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Calculation of Consumption and Expenditures for Electricity Energy Costs at Lido Graha Hotel Lhokseumawe City Based on Electrical Power Measurement

Arnawan Hasibuan[1,2], Widyana Verawaty Siregar[3], Elvy Sahnur Nasution[4], Rohana Ismail[5]
[1]School of Electrical Engineering, Universiti Malaysia Perlis, Malaysia
[2]School of Electrical Engineering, Universitas Malikussaleh, Indonesia
[3]School of Management, Universitas Malikussaleh, Indonesia
[4,5]School of Electrical Engineering, Universitas Muhammadiyah Sumatera Utara, Indonesia

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ABSTRACT

Evaluation of energy utilization and identification become energy saving opportunities, as well as recommendations for increasing efficiency, on energy use and use of energy sources in the context of energy conservation This paper aims to describe the audit of electrical energy in the Lido Graha Lhokseumawe Hotel room, by taking samples in different room types and conducting an electrical energy audit on the use of installed lights and air conditioners. The method used in this study is data collection, interviews, observations and direct measurements on the use of lights and AC (Air Conditioning). The data analysis technique used is to determine the estimated value of electricity consumption and how much it will cost for electricity. From the results of calculations and analysis obtained total electricity consumption needs based on the type of room with various types of loads used 855.62 kWh/days with costs that must be spent per day is IDR 1,190,574.96, 25,668.6 kWh/month with a monthly cost of IDR 35,087,608.60. Whereas for a year electricity demand is 308,494.8 kWh/year with a cost of IDR 421,051,305.24.

Corresponding Author:

Arnawan Hasibuan,
School of Electrical Engineering,
Universitas Malikussaleh, Indonesia
Kampus Unimal Bukit Indah Kota Lhokseumawe, Provinsi Aceh
Email: arnawan@unimal.ac.id

1. INTRODUCTION

Hospitality is a service business that requires large electrical energy. Hotel operation is providing services to consumers who use the facilities in the hotel [1]. To provide the highest quality service is closely related to energy use [2] [3]. The most competitive energy used in hotel operations is electricity. Hotel operating costs in terms of energy purchases range from 30%, this shows that the cost for energy is very high. According to [4] [5] [6] [7], energy consumption for lighting, temperature regulation systems (air conditioning), and water heating systems generally account for 70% of the total energy use in hotel buildings.

Lido Graha Hotel, is one of the big hotels in the city of Lhokseumawe which certainly requires quite large electrical energy. With a building area of around 1 hectare and has a building with 4 floors, the Lido Graha Hotel certainly uses a lot of electrical energy. The problem to be examined

in this paper is how efficient the use of electrical energy in the Lido Graha Hotel when it is adapted to existing electrical equipment [8]. This was done because the Lido Graha Hotel is a hotel that has long operated in the city of Lhokseumawe, so there needs to be an analysis of the use of electrical energy available. The number of visitors that fluctuates every day can change the amount of electrical energy used. Activities or events carried out at the Lido Graha hotel at any time will lead to an increase in the capacity of using different electrical energy. However, this change in usage is sometimes not adjusted to the level of Energy Consumption Intensity.

The energy cost component in a hotel is usually expressed in terms of the cost per room sold, or the total number of hotel rooms [5]. Ideally, the calculation of energy costs is carried out every day in support of energy saving programs. This can also be used to help plan for a gradual reduction in energy consumption in hotel rooms [9], or as part of an overall environmental awareness progra. In its calculation, energy costs in hotels use the formulation (1):

$$Energy\ cost = \frac{\text{The total cost of electricity (KWh)}}{\text{Total rooms sold}} \quad (1)$$

Acording to [10] energy management includes increasing in profitability due to the reduced operational costs and it is also a potential for improved market share. But there have not been so many systematic approaches to comparing the relative efficiency of the system [11]. Data envelopment analysis is a special linear programming model for obtaining comparative efficiency of multi input multi output in decision making.

