Injuruty: Interdisciplinary Journal and Humanity
Volume 4, Number 12, December 2025
e-ISSN: 2963-4113 and p-ISSN: 2963-3397

Analysis of Green Building Implementation on the Additional Building of Universitas Swadaya Gunung Jati

Trianto Gustoro, Arya Ihcsan Alhafidin, Mohammad Dody Suyuti, Fathur Rohman Robandi
Universitas Swadaya Gunung Jati, Indonesia
Email: triyantohustoro@gmail.com, arya@gmail.com, dody@gmail.com, fathur@gmail.com

Abstract
Environmental degradation and the rising energy demand in the building sector have underlined the urgency of implementing green building principles to mitigate ecological impacts and support long-term sustainability. This study aims to assess the sustainability performance of the Additional Building at Universitas Swadaya Gunung Jati using several evaluative parameters, including green open space, water efficiency, thermal comfort, lighting, carbon emission control, and energy performance. A quantitative-descriptive approach was employed using field measurements, direct observations, documentation, and verification interviews based on the Greenship Existing Building Version 1.1 standard issued by the Green Building Council Indonesia. The findings reveal that the building demonstrates strong compliance in terms of green open space (92.24%), optimal natural lighting (256.66 lux), and low OTTV values (16.91 W/m²), indicating efficient thermal resistance and minimal heat transfer through the building envelope. Conversely, water efficiency remains suboptimal due to the absence of alternative water management systems and roof tank infrastructure, leading to full reliance on electrical pumping. Thermal comfort also requires improvement since indoor temperatures and humidity exceed recommended benchmarks, which may influence user well-being and productivity. Overall, this study provides a comprehensive sustainability performance assessment and identifies key improvement indicators that can drive the development of a more energy-efficient and environmentally responsible campus. The results reinforce the strategic role of green building implementation in educational facilities as a foundation for future sustainable development.

Keywords: Green building; energy efficiency; water conservation; thermal comfort; sustainability; campus development

INTRODUCTION

Global warming occurs due to massive building development (Syahriyah, 2017). Over the past hundred years or so, the average temperature on the earth's surface has increased by 0.74 ± 0.18 °C. The earth's temperature rises due to the capture of sunlight waves by greenhouse gases(Pratama & Parinduri, 2019). The gas spreads the earth's temperature and the seawater gets hotter and finally hotter than normal temperatures (jacobus Samidjo, 2022). This will happen repeatedly and result in the average annual temperature of the earth continuing to increase. Rising global temperatures, climate change, rising sea levels, ecological disturbances, and socio-political impacts are some of the effects of global warming that can harm living things around the world. (Sulistiyono, 2012). Green buildings have become one of the increasingly prioritized solutions in the construction industry to face the challenges of climate change and increasing energy demand. (Andrian, 2024).

The building sector contributes significantly to global energy consumption and carbon emissions, accounting for approximately 40% of total energy use worldwide (UNEP, 2020). Green buildings have become one of the increasingly prioritized solutions in the construction

industry to face the challenges of climate change and increasing energy demand (Andrian, 2024). In Indonesia, the government has mandated efforts to save energy, electricity, water, and fuel through various policies and regulations (Ariansyah & Setiono, 2023).

The concept of green development is a great idea to implement because it can help reduce the impact of global warming.(Roshaunda et al., 2019). Green building is a building that in the process of planning and construction and operations considers the use of environmentally friendly materials, water conservation, energy efficiency, and air quality (Sudarman et al., 2021). This theory can be used in universities, commercial buildings, and offices in Indonesia. (Ariansyah & Setiono, 2023). The green campus concept is a development of the green building concept that must be carried out by universities as an effort to overcome environmental problems (Maryam et al., 2021). The government has announced that it will strive to save energy, electricity, water, and fuel (Ariansyah & Setiono, 2023).

