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ANALYSIS OF ENERGY SAVING OPPORTUNITIES IN BUILDING A REGIONAL SECRETARIAT OF CENTRAL JAVA PROVINCE AND THE SUITABILITY OF GREEN BUILDING CRITERIA

Handoko Bayu, Djaka Windarta, Hadiyanto
Universitas Diponegoro, Semarang, Indonesia
E-mail: handokobayu@students.undip.ac.id, jakawindarta@lecturer.undip.ac.id, hadiyanto@lecturer.undip.ac.id

KEYWORDS
energy saving; green building

ABSTRACT

The government through Law No. 30 of 2007 concerning Energy, seeks to manage the energy sector in Indonesia in a fair and equitable manner and provide benefits to all Indonesian people. The pattern of energy consumption which increases every year in line with the increase in population illustrates that a concerted effort is needed to increase the reliability of energy supply. This research is a quantitative research conducted by processing secondary data and observing on site to determine patterns of energy consumption, recommendations for energy saving opportunities and suitability of green building criteria . In this study, to obtain data regarding the condition of electricity in Building A of the Regional Secretariat of Central Java Province, primary data and secondary data were collected. Primary data was obtained from the results of a survey that was carried out in Building A of the Regional Secretariat of Central Java Province by collecting data on the type of Air Conditioner (AC) load and the lights used, data regarding the building envelope and measuring the intensity of light in each room which was assisted by a measuring instrument. Smart Sensor AS803 Digital Lux Meter

INTRODUCTION

The government through Law No. 30 of 2007 concerning Energy, seeks to manage the energy sector in Indonesia in a fair and equitable manner and provide benefits to all Indonesian people (Hudaya, 2016) . The pattern of energy consumption which increases every year in line with the increase in population illustrates that a concerted effort is needed to increase the reliability of energy supply. Dependence on energy using fossil fuels has received considerable attention, in addition to the increasingly depleted condition of fossil energy, the issue of environmental impacts is also a serious problem in the context of energy supply (Indonesia, 2007) .

Energy supply by utilizing energy from non-fossil fuels needs to be increased to reduce dependence on fossil fuels. In addition, energy conservation efforts are also needed in various sectors, including energy conservation in buildings (Fasya, 2018) . The impact of large building energy consumption on nature, of course, causes the condition of natural resources, especially non-renewable sources, to become increasingly scarce and difficult to access in the coming years. (Magdalena & Tondobala, 2016) .

Energy conservation is a systematic, planned and integrated effort to conserve domestic energy resources and increase the efficiency of their utilization (Government

Regulation of the Republic of Indonesia, 2009) . Energy conservation is carried out through energy management.

Energy audit is one way of implementing energy management. Energy audits carried out periodically will provide an overview or profile of energy use in a building as well as produce recommendations for energy saving opportunities (Oktaviani, n.d.) . Energy audits are generally divided into 3 types namely:

1. Walkthrough/brief energy audit
2. Detailed energy audit
3. Detailed energy audit

The main indicator of energy saving in a building generally uses Energy Consumption Intensity (IKE). IKE shows the amount of energy consumption (kWh) per square meter (m2) every month. The IKE figure (kWh/m2/month) is obtained by dividing the number of kWh of electricity used for a month by the area of the building used (Sinaga, Sasue, & Hutahaean, 2021) .

In contrast to shopping centers and hotels, the amount of energy used in offices is influenced by the number of employees and the amount of time/hours worked by office employees (Rahardjo, nd) . Like other types of buildings, the main energy-consuming equipment in offices is generally air conditioning (AC), sockets, lights, transportation systems and utilities. Based on this, the steps for implementing energy conservation in office buildings can be applied primarily to air conditioning, the use of office equipment and lights. Several matters related to the application of energy conservation in offices include: (Directorate General of New, Renewable Energy and Energy Conservation, 2020) :

1. To reduce the burden of using energy originating from air conditioning equipment, this can be done by regulating natural air circulation in buildings, planting natural vegetation and using efficient air conditioning devices.
2. Optimizing natural lighting, replacing lamps with LEDs and using automatic sensors can reduce energy consumption in lighting systems.
3. Building owners are required to provide education and understanding regarding energy efficiency for building users. The behavior and habits of office equipment users determine how much energy consumption is in offices.

