of natural lighting in environmentally friendly residential building design	30	1	5

Three houses were surveyed for further study, each oriented along the East–West axis (Figure 2). The outreach method used in this activity included a presentation-based training session, accompanied by the distribution of pocket books, which served as a reference for building environmentally friendly homes utilizing natural lighting.

Figure 2. House Photo Related to the Utilization of Natural Lighting

RESULTS AND DISCUSSIONS

The field survey was conducted on July 5, with the initial data collection focusing on three residential houses to observe the utilization of windows in maximizing natural lighting. All surveyed houses faced east-west. Two of the homes had windows installed, while one had none at all. An interesting observation occurred during the survey of the first house: there was a power outage at the time. As a result, several rooms were noticeably dark due to the lack of sunlight entering the building, highlighting the limited use of natural lighting in that home. By contrast, when surveying the second house, the electricity had already returned. Based on visual assessment, the rooms in that house appeared adequately lit—approximately 100 lux—yet the residents still turned on the lights for additional illumination as shown in Figure 3.

Figure 3. Residents' Habit of Keeping the Lights On

During the subsequent interview, it was revealed that the habit of switching on electric lights during the day had become routine. This highlights the importance of conducting training and awareness programs to educate residents about the benefits of utilizing natural sunlight, which can help reduce electricity consumption, lower energy costs, and contribute to environmental sustainability.

Table 2 presents the analysis results regarding the application of windows in utilizing natural lighting. Generally, houses in Nyogan Village use vertical windows with sufficient height, which are quite effective in allowing sunlight into the building. These houses are oriented towards the West-East or the opposite, East-West, which is beneficial for those facing East in the morning as they receive good sunlight. However, some houses have a significant number of windows on the North-South sides. From the perspective of obtaining sunlight, this is less effective, and there are obstructions on the North-South side, which can block direct sunlight from entering. As a result, during the day, residents still have the habit of turning on lights

Table 2. Analysis Results on the Application of Windows for Utilizing Natural Lighting

No.	House	House Orientation	Window Application	Day
1.		Facing East		The use of sunlight in the morning is very effective in this house. However, in the afternoon, it is less effective, even though there are windows on the north and south sides, as there are also trees that block the sunlight from entering the building.
2.		Facing West		This house, on the other hand, benefits in the afternoon as the living room still effectively receives sunlight. However, the living room requires artificial lighting during the day due to the lack of natural light.
3.		Facing West		The house only has one window at the front near the door. This is clearly insufficient for natural lighting. However, the house is made of wood, which still has porosity, allowing some light to enter, but it is not enough for adequate natural lighting.

Training and Outreach on the Construction of Environmentally Friendly Houses from the Perspective of Utilizing Natural Light. Based on the results of a field survey, it is highly appropriate to conduct an outreach program to raise awareness about the importance of utilizing natural light in residential buildings, so that daily activities within the home can be carried out effectively. The training was held on Monday, August 31, 2020, at the village office, from 09:00 AM to 12:00 PM. The training was attended by the Village Head, Deputy Village Head, village infrastructure staff, members of the general public, and local construction workers. The event was conducted in adherence to health protocols, with masks and hand sanitizers distributed to attendees as shown in Figure 4.

Figure 4. Training Implementation at the Village Office

The training was conducted through a presentation, accompanied by the distribution of a pocket guide shown in Figure 5, titled "Guidelines for Building Environmentally Friendly Homes with a Focus on the Use of Natural Lighting in Nyogan Village, Mestong Subdistrict, Muaro Jambi Regency". This pocket guide provides a comprehensive explanation in simple language, making it easy to understand for construction workers and other community members.

Figure 5. Pocket guide 'Guidelines for Building Environmentally Friendly Houses'

During the session, participants gained practical knowledge about types of environmentally friendly houses. These houses can be designed simply to utilize sunlight as a source of lighting during the day. The practical knowledge shared during the training greatly captured the participants' attention. The participants were very enthusiastic while listening to the training. This was evident from the numerous questions asked. Some of the questions and their answers can be seen in Table 3.

Table 3. Questions Asked by Training Participants

No	Questions	Answer
1.	What should the distance between the house and the road be? What type of window design is recommended?	Several sources state that the building setback from the road, according to regulations, should be 1/2 + 1 of the road width. "For example, if the road width is 10 meters, the setback should be 5 meters plus 1, which is 6 meters from the edge of the road. If it is less than that, the permit (building permit) will not be issued."
2	There is a case of a completed shophouse building, with neighboring buildings on both sides, so natural lighting only comes through the ventilation openings on top. How can additional natural lighting be incorporated in this situation?	This can be addressed by adding an extension to the roof, such as using glass blocks, so that sunlight can still enter the room.
3	Some have inquired about the standard regulations regarding lighting requirements for residential buildings.	According to a regulation from the National Standardization Agency in the year 2000, a residential building requires a light intensity of 100-250 lux to support daily activities.