As the demand for efficient, comfortable, and environmentally friendly spaces increases, the construction of educational facilities that can last a long time is becoming an important issue (Deng et al., 2011; Liu & Ren, 2020). The green building concept is used to ensure that campus buildings meet user comfort requirements while reducing energy use, clean water use, and long-term impact on the environment (Adeswastoto et al., 2023). Studies show that the quality of lighting, ventilation, and the amount of open green space available have an important role in determining how comfortable and productive academic activities are (Pakaya et al., 2024). The focus of building sustainability research includes a variety of things, such as energy savings (Asriatul Kholifah et al., 2023), water use efficiency (Madonna et al., 2014), and how environmental conditions affect thermal comfort in campus environments (I Gusti Agung Ayu Cantika Indraswari, Anak Agung Ayu Oka Saraswati, 2024). In addition, to realize a successful green campus, building design, management policies, and user behavior must be integrated to achieve optimal levels of sustainability (Puspadi et al., 2016).

Recent research on building sustainability has primarily focused on isolated aspects such as energy savings (Asriatul Kholifah et al., 2023), water use efficiency (Madonna et al., 2014), and thermal comfort in campus environments (I Gusti Agung Ayu Cantika Indraswari et al., 2024). While these studies provide valuable insights, they often examine parameters independently without considering the interdependencies and synergistic effects among various sustainability indicators. In addition, to realize a successful green campus, building design, management policies, and user behavior must be integrated to achieve optimal levels of sustainability (Puspadi, Wimala, & Sururi, 2016).

However, a significant gap exists in the literature regarding comprehensive evaluations of campus buildings that simultaneously assess multiple sustainability parameters including green open spaces, alternative water sources, thermal comfort, lighting quality, water consumption patterns, carbon emissions, and energy efficiency. Furthermore, there is insufficient analytical framework to examine how internal and external environmental variables—such as temperature, humidity, lighting intensity, and space density—interact with one another and collectively influence building performance and user comfort.

Most existing studies also lack the integration of quantitative field measurements with qualitative verification methods, resulting in assessments that may not fully capture the actual operational performance of buildings. Additionally, limited research has been conducted specifically on existing educational buildings in Indonesia using the Greenship Existing Building standards, despite the country's growing commitment to sustainable development.

Based on the identified research gaps, this study introduces novelty through an integrated evaluative approach that combines multiple sustainability parameters via comprehensive quantitative analysis and examines their interrelationships. Specifically, it contributes by developing a holistic framework that simultaneously assesses six critical parameters—green

open space, water efficiency, thermal, visual, and natural lighting comfort, and energy efficiency—using standardized measurements. This is achieved through a mixed-method approach combining field measurements, observational data, documentation analysis, and verification interviews to ensure data triangulation, while also analyzing correlation patterns among environmental variables to understand their collective influence on sustainability performance. Ultimately, it provides empirical evidence from an Indonesian university context, addressing the limited knowledge on green building implementation in tropical educational facilities.

Building on this contribution, the study aims to evaluate the functional performance of the Universitas Swadaya Gunung Jati Additional Building against Greenship Existing Building Version 1.1 standards, focusing on its environmental and operational parameters. It further seeks to identify specific metrics and performance indicators requiring improvement to support a more sustainable green campus. Through this analysis, the research will provide evidence-based recommendations for enhancing building sustainability that can be adapted and applied to similar educational facilities across Indonesia.

RESEARCH METHOD

The quantitative-descriptive method is one of the methods used in this study using primary and secondary data collection techniques (Jayusman & Shavab, 2020). Primary data in this study was obtained through observations, verification interviews and direct measurements with reference to the Greenship Existing Building Version 1.1-GBCI standard. (Kustiani et al., 2023)

Direct Observation

The researcher conducted direct observations and measurements on the research object, namely the Gunng Jati Swadaya University Additional Building with reference criteria in Greenship Existing Building Version 1.1-GBCI and planning documents (building plans) that had been prepared in advance.

Documentation

It is a data collection technique in the form of photos and or drawings during observation at the Gunung Jati Independent Auxiliary Building.

Verification interview

There is a possibility that the observations made by the researcher are not thorough or periodic so that in conducting the assessment, a verification interview is needed to ensure the truth about the state of the building of the object of study.

The direct observation method is used to record the physical aspects of the building, which is then reinforced by interviews. Secondary data were collected through the literature, and relevant journals(Beno, et al.2022)

To assess the sustainability performance of the Gunung Jati Swadaya University Additional Building. This study conducted direct measurements in the inside, outside, and open spaces of the campus. By using key equipment such as digital thermohygrometers, digital lux meters, and GPS devices to determine observation points, key data is obtained from measurements of temperature, humidity, and lighting intensity. Secondary data is collected from campus facility managers and consists of building plans, water usage records, and operational information.