Based on Presidential Instruction No. 13 of 2011, the use of energy and water within Government/Regional Government agencies, BUMN, and BUMD must be limited, supervised, and set an example for society (Presidential Instruction, 2011) . The Central Java Provincial Secretariat is located in the Central Java Governor's Office complex which is located at Jalan Pahlawan No. 9, Semarang, consists of several main buildings including Building A, Building B, Building C, Building D, Building E and Gradhika Bhakti Praja Building (Abdurrahman, Pramudya, Sutjahjo, & Tambunan, 2013) .

Building A Regional Secretariat of Central Java Province has 13 floors which is the building with the most number of floors owned by the Provincial Government of Central Java for this type of office building. Based on the area of the building, Building A of the Central Java Provincial Secretariat is classified as a large building, namely a building with an area of at least 5,000 m² (five thousand square meters) including the basement (Semarang Mayor Regulation, 2019) , Meanwhile, the classification based on height includes high-rise buildings or buildings with more than 8 (eight) floors (Government Regulation of the Republic of Indonesia, 2021) . Energy use in Building A of the Regional Secretariat uses energy sources from PT. PLN (Persero) with a subscription power of

1,385 kVA in the tariff group for the needs of large government offices at medium voltage or with power above 200 kVA (P2), with a graph of monthly billing data starting in January 2019 in the following figure:

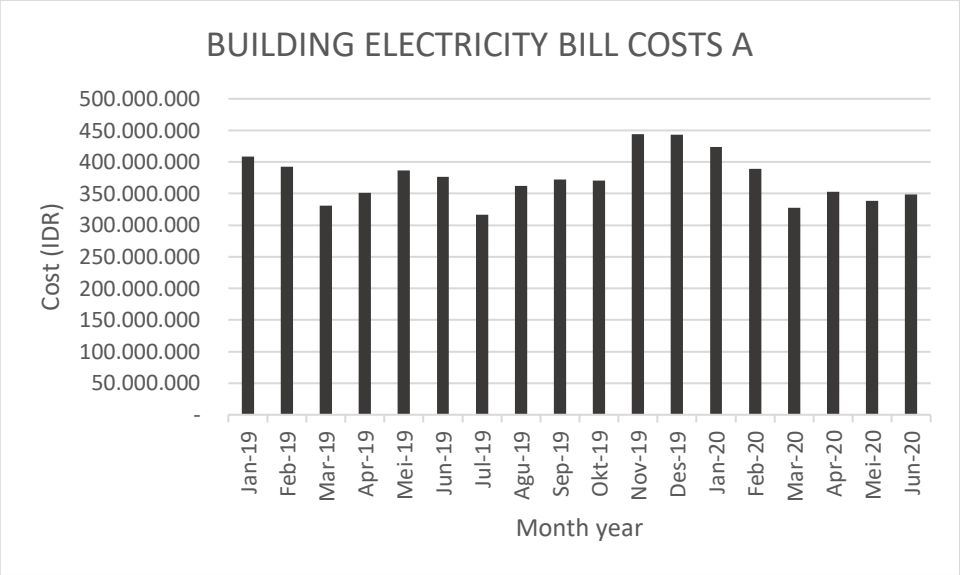

Figure 1
The cost of electricity bills for building A

The graph of energy consumption based on data on electricity bills in Building A of the Regional Secretariat of Central Java Province still shows a pattern of fluctuating energy consumption. In certain months there is a significant increase in the cost of electricity bills, whereas when there is a decrease, it may be due to the influence of the Covid 19 pandemic with the implementation of the Work From Home work system at certain times or months.