CONCLUSION

The community service implementation in Selapik Hamlet, Nyogan Village, Mestong Subdistrict, Muaro Jambi Regency was successfully carried out, following health protocols. Both the village officials and local residents were highly enthusiastic about the training and outreach, as it expanded their knowledge and enhanced their skills in building environmentally friendly houses. Consequently, if the community members apply the knowledge gained, it could reduce electricity consumption, which would lead to cost savings and contribute to the preservation of the surrounding environment. Conclusion the training and outreach successfully increased the local community's understanding and practical skills in building sustainable homes. The application of this knowledge is expected to help reduce energy consumption, leading to both financial savings and environmental benefits.

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We hope that the knowledge shared during this training will contribute to environmentally friendly and energy-efficient housing practices in Nyogan Village and beyond.

REFERENCES

Aflaki, A., Mahyuddin, N., Mahmoud, Z. A., & Baharum, M. R. (2015). A review on natural ventilation applications through building façade components and ventilation openings in tropical climates. *Energy and Buildings*, *101*, 153–162. https://doi.org/10.1016/j.enbuild.2015.04.033

Amani, A. H. M. (2017). Public perception of environmentally friendly home buildings in Banjarmasin City [in Bahasa]. *Jurnal Pendidikan Kewarganegaraan*, *7*(1), 1–8. https://doi.org/10.20527/kewarganegaraan.v7i1.3530

Asnuddin, A. (2012). Control of construction material remains in residential house construction. *Mektrik*, *12*(3), 155110. http://jurnal.untad.ac.id/jurnal/index.php/Mektek/article/download/545/469

Atmando, C. R. (2021). The influence of green product perception and green brand image on interest in buying environmentally friendly houses among generation Y in Surabaya. *PERFORMA*, *4*(3), 394–405. https://doi.org/10.37715/jp.v4i3.1651

Avesta, R., Putri, A. D., Hanifah, R. A., Hidayat, N. A., & Dunggio, M. D. (2017). Opening design strategy for natural lighting to support the energy-efficient building concept in West Jatinegara flats [in Bahasa]. *Jurnal Rekayasa Hijau*, *1*(2). https://doi.org/10.26760/jrh.v1i2.1633

Cadena, J. D. B., Poli, T., Košir, M., Lobaccaro, G., Mainini, A. G., & Speroni, A. (2022). Current trajectories and new challenges for visual comfort assessment in building design and operation: A critical review. *Applied Sciences*, *12*(6), 3018. https://doi.org/10.3390/app12063018

Cetintahra, G. E., & Cubukcu, E. (2014). The influence of environmental aesthetics on economic value of housing: An empirical research on virtual environments. *Journal of Housing and the Built Environment*, *30*(2), 331–340. https://doi.org/10.1007/s10901-014-9413-6

Dewantoro, F., Budi, W. S., & Prianto, E. (2019). Study of natural lighting in the reading room of the university of indonesia library. *Jurnal Arsitektur ARCADE*, *3*(1), 94. https://doi.org/10.31848/arcade.v3i1.162

Fuerst, F., & Shimizu, C. (2016). Green luxury goods? The economics of eco-labels in the Japanese housing market. *Journal of the Japanese and International Economies*, *39*, 108–122. https://doi.org/10.1016/j.jjie.2016.01.003

Gago, E., Muneer, T., Knez, M., & Köster, H. (2014). Natural light controls and guides in buildings. Energy saving for electrical lighting, reduction of cooling load. *Renewable and Sustainable Energy Reviews*, *41*, 1–13. https://doi.org/10.1016/j.rser.2014.08.002

Geng, Y., Ji, W., Wang, Z., Lin, B., & Zhu, Y. (2018). A review of operating performance in green buildings: Energy use, indoor environmental quality and occupant satisfaction. *Energy and Buildings*, *183*, 500–514. https://doi.org/10.1016/j.enbuild.2018.11.017

GhaffarianHoseini, A., Dahlan, N. D., Berardi, U., GhaffarianHoseini, A., Makaremi, N., & GhaffarianHoseini, M. (2013). Sustainable energy performances of green buildings: A review of current theories, implementations and

challenges. *Renewable and Sustainable Energy Reviews*, *25*, 1–17. https://doi.org/10.1016/j.rser.2013.01.010

Hong, S., Kim, Y., & Yang, E. (2021). Indoor environment and student productivity for individual and collaborative work in learning commons: A case study. *Library Management*, *43*(1/2), 15–34. https://doi.org/10.1108/lm-06-2021-0055