The measurement procedure is carried out in accordance with the standards set for thermal comfort and lighting of the building. The collected data undergoes basic statistical analysis to determine the characteristics of the space. The comfort index is analyzed to assess the alignment between actual conditions and user perceptions. Correlation analysis is performed to identify relationships between environmental variables, including temperature, humidity, lighting, and space density. The results are then synthesized to provide a

comprehensive evaluation of the building's sustainability performance and to identify areas that need improvement to align with the principles of sustainable campus building.

The research location is in the Additional Building of Swadaya Gunung Jati University, Sunyaragi, Kesambi District, Cirebon City, West Java Province 45132.

DISCUSSION RESULTS

The selection of criteria for green development was carried out by direct observation and verification interviews occupying the Additional Building of Gunung Jati Swadaya University and understanding the Green Building Concept (Ariansyah & Setiono, 2023).

Measurement of Green Building Criteria

Based on direct observation and verification interviews that have been carried out, several aspects that are considered the most important are obtained, namely:

Green Open Space
Thermal Comfort

Figure 1. Research Location

Visual Comfort
Natural Lighting
Water Usage
Energy Efficiency

After that, it is explained about some of the aspects above and described as follows:

Green Open Space

Based on research through manual measurements using roller meters and Google Earth by determining the coordinate points of the land boundary of the Additional Building of Swadaya Gunung Jati University to find the total area of the area.

Figure 2. Coordinate Points

Table 1. Coordinate Points

Dot	X (Longtitude)	Y (Latitude)
P1	1.085.394.143	-67.336.085
P2	1.085.394.656	-67.326.565
P3	1.085.394.539	-67.326.482
P4	1.085.389.902	-67.327.118
P5	1.085.389.167	-67.327.504
P6	1.085.387.417	-67.328.060
P7	1.085.385.402	-67.328.223
P8	1.085.385.094	-67.335.509

The measurement results show that the total area of green open space reaches ± 8,776.68 m² of the total campus land area of 9,515 m², or about 92.240% of the area. This value has met the minimum RTH standard based on Law Number 26 of 2007 concerning Spatial Planning and the Minister of Public Works No. 05/PRT/M/2008, which requires the availability of RTH of at least 30% of the total area area. Thus, green space in the campus environment has been in the good category and supports the principle of sustainable campus.

Thermal Comfort

Based on direct temperature and humidity measurements using a thermohygrometer in each room of the Additional Building of Gunung Jati Swadaya University on Monday, August 25, 2025 in the morning at 09.00, in the afternoon at 12.00 and in the afternoon at 15.00 WIB. And thermal comfort analysis using graphs.

According to the measurement results shown on the Classroom Average Temperature graph, five classrooms have an average temperature between 27,233°C and 27,600°C; classroom 2.02 has the highest average temperature of 27,600°C, and classroom 1.02 has an average temperature of 27,233°C. In general, the temperature distribution pattern shows relatively small variation and tends to be stable at around 27.3°C.