One way to implement energy savings is to include the green building concept for office buildings. Green buildings or green buildings are buildings that meet building requirements and have significant measurable performance in saving energy, water and other resources through the application of green building principles in accordance with their functions and classifications in each stage of their implementation. (Semarang Mayor Regulation, 2019) . There are several aspects or elements that will influence a building to be labeled a green building. These elements include effective land management, energy saving and energy conservation use, saving water consumption, selecting the right materials, air conditioning and creating comfortable indoor air as well as building environmental management. (Artha, Tyas, & Murti, 2020) . Of the six elements that greatly affect energy consumption because it is not only related to the comfort of occupants in space but is also closely related to economic aspects. Efforts to be able to reduce the amount of energy consumption in buildings include applying designs that can reduce energy values such as reducing the percentage of openings, choosing the right transparent material and adding shading applications.

In accordance with the mandate contained in Presidential Instruction No. 13 of 2011 which states regarding energy saving steps and innovations in office buildings and/or buildings managed by the Government, Regional Governments, BUMN, and BUMD, so with this research it is hoped that it will be able to find out energy saving opportunities that can be applied in one of the building of the Regional Government agency, namely in

Building A of the Regional Secretariat of Central Java Province as well as knowing the suitability of green building criteria.

The implementation of energy audits on buildings for the Government of Central Java Province has the benefit of providing an overview of energy use profiles and recommendations for energy saving opportunities as a reference for building owners in the context of energy-efficient building management as well as a reference for Regional Governments in conducting building suitability assessments based on green building criteria .

RESEARCH METHODS

This research was conducted in building A, the Regional Secretariat Complex for Central Java Province, which is located at Jalan Pahlawan No. 9, Semarang.

This research is a quantitative research conducted by processing secondary data and observing on site to determine patterns of energy consumption, recommendations for energy saving opportunities and suitability of green building criteria.

This study uses primary data and secondary data. Primary data is data that is directly obtained from observations, interviews, measurements and analysis at research locations, while secondary data comes from a literature review in the form of data that supports analysis related to research.

RESULTS AND DISCUSSION

In this study, to obtain data regarding the condition of electricity in Building A of the Regional Secretariat of Central Java Province, primary data and secondary data were collected. Primary data was obtained from the results of a survey that was carried out in Building A of the Regional Secretariat of Central Java Province by collecting data on the type of Air Conditioner (AC) load and the lights used, data regarding the building envelope and measuring the intensity of light in each room which was assisted by a measuring instrument. Smart Sensor AS803 Digital Lux Meter.

Secondary data was obtained from documents related to Building A of the Regional Secretariat of Central Java Province, such as the master plan for Building A of the Regional Secretariat of Central Java Province. In addition, the secondary data needed to carry out this research is in the form of a standard that is used as a reference for improvements in Building A of the Regional Secretariat of Central Java Province.

Primary data and secondary data will then be processed using the help of Microsoft software, so that it can generate existing data on energy consumption in Building A of the Regional Secretariat of Central Java Province. The existing energy consumption data will then be compared with standards, to find out potential improvements that can be implemented in Building A of the Regional Secretariat of Central Java Province so that it meets green building standards in terms of energy conservation.

Existing Data of Building A Regional Secretariat of Central Java Province

Air System

Building A Regional Secretariat of Central Java Province uses air *conditioning* (AC) equipment. Based on the survey results that have been carried out, the types of air conditioners used in Building A of the Regional Secretariat of the Province of Central Java are *single split* air conditioners and central air conditioners with various capacities. The following is a table of survey results regarding the types and types and capacities of air conditioners used in Building A of the Regional Secretariat of Central Java Province.

Table 1
Existing condition of AC type and capacity

Air conditioner type and capacity	Volumes (units)	Power (W)	Total Power (W)
1st – 13 th floor			
Split AC, 17,750 Btu/h	65	1,650	107,250
Split AC, 18,000 Btu/h	19	1,800	34,200
Split AC, 19,000 Btu/h	37	2,000	74,000
Standing floor AC, 42,700 Btu/h	6	4,800	28,800
AC cassette, 136,500 Btu/h, VRF type	39	10,200	397,800
		Total :	**642.050**

COP (*Coefficient of* Performance) is an indication of how efficiently the AC unit uses energy, the greater the COP value, the greater the efficiency of the AC used. AC value calculation is a comparison of the cooling effect (Q) with work input (W). The amount of AC COP for each floor in Building A of the Regional Secretariat of Central Java Province can be seen from the following table.