2. RESEARCH METHOD

2.1. Data collection technique

The data collection technique used in this research is a descriptive study that will explain descriptively about the electrical energy requirements at Lido Graha Lhokseumawe Hotel in 2016. Descriptive research is aimed at gathering actual information in detail that describes existing symptoms, identifies problems or checks conditions and applicable practices, makes comparisons or evaluations, determines what other people do in dealing with similar problems and learns from their experiences to establish plans and decisions in the future [12]. Data collection techniques that will be used in this study are as follows [13]:

a. Observation for data collection where observation is focused on describing and explaining research phenomena.
b. Face to face interview to dig up information from respondents.
c. Secondary data documentation as a complement to primary data by studying and analyzing relevant books or information from various sources related to research studies.

Descriptive data analysis techniques [14] [15] that have been carried out include three activities, namely:

a. Collecting data, we have recorded all data objectively and in accordance with field observations and interviews.
b. Reduction of procedures, the selection process, concentration, attention, abstracting and transformation of rough data has been carried out from the field.
c. Presentation of data, has shown information arranged for analysis as material to draw conclusions and take action.
d. Verification or drawing conclusions, set conclusions written based on the results of the analysis during the study took place from the measurement and compliance with conditions in the field

2.2. Energy Consumption Data

The consumption of electrical energy obtained from surveys to hotel [16] [17] locations is as follows:

a. Documentation of hotel buildings, and room layout, kitchen, meeting rooms, etc. where there is electricity as lighting.

b. Data type of equipment used at Lido Graha Hotel.
c. Data for payment of monthly electricity bills last year.
d. Data on the number of occupancy rates per month during the past year, the data can be categorized as details of building area and total building area (m^2), total electricity needed, installed electrical power per m^2 floor area for the whole building, energy consumption building and hotel building energy usage costs.

2.3. Room Size Data and Equipment Used

Room sizes and types of equipment used at Lido Graha Hotel are shown in Table 1 and Table 2.

Table 1. Room size

Room Type	Number of room	Room size (m^2)
Suite Room	4	6×5
Superior	50	5×5
Standart	6	4×4
Office	5	4×5

Table 2. Equipment used

Type of Equipment	Brand
Air Conditioning	Panasonic dan LG
Lighting	Philip dan Hannocs
Television	Panasonic and Sharp
Chiller Pump	Sanyo

2.4. Consumption of Electric Power and Electric Energy

The electrical power installed at the Lido Graha Hotel can be seen in Table 3 to Table 7.

Table 3. Lamp power data

Room Type	Number of rooms	Bulb type				Duration (hours)
		HE		Hallogen		
		Power (W)	Number of bulb	Power (W)	Number of bulb	
Suite Room	4	60	4	42	2	9
Superior	50	55	3	20	2	9
Standart	6	50	3	20	1	9
Restaurant	1	75	6	150	1	9
Kitchen	1	75	5	-	-	9

Table 4. Television data

Room Type	Number of rooms	Size (Inch)	Power of Television (W)	Duration (hours)
Suite Room	4	24	100	5
Superior	50	22	100	5
Standart	6	21	100	5

Table 5. Air conditioner data

Room Type	Number of rooms	Power of Air Conditioner (W)	Duration (hours)
Suite Room	4	1.119	14
Superior	50	660	14
Standart	6	660	14
Office	5	660	9

Table 6. Water heater data

Room Type	Number of rooms	Power of Water Heater (W)	Duration (hours)
Suite Room	4	1.250	01
Superior	50	1.250	1
Standart	6	1.250	1

Table 7. Water pump data

Points of use	Total	Power of Water Heater (W)	Duration (hours)/month
Swimming pool	2	1.100	12

2.5. Cost of Electric Energy Consumption

Electrical energy at the Lido Graha Hotel uses electricity sourced from the state electricity company (PLN). The cost of electricity in the past year can be seen in Table 8.