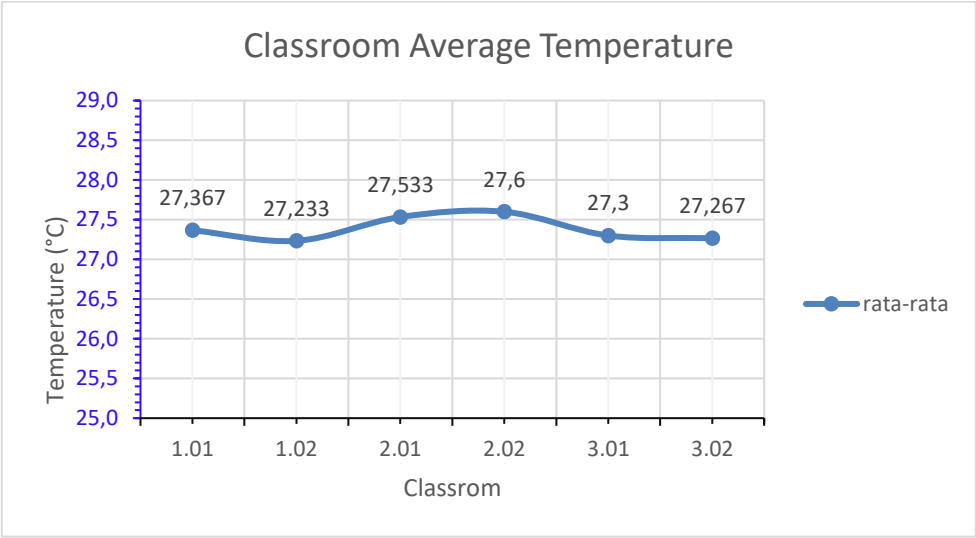

Figure 3. Average Classroom Temperature Graph

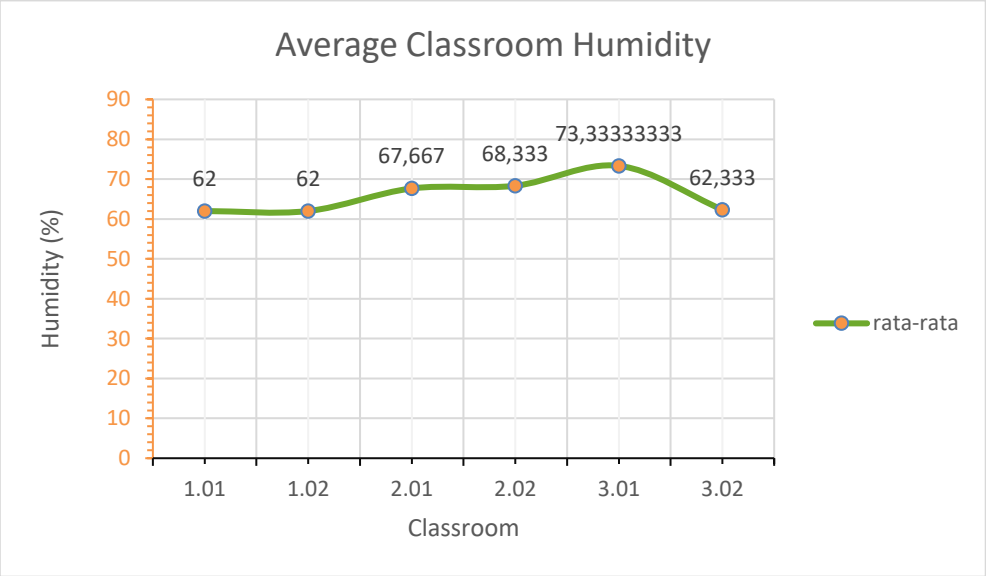

Figure 4. Average Classroom Humidity Graph

According to the Average Classroom Humidity chart, six classrooms have humidity levels ranging from 62% to 73.33%. Classrooms 3.01 had the highest humidity value, 73.33%, while classrooms 1.01 and 1.02 had the lowest humidity values, 62%, respectively. The moisture distribution pattern shows an increasing trend from the 1st floor to the 3rd floor, before decreasing again on the 3.02nd floor, which has an average humidity of 62.33%.

Based on SNI 03-6572-2001 and Permenkes NO. 1405/Menkes/SK/XI/2002 which regulates the thermal conditions of the room, namely at a comfortable air temperature ranging from 24°C – 27°C for rooms with light activities (such as classrooms, offices, or laboratories) and the recommended relative humidity (RH): 40% – 60%. Therefore, the results of the temperature and humidity that occur in the room at the Gunung Jati Swadaya University Additional Building, namely that good thermal comfort conditions have not been created. Because the Gunung Jati Swadaya University Additional Building has an average value of 27.383°C and an average air humidity of 65.944%.

Visual Comfort

The measurement results show that the lux meter was used in each room on Monday, August 25, 2025, at 09.00 am, 12.00 pm, and 15.00 pm. Based on SNI 03-6197-2000 The level of lighting in the public area of the Gunung Jati University Additional Building building is between 100-300 lux. The researchers conducted the study at three different times, namely in the morning, afternoon, and evening. Based on the results of measurements at the Gunung Jati Swadaya University Auxiliary Building, the researcher obtained an average lighting value of 256.66 lux according to the permitted lighting level.