Table 2
AC COP calculation

Air conditioner type and capacity	Specification			COP (Q/W)
	Btu/h	Q	W	
Split AC, 17,750 Btu/h	18,000	5,200	1,650	3.15
Split AC, 18,000 Btu/h	18,000	5,275	1,800	2.93
Split AC, 19,000 Btu/h	19,000	5,280	2,000	2.64
Standing floor AC, 42,700 Btu/h	42,700	12,500	4,800	2.60
AC cassette, 136,500 Btu/h, VRF type	136,500	40,000	10,200	3.92

According to the SNI 6390:2020 standard, the COP of an air conditioner in order to meet *green building standards* based on energy conservation is a minimum value of 2 for a *single split type air conditioner* with a capacity of less than 27,000 BTU (AC capacity <27,000 BTU), 4.0 for AC with a *single split type* with a capacity of more than 27,000 BTU and less than 65,000 BTU (27,000 BTU < AC Capacity < 65,000 BTU) and 3.81 for VRF *(Variable Refrigerant Flow) AC types*

Based on this, it can be seen that based on the results of COP AC calculations in Building A of the Regional Secretariat of Central Java Province, the air conditioners used in the building do not meet the standards for green building on the basis of energy conservation. This is because the COP calculation value for each air conditioner in Building A of the Regional Secretariat of Central Java Province is still below the allowable AC standard value, which is 4.2 for a capacity of less than 27,000 BTU (AC capacity <27,000 BTU) and 4 .0 for air conditioners with a capacity of more than 27,000 BTU and less than 65,000 BTU (27,000 BTU < AC Capacity <

65,000 BTU). As for the AC with the VRF type, it already meets the standards according to SNI. The following table compares the results of COP AC calculations with the SNI standards used.

Table 3
COP calculation table and SNI standard

Air conditioner type and capacity	COP			Description
	calculation	SNI	Peraturan Walikota	
Split AC, 17,750 Btu/h	3.15	4.20	3.70	Non standard
Split AC, 18,000 Btu/h	2.93	4.20	3.70	Non standard
Split AC, 19,000 Btu/h	2.64	4.20	3.70	Non standard
Standing floor AC, 42,700 Btu/h	2.60	4.0	3.70	Non standard
AC cassette, 136,500 Btu/h, VRF type	3.92	3.81	3.70	Standard

Lighting System

There are 2 (two) types of lighting systems used in Building A of the Regional Secretariat of Central Java Province, namely natural lighting using ventilation and windows used and artificial lighting using lamps. This chapter will discuss the comparison of artificial lighting with the density standards permitted by SNI 6197:2020. Following are the existing conditions of the artificial lighting system used in Building A of the Regional Secretariat of Central Java Province.

Table 4
The existing condition of artificial lighting in Building A Regional Secretariat of Central Java Province

Room	Lamp Type	Number of light points	Number of lights		Power (W)	Total (W)
			Total	It works		
1st floor						
R. Transit VIP	LED 20 W	8	8	8	20	160
Klinik	TL LED T8 3 x 9 W	12	12	12	9	108
R Transit dan Makan Tamu	LED 16 W	30	30	7	16	112
	TL LED T5 24 W	6	6	6	24	144
	TL LED T5 18 W	4	4	4	18	72
Lobby Utama Gedung A	TL LED T5 24 W	36	36	25	24	600
	LED 16 W	26	26	26	16	416
	TL 4 x 16 W	8	8	2	16	32
	TL 4 x 16 W	4	4	4	24	64
R Sound system	LED 16 W	3	3	3	16	48