Horr, Y. A., Arif, M., Kaushik, A., Mazroei, A., Katafygiotou, M., & Elsarrag, E. (2016). Occupant productivity and office indoor environment quality: A review of the literature. *Building and Environment*, *105*, 369–389. https://doi.org/10.1016/j.buildenv.2016.06.001

Jatmiko, A. D., & Setiadarma, E. (2017). The concept of an environmentally friendly house facade with solar analysis of the building to reduce heat radiation into the room [in Bahasa]. *Seminar Nasional Ilmu Terapan (SNITER)*, *1*(1). https://ojs.widyakartika.ac.id/index.php/sniter/article/download/31/26

Kapferer, J., Klippert, C., & Leproux, L. (2013). Does luxury have a minimum price? An exploratory study into consumers' psychology of luxury prices. *Journal of Revenue and Pricing Management*, *13*(1), 2–11. https://doi.org/10.1057/rpm.2013.34

Kaygusuz, K. (2011). Energy for sustainable development: A case of developing countries. *Renewable and Sustainable Energy Reviews*, *16*(2), 1116–1126. https://doi.org/10.1016/j.rser.2011.11.013

Keyvanfar, A., Shafaghat, A., Majid, M. Z. A., Lamit, H. B., Hussin, M. W., Ali, K. N. B., & Saad, A. D. (2014). User satisfaction adaptive behaviors for assessing energy efficient building indoor cooling and lighting environment. *Renewable and Sustainable Energy Reviews*, *39*, 277–295. https://doi.org/10.1016/j.rser.2014.07.094

Kwong, Q. J. (2020). Light level, visual comfort and lighting energy savings potential in a green-certified high-rise building. *Journal of Building Engineering*, *29*, 101198. https://doi.org/10.1016/j.jobe.2020.101198

Maachi, I. N., Mokhtari, A., & Slimani, M. E. (2019). The natural lighting for energy saving and visual comfort in collective housing: A case study in the Algerian building context. *Journal of Building Engineering*, *24*, 100760. https://doi.org/10.1016/j.jobe.2019.100760

Majid, Z. K. (2022). Exterior façade design and its impact on boosting business and attracting customers in retail sectors. *Journal of Design Business & Society*, *8*(1), 69–86. https://doi.org/10.1386/dbs_00033_1

Maskur, A. (2022). Analysis of estimated costs for building economical and environmentally friendly houses for low-income communities [in Bahasa]. *Jurnal Media Teknologi*, *8*(2), 75–88. https://doi.org/10.25157/jmt.v8i2.2665

Mazur, Ł., Bać, A., Vaverková, M. D., Winkler, J., Nowysz, A., & Koda, E. (2022). Evaluation of the quality of the housing environment using multi-criteria analysis that includes energy efficiency: a review. *Energies*, *15*(20), 7750. https://doi.org/10.3390/en15207750

Moazzeni, M., & Ghiabaklou, Z. (2016). Investigating the influence of light shelf geometry parameters on daylight performance and visual comfort, a case study of educational space in Tehran, Iran. *Buildings*, *6*(3), 26. https://doi.org/10.3390/buildings6030026

Palarino, C., & Piderit, M. B. (2020). Optimisation of passive solar design strategies in side-lit offices: Maximising daylight penetration while reducing the risk of glare in different Chilean climate contexts. *Journal of Daylighting*, *7*(1), 107–121. https://doi.org/10.15627/jd.2020.9

Romano, R., Aelenei, L., Aelenei, D., & Mazzucchelli, E. S. (2018). What is an adaptive façade? Analysis of Recent Terms and definitions from an international perspective. *DOAJ (DOAJ: Directory of Open Access Journals)*. https://doi.org/10.7480/jfde.2018.3.2478

Roufechaei, K. M., Bakar, A. H. A., & Tabassi, A. A. (2013). Energy-efficient design for sustainable housing development. *Journal of Cleaner Production*, *65*, 380–388. https://doi.org/10.1016/j.jclepro.2013.09.015

Šujanová, P., Rychtáriková, M., Mayor, T. S., & Hyder, A. (2019). A healthy, energy-efficient and comfortable indoor environment, a review. *Energies*, *12*(8), 1414. https://doi.org/10.3390/en12081414

Tanuwidjaja, G., Mulyono, L. L. A., & Silvanus, D. C. (2013). Heinz Frick's eco-friendly and affordable home design [in Bahasa]. *.Jurnal TESA Arsitektur*. http://repository.petra.ac.id/id/eprint/16440

Wibowo, A. P. (2017). Eco-friendly house criteria. *Jurnal Muara Sains Teknologi Kedokteran Dan Ilmu Kesehatan*, *1*(1). https://doi.org/10.24912/jmstkik.v1i1.386