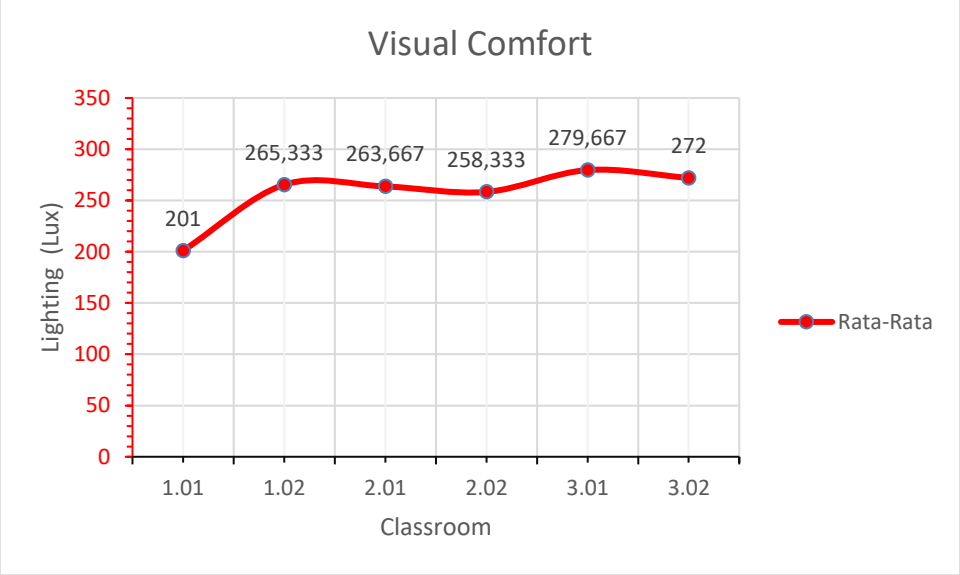

Figure 5. Artificial Lighting Average Graph

Natural Lighting Analysis

The results of the measurement of the average natural lighting level carried out at the Gunung Jati Swadaya University Additional Building on Monday, August 25, 2025 in the morning at 09.00, in the afternoon at 12.00, and in the afternoon at 15.00 WIB are as follows: Based on the results of measurements that have been carried out in the room of the Gunung Jati Swadaya University Additional Building in the morning, afternoon and evening, the average intensity of sunlight entering the room is around 218,333 lux. Therefore, it can be concluded that the intensity of incoming sunlight has met the optimal standard for the use of natural sunlight, which is 200-300 lux. So that the design of the opening in the building has met the Greenship criteria.

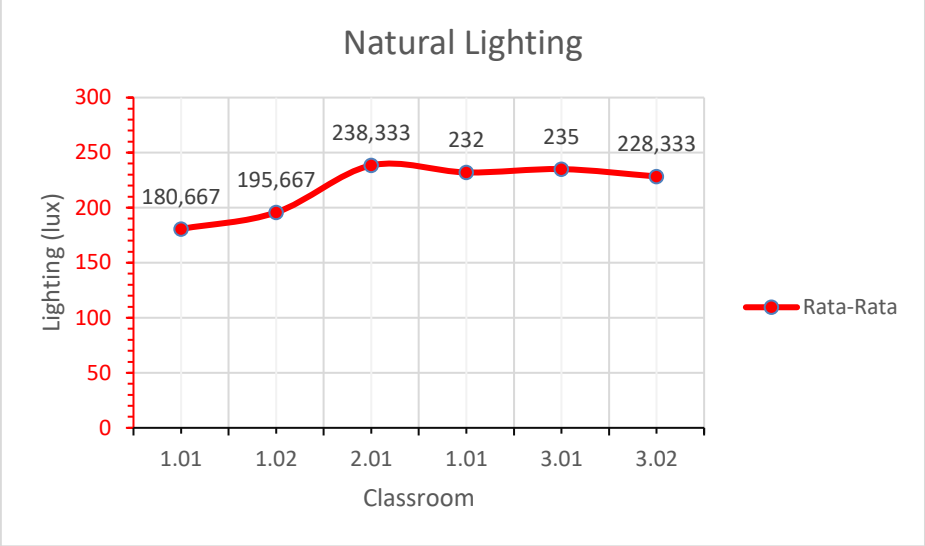

Figure 6. Natural Lighting Average Graph

Water Usage Analysis

Table 2. Comparison of Water Needs with SNI Standard 03-7065-2005

Parameters	Standard Grades	Calculation Results	Remarks
Water requirements per person per day	50–70 liters/person/day	60 liters/person/day	Compliant with standards
Number of users	-	62 people	Students, lecturers, staff
Total water requirement (Qk)	-	3,720 liters/day	Follow the standard requirements
Water availability (Qs)	Customized to the supply source	15,955 liters/day	Water discharge available
Water availability after reduced demand (K_a)	-	12,235 liters/day	Surplus water availability
SNI Compliance	Must meet the needs of users	Sufficient / Surplus	Availability far above needs