Room	Lamp Type	Number of light points	Number of lights		Power (W)	Total (W)
			Total	It works		
R Santel	LED 16 W	2	2	2	16	32
R Pers	LED 16 W	4	4	4	16	64
2nd floor						
R TU Gubernur	LED 16 W	12	12	12	16	192
	TL 4 x 18 W	36	36	36	18	648
R Gubernur	LED 16 W	30	30	30	16	480
	TL 4 x 18 W	36	36	36	18	648
	TL LED T5 3 x 14 W	48	48	48	14	672
Situation Room	LED 20 W	18	18	18	20	360
R Rapat Gedung A	LED 14 W	11	11	11	14	154
	TL 24 W	16	16	16	24	384
	TL 18 W	12	12	12	18	216
	Bulb	10	10	10	5	50
R kontrol	TL LED T5 3 x 14 W	3	9	3	14	42
	TL 4 x 18 W	1	4	1	18	18
R TU Wakil Gubernur	LED 16 W	18	18	18	16	288
R Tamu Wakil Gubernur	LED 16 W	8	8	8	16	128
	TL 4 x 16 W	8	8	2	16	32
R Kerja Wakil Gubernur	LED 16 W	22	22	22	16	352
	TL 4 x 16 W	20	20	20	16	320
3rd floor						
R Rapat	TL LED T5 3 x 14 W	18	18	17	14	238
R Staf	TL LED T5 3 x 14 W	18	18	14	14	196
R Staf Ahli 1	TL LED T5 3 x 14 W	6	6	4	14	56
R Staf Ahli 2	TL LED T5 3 x 14 W	12	12	8	24	112
R Staf Ahli 3	TL LED T5 3 x 14 W	6	6	6	24	84
R Tamu Staf Ahli	LED 16 W	2	2	2	16	32
	TL LED T5 24 W	1	1	1	24	24
Lobby R Staf Ahli	LED 18 W	1	1	1	18	18
	TL LED T5 3 x 14 W	24	24	19	14	266
R Tata Usaha	LED 16 W	20	20	20	16	320
R Tamu Sekda	TL LED T5 3 x 14 W	18	18	18	14	252
R Kepala Staf	TL LED T5 3 x 14 W	12	12	12	14	168
	LED 16 W	43	43	43	16	688

Room	Lamp Type	Number of light points	Number of lights		Power (W)	Total (W)
			Total	It works		
R Sekretaris Daerah	Halogen 20 W	18	18	18	20	360
R Rapat Sekda	LED 16 W	29	29	29	16	464
4th floor						
R Rapat	LED 14 W	4	4	4	14	56
	TL LED T5 14 W	16	16	14	14	196
	Halogen 20 W	2	2	2	20	40
R Staf Asisten 1	LED 16	6	6	4	16	64
R Kerja Asisten 1	LED 16	4	4	4	16	64
	TL LED T5 14 W	16	16	8	14	112
	Halogen 20 W	2	2	2	20	40
R Rapat	LED 16	6	6	6	16	96
	TL LED T5 14 W	16	16	10	14	140
R Kerja Asisten 3	LED 16	7	7	7	16	112
	TL LED T5 14 W	10	10	4	14	56
R Staf Asisten 3	LED 16 W	9	9	9	16	144
R Korpri	TL 4 x 18 W	8	8	3	18	54
R Rapat Utama	TL LED T8 4 x 8 W	32	32	21	8	168
R Staf Asisten 2	LED 16 W	6	6	6	16	96
R Rapat	LED 16 W	4	4	4	16	64
	TL LED T5 14 W	8	8	4	14	56
R Kerja Asisten 2	LED 16 W	6	6	6	16	96
R Rapat	LED 14 W	4	4	4	14	56
R Kerja Staf Penugasan Khusus	LED 16	6	6	6	16	96
	TL LED T5 24 W	12	12	7	24	168
R Staf Penugasan Khusus	LED 16 W	6	6	6	16	96
R Staf	TL LED T5 3 x 14 W	6	6	3	14	42
R NOC	TL 4 x 18 W	4	4	2	18	36
5th floor						
Perpusatakaan	TL LED T5 3 x 14 W	33	33	12	14	168
R Rapat	TL LED T5 3 x 14 W	12	12	7	14	98
R Staf bag Pengawasan Produk Hukum Kab/Kota	TL LED T5 3 x 14 W	18	18	7	14	98
	TL LED T8 4 x 9 W	16	16	3	9	27
R Kabag Pengawasan	TL LED T5 3 x 14 W	8	8	2	14	28