The results of the comparison show that the water requirement for building users of 60 liters per person per day meets the standard range of SNI and Permen, which is 50 to 70 liters per person per day. In addition, the amount of water available daily of 15,955 liters indicates a significant water surplus condition, with a difference of 12,235 liters per day. This indicates that the building has an adequate amount of water to support optimal daily operations.

Energy Efficiency Analysis

Table 3. Niai OTTV Building Orientation

Orientation	And	Your	Aw	ΔT	Uf	Off	SC	Sf	OTTV
Stuart	203,54	0,8	147,6	4,7	5,8	55,94	0,5	125	27,396
West	70,2	0,8	70,2	4,7	5,8	-	0,5	196	5,544
South	203,54	0,8	147,6	4,7	5,8	54,54	0,5	145	29,458

Orientation	And	Your	Aw	ΔT	Uf	Off	SC	Sf	OTTV
East	70,2	0,8	70,2	4,7	5,8	-	0,5	154	5,245
Total									16,911

Based on the results of calculations using the SNI 03-6389-2011 method concerning Energy Conservation of Building Sheaths in Air-Conditioned Buildings, the average Overall Thermal Transfer Value (OTTV) value in the Campus Additional Building of Universitas Swadaya Gunung Jati (UGJ) was 16,911 W/m². This value is below the maximum limit of 45 W/m² set by national standards, so it can be categorized as a low OTTV value. This condition shows that the building has a good ability to withstand heat transfer from outside to the room, which means that the thermal energy efficiency of the building is relatively high.

CONCLUSION

The Additional Building at Universitas Swadaya Gunung Jati Campus demonstrates fairly good Green Building implementation, particularly in energy efficiency, natural lighting, and green open space provision. However, improvements in water conservation and electrical energy management are needed to meet higher Greenship Existing Building (EB) criteria from the Green Building Council Indonesia (GBCI). With these enhancements, it holds strong potential as a model for sustainable, energy-efficient, environmentally friendly, and healthy educational buildings, advancing the Green Campus concept. Future research could assess post-improvement performance through longitudinal Greenship audits and benchmarking against regional green campuses.

REFERENCES

Adeswastoto, H., Setiawan, B., Desrimon, A., Alisa Putra, A., Islah, M., & Tuanku Tambusai, P. (2023). Analisis Penerapan Green Building Pada Bangunan Gedung Klinik Universitas Pahlawan E-mail: a hanantatur@universitaspahlawan.ac.id, (Corresponding author). *Journal of Engineering Science and Technology Management*, *3*(1), 2828–7886.

Andrian, F. (n.d.). *Analisis Kinerja Bangunan Hijau dalam Konteks Kebutuhan Energi*. 1–11.

Ariansyah, N. K., & Setiono, J. (2023). *Evaluasi Kelayakan Green Building Pada Gedung Jurusan Teknik Sipil Polinema*. *4*, 37–43.

Asriatul Kholifah, N., Adelia Nanda Baihaki, J., Jannah, M., Frisca, H., Ramzi Aushaafranaa, M., Andriani, W., & Tara Sabila, A. (2023). Analisis Konservasi Dan Efisiensi Energi Di Gedung Fakultas Teknik Universitas Mulawarman. *Seminar Karya Dan Pameran Arsitektur Indonesia*, *6*(1), 1267–1274.

Beno 2022. (2022). Dampak Pandemi Covid -19 Pada Kegiatan Ekspor Impor (Studi Pada Pt. Pelabuhan Indonesia Ii (Pesero) Cabang Teluk Bayur). *Dampak Pandemi Covid -19 Pada Kegiatan Ekspor Impor (Studi Pada Pt. Pelabuhan Indonesia Ii (Pesero) Cabang Teluk Bayur)*, *22*(8.5.2017), 2003–2005.

Deng, S., Dai, Y. J., Wang, R. Z., & Zhai, X. Q. (2011). Case Study Of Green Energy System Design For A Multi-Function Building In Campus. *Sustainable Cities And Society*, *1*(3), 152–163.

Gusti Agung Ayu Cantika Indraswari[1], Anak Agung Ayu Oka Saraswati[2], I. N. S. (2024). *Universitas Udayana Penerbit Universitas Udayana*. *1883*(256), 2024.

Jacobus Samidjo, Y. S. (2022). Memahami Pemanasan Global Dan Perubahan Iklim. *Nuevas Tendencias*, *24*(107), 39–40.

Jayusman, I., & Shavab, O. A. K. (2020). Aktivitas Belajar Mahasiswa Dengan Menggunakan

Media Pembelajaran Learning Management System (Lms) Berbasis Edmodo Dalam Pembelajaran Sejarah. *Jurnal Artefak*, *7*(1), 13. Https://Doi.Org/10.25157/Ja.V7i1.3180

Kustiani, I., Helmi, M., & Aini, N. S. (2023). Green Building Assessment And Recommendations For Optimization Case Study Of The Rectorate Building The University Of Lampung. *Journal Of Engineering And Scientific Research*, *5*(1), 20–26. Https://Doi.Org/10.23960/Jesr.V5i1.135

Liu, Q., & Ren, J. (2020). Research On The Building Energy Efficiency Design Strategy Of Chinese Universities Based On Green Performance Analysis. *Energy And Buildings*, *224*, 110242.

Madonna, S., Studi, P., Lingkungan, T., & Bakrie, U. (2014). *Efisiensi Energi Melalui Penghematan Penggunaan Air (Studi Kasus : Institusi Pendidikan Tinggi Universitas Bakrie)*. *12*(4), 267–274.

Maryam, M., Fanani, F., & Efendi, H. (2021). Penerapan Konsep Green Building Pada Perguruan Tinggi Di Daerah Istimewa Yogyakarta Dalam Mendukung Program Pengembangan Kota Hijau. *Specta Journal Of Technology*, *5*(3), 261–272. Https://Doi.Org/10.35718/Specta.V5i3.387

Pakaya, P., Lihawa, F., & Baderan, D. W. K. (2024). Efektivitas Ruang Terbuka Hijau Publik Dalam Menyerap Emisi Karbon Dioksida Untuk Mendukung Keberlanjutan Lingkungan Perkotaan. *Hidroponik: Jurnal Ilmu Pertanian Dan Teknologi Dalam Ilmu Tanaman*, *1*(3), 54–75.

Pratama, R., & Parinduri, L. (2019). Penanggulan Pemanasan Global. *Buletin Utama Teknik*, *15*(1), 91–95.

Puspadi, N. A., Wimala, M., & Sururi, R. (2016). Perbandingan Kendala Dan Tantangan Penerapan Konsep Green Campus Di Itenas Dan Unpar. *Rekaracana: Jurnal Teknil Sipil*, *2*(2), 23.

Roshaunda, D., Diana, L., Caroline, L. P., Khalisha, S., & Nugraha, R. S. (2019). Penilaian Kriteria Green Building Pada Bangunan Gedung Universitas Pembangunan Jaya Berdasarkan Indikasi Green Building Council Indonesia. *Widyakala Journal*, *6*, 29. Https://Doi.Org/10.36262/Widyakala.V6i0.181

Sudarman, S., Syuaib, M., & Nuryuningsih, N. (2021). Green Building: Salah Satu Jawaban Terhadap Isu Sustainability Dalam Dunia Arsitektur. *Teknosains: Media Informasi Sains Dan Teknologi*, *15*(3), 329. Https://Doi.Org/10.24252/Teknosains.V15i3.22493

Sulistiyono. (2012). Sulistiyono. *Majalah Ilmiah Ppsdm Migas*, *02*(2), 47–56.

Syahriyah, D. R. (2017). Penerapan Aspek Green Material Pada Kriteria Bangunan Rumah Lingkungan Di Indonesia. *Jurnal Lingkungan Binaan Indonesia*, *6*(2), 100–105. Https://Doi.Org/10.32315/Jlbi.6.2.95