Room	Lamp Type	Number of light points	Number of lights		Power (W)	Total (W)
			Total	It works		
Produk Hukum Kab/Kota						
R Kabag Perundang undangan	TL LED T5 3 x 14 W	8	8	6	14	84
R Staf Bagian Perundang Undangan	TL LED T8 4 x 9 W	16	16	14	9	126
	TL LED T5 3 x 14 W	30	30	6	14	84
R Tamu	TL LED T5 3 x 14 W	12	12	6	14	84
R TU Kepala Biro Hukum	TL LED T5 3 x 14 W	30	30	23	14	322
R Staf Bantuan Hukum dan HAM	TL LED T5 3 x 14 W	18	18	12	14	168
R Kabag Bantuan Hukum dan HAM	LED 16 W	4	4	4	16	64
R Kepala Biro Hukum	LED 14 W	6	6	6	14	84
	TL LED T5 24 W	10	10	6	24	144
R Rapat Biro Hukum	TL LED T5 3 x 14 W	78	78	26	14	364
	6th floor					
R Staf	LED 14 W	4	4	4	14	56
	TL LED T5 3 x 14 W	39	39	18	14	252
	LED 16	7	7	7	16	112
R Kabag Pelaksanaan dan Analisis Pembangunan	LED 16 W	2	2	2	16	32
R Rapat	TL LED T5 3 x 24 W	6	6	3	24	72
R Kepala Biro Administrasi Pembangunan Daerah	LED 14 W	6	6	6	14	84
	TL LED T5 24 W	10	10	6	24	144
R Rapat 1	TL LED T5 3 x 14 W	18	18	15	14	210
R Rapat 2	TL LED T5 3 x 14 W	18	18	12	14	168
R Staf Pengendalian	TL LED T5 3 x 14 W	60	60	32	14	448
	LED 14	8	8	7	14	98

Room	Lamp Type	Number of light points	Number of lights		Power (W)	Total (W)
			Total	It works		
R Kabag Pengendalian 1	TL LED T5 3 x 14 W	8	6	6	14	84
R Kabag Pengendalian 2	LED 16 W	2	2	2	16	32
7th floor						
R Staf Ka. Biro Perekonomian	TL LED T5 3 x 14 W	21	21	13	14	182
	TL 4 x 18 W	12	12	5	18	90
R Staf Ka. Biro Perekonomian	TL LED T5 3 x 14 W	12	12	8	14	112
R Ka Biro Perekonomian	LED 18	7	7	7	18	126
	TL LED T5 24 W	10	10	7	24	168
R Rapat BUMD	TL LED T5 3 x 14 W	12	12	7	14	98
R Kabag BUMD	TL LED T5 3 x 14 W	12	12	7	14	98
R Staf BUMD	TL LED T5 3 x 14 W	24	24	16	14	224
R Rapat	TL 4 x 18 W	40	40	29	18	524
R Staf PPKU	LED 16	14	14	14	16	224
R Kabag PPKU	TL LED T5 3 x 14 W	6	6	5	14	70
R Kabag PPMP	TL LED T5 3 x 14 W	6	6	4	14	56
R Staf PPMP	LED 16	4	4	4	16	64
	TL LED T5 3 x 14 W	24	24	12	14	168
R Staf PPKU	LED 16	4	4	4	66	64
	TL LED T5 3 x 14 W	6	6	1	14	14
8th floor						
R Kabag Infrastruktur	TL 4 x 18 W	8	8	3	18	42
R Staf Infrastruktur dan LHKESDM	TL 4 x 18 W	20	20	10	18	180
	TL LED T8 3 x 8 W	9	9	5	8	40
	TL LED T8 4 x 9 W	60	60	27	9	243
R Kabag LHKESDM	LED 8 W	2	2	2	8	16
R Rapat	LED 18 W	6	6	0	18	0
	TL LED T5 24 W	10	10	5	24	120
R Rapat	TL 4 x 18 W	16	16	12	18	216
R Kabiro ISDA	LED 16 W	6	6	4	16	64
	TL LED T5 24 W	10	10	7	24	168

Room	Lamp Type	Number of light points	Number of lights		Power (W)	Total (W)
			Total	It works		
R Staf Kabiro ISDA dan KPKP2	TL LED T8 4 x 8 W	72	72	12	8	96
	TL 4 x 18 W	36	36	4	18	72
R Kabag KPKP2	TL 4 x 18 W	8	8	5	18	90
R rapat	TL 4 x 18 W	8	8	4	18	72
9th floor						
R Kasubag Pelayanan Publik	TL 4 x 18 W	4	4	2	18	36
R Kasubag Tata Laksana	TL 4 x 18 W	4	4	2	18	36
R Staf Tata Laksana dan Publik	TL 4 x 18 W	32	32	8	18	144
R Staf TU Biro Organisasi	TL 4 x 18 W	52	52	6	18	108
R Kabiro Organisasi	LED 16 W	6	6	2	16	32
	TL LED T5 24 W	10	10	5	24	120
R Kasubag TU Biro	TL 4 x 18 W	8	8	6	18	108
R Kabag Tata Laksana dan Yanblik	TL 4 x 18 W	8	8	3	18	54
R Kabag Kelembagaan	TL 4 x 18 W	8	8	2	18	36
R Kabag Akuntabilitas Kinerja dan RB	TL 4 x 18 W	8	8	4	18	72
R Rapat	TL 4 x 18 W	32	32	17	18	306
R Arsip	TL LED T5 3 x 14 W	6	6	3	14	42
R Staf Bagian Kelembagaan	TL LED T5 3 x 14 W	30	30	13	14	182
R Staf Akuntabilitas dan RB	TL LED T5 3 x 14 W	36	36	24	14	1128
R Staf Akuntabilitas dan RB	TL LED T5 3 x 14 W	12	12	2	14	28
10th floor						
R Kasubag Pendidikan	LED 16 W	2	2	2	16	32
R Kasubag Kesehatan	LED 16 W	3	3	3	16	48
R Staf	LED 16 W	10	10	10	16	160
R Staf	LED 16 W	6	6	6	16	96

Room	Lamp Type	Number of light points	Number of lights		Power (W)	Total (W)
			Total	It works		
R Arsip Non Aktif	TL 4 x 18 W	8	8	0	18	0
R Kabag PMKM	LED 16 W	2	2	2	16	32
R Kabag Kesos	LED 16 W	2	2	2	16	32
R Rapat	TL 4 x 18 W	24	24	15	18	270
R Rapat	TL 4 x 18 W	16	16	4	18	72
R Arsip	TL 4 x 18 W	12	12	4	18	72
	TL LED T8 4 x 8 W	12	12	4	8	32
R Kabag Keagamaan	TL LED T8 4 x 8 W	8	8	2	8	16
R Tamu	TL 4 x 18 W	8	8	0	18	0
R Kabiro Kesra	LED 16 W	6	6	4	16	64
	TL LED T5 24 W	10	10	7	24	168
R TU Biro Kesra	TL 4 x 18 W	40	40	24	18	432
R Rapat	TL LED T8 4 x 8 W	12	12	11	8	88
	TL 4 x 18 W	8	8	6	18	108
11st floor						
R Tamu	LED 16 W	5	5	5	16	80
R Arsip	LED 16 W	1	1	1	16	16
R Staf	LED 16 W	16	16	16	16	256
R Kabag Pemerintahan	LED 16 W	2	2	2	16	32
R Staf Kabiro	TL 4 x 18 W	32	32	18	18	324
R Kabiro	TL LED T5 24 W	10	10	6	24	144
	LED 16	6	6	4	16	64
	Halogen	4	4	4	20	80
R Rapat	TL 4 x 18 W	32	32	22	18	396
R Subbag Kerjasama	TL 4 x 18 W	44	44	18	18	324
	TL LED T8 4 x 9 W	4	4	2	9	18
R Staf	TL 4 x 18 W	32	32	13	18	234
R Rapat	LED 16 W	2	2	2	16	32
R Tamu	TL LED T8 4 x 9 W	8	8	4	9	36
R Kabag Kerjasama	LED 16 W	2	2	2	16	32
	TL 4 x 18 W	4	4	4	18	72
R Kabag Otonomi Daeerah	LED 8 W	1	1	1	8	8
	TL 4 x 18 W	4	4	2	18	36
12nd floor						
R Transit	TL 4 x 14 W	16	16	7	14	98

Room	Lamp Type	Number of light points	Number of lights		Power (W)	Total (W)
			Total	It works		
R Rapat	TL 4 x 18 W	16	8	4	18	72
R Staf	LED 16 W	12	12	12	16	192
	LED 8 W	3	3	3	8	24
R Simaset	TL 4 x 18 W	8	8	4	18	72
R Koordinasi	LED 8 W	2	2	2	8	16
R Kabid	LED 16 W	5	5	5	16	80
	TL LED T5 28 W	10	10	2	28	56
R GOPTKI	LED 14 W	10	10	10	14	140
R Kerja Dharma Wanita	LED 16 W	4	4	4	16	64
R Rapat Dharma Wanita	LED 14 W	10	10	10	14	140
R Komputer	TL LED T8 3 x 9 W	12	12	12	9	108
R Rapat	TL LED T8 4 x 9 W	16	16	16	9	144
R Arsip	TL 4 x 18 W	16	16	1	18	18
R Dokumen	TL 4 x 18 W	8	8	2	18	36
23th floor						
R Kantor Lift Control	TL 4 x 18 W	8	8	4	18	72
					Total (W) =	**27.340**

A good lighting system must meet the density standards contained in SNI 6197: 2020 in order to prevent and reduce work accidents and improve occupational health (K3) for users of each room. Building A Regional Secretariat of Central Java Province is included in the category of office buildings. The allowable density standard for workspaces in office buildings used as a reference for improving the lighting system in this study is 7.53 W/m2 or the amount of lux allowed for workspaces according to the SNI for artificial lighting is a minimum of 350 lux.

CONCLUSION

The conclusions from research on the suitability of green buildings and potential savings in Building A of the Regional Secretariat of Central Java Province are as follows:

The design of Building A Regional Secretariat of Central Java Province on the building envelope system is in accordance with the green building criteria with an OTTV value of 33.27 W/m2, but the air conditioning system does not meet the green building criteria. The lighting system in Building A of the Regional Secretariat of Central Java Province is not in accordance with the required light intensity standards.

The air conditioning system in Building A of the Regional Secretariat of the Province of Central Java has a COP (Coefficient of Performance) value that is not up to standard because there are still specifications for the existing AC being used which is non-inverter. For this reason, the improvement of the air conditioning system is carried out by replacing the technology used, namely the VRF (Variable Refrigerant Flow)

system. By replacing this technology, the AC COP value is fulfilled, so that it meets the green building criteria. By replacing the system, you can save electricity from 642,05 kW to 592,05 kW.

Lighting system in Building A Regional Secretariat of Central Java Province is energy efficient because the maximum value of light density is below the maximum standard of SNI for lighting. But this affects the level of intensity of light that is obtained in the room. The value of light intensity is still below that standardized in SNI. The improvement in the value of this light intensity is by replacing the existing lamp with a 15.5 W TubeLED Master which has a 2,500 lumen. The total electric power consumption of lamps decreased from 27.34 kW to 26.80 kW and is in accordance with the green building criteria for maximum power density and value of light intensity.

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