Table 8. Consumption and Cost of Electrical Energy at Lido Graha Hotel in 2016

Number	Month	Total electricity Consumption (kWh)/month	Cost
1	Januari	47005,78	IDR 63,551,812
2	Februari	34876,51	IDR 47,153,047
3	Maret	31290,02	IDR 42,304,109
4	April	34798,94	IDR 47,048,171
5	Mei	45218,33	IDR 61,135,181
6	Juni	40581,35	IDR 54,865,991
7	Juli	23364,76	IDR 31,589,162
8	Agustus	27513,77	IDR 37,198,611
9	September	38152,28	IDR 51,581,887
10	Oktober	34784,98	IDR 47,029,299
11	November	40951,99	IDR 55,367,096
12	Desember	43811,85	IDR 59,233,620

3. RESULTS AND DISCUSSION

Based on Table 8, it can be seen that the biggest electricity consumption in January is IDR 63,551,812.00, this is because there are activities in almost all rooms filled with many local government agendas held at the hotel, namely training events, political party conventions, new year's agenda, maulidurrasul, and also the activity of the holidays, so that the use of electricity loads and costs incurred also high. The smallest electricity consumption occurred in July, amounting to IDR 31,589,162.00. This month, the consumption of electricity was relatively small due to the lack of consumption at the hotel, as well as other activities such as training, congresses, regional political party meetings, which were reduced compared to other months. The total amount of electricity consumption costs with various types of loads and activities that operate 24-hour diving must be paid an average of IDR 49,821,499.00 per month, while the costs for a year are IDR 597,857,986.00.

3.1. Results of measurements of daily load characteristics at Lido Graha Hotel

The results of measurements of daily load characteristics at Lido Graha Hotel are listed in table 9 and table 10.

Table 9. Voltage values in the electrical system of Lido Graha Lhokseumawe Hotel

Voltage	Phasa (Volt)		
	V_{R-N}	V_{S-N}	V_{T-N}
Maximum	229	230	231
Minimum	225	225	225
Average	227	227,5	228

Table 10. Current values in the electrical system of Lido Graha Lhokseumawe Hotel

Current	Phasa (Ampere)		
	I_R (A)	I_S (A)	I_T (A)
Maximum	48,5	50,5	40,6
Minimum	24,2	22,5	22,8
Average	36,5	36,5	31,7

3.2. Evaluation of electrical power requirements and intensity of electrical energy consumption

The data obtained that shows the characteristics of the use of electrical energy to be observed and calculated how much the burden of costs that must be incurred daily, monthly, and annual costs.

Table 11. Characteristics of electricity consumption in Lido Graha Hotel

Room Type	Electrical power requirements							
	Load name	Total	Power total (W)	Duration (hours)	Electrical energy (kWh)/ days	Electrical energy (kWh)/ week	Electrical energy (kWh)/ month	Electrical energy (kWh)/ year
Suite Room	HE bulb	16	960	9	8,64	60,48	259,20	3110,40
	Hallogen bulb	8	440	9	3,96	27,72	118,80	1425,60
	Television (24 inch)	4	440	4	2,2	15,4	66,00	792,00
	AC 1,5 HP	4	4040	14	56,56	395,92	1696,80	20361,60
	Water Heater	4	5.000	1	5	35	150,00	1800,00
	Total				**76,37**	**534,59**	**2291,10**	**27489,60**
Superior	HE bulb	150	8250	9	74,25	519,75	2227,50	26730,00
	Hallogen bulb	100	5500	9	49,5	346,5	1485,00	17820,00
	Television (22 inch)	50	5000	5	25	175	750,00	9000,00
	AC 1,5 HP	50	33000	14	462	3234	13860,00	166320,00
	Water Heater	50	62500	1	62,5	437,5	1875,00	22500,00
	Total				**673,25**	**4712,75**	**20197,5**	**242370,00**
Standart	HE bulb	18	900	9	8,1	56,7	243,00	2916,00
	Hallogen bulb	6	120	9	1,08	7,56	32,40	388,80
	Television (21 inch)	6	600	4	2,4	16,8	72,00	864,00
	AC 1HP	6	3960	14	55,44	388,08	1663,20	19958,40
	Total				**67,02**	**469,14**	**2010,60**	**24127,20**
Restaurant	HE bulb	6	450	6	2,7	18,9	81,00	972,00
	Hallogen bulb	1	150	6	0,9	6,3	27,00	324,00
	Total				**3,6**	**25,2**	**108**	**1296,00**
Kitchen	HE bulb	5	375	8	3	21	90,00	1080,00
Total					**3**	**21**	**90**	**1080,00**
Office	**AC**	5	3300	9	29,7	207,9	891,00	10692,00
	HE bulb	10	600	3	1,8	12,6	54,00	648,00
	Total				**31,5**	**220,5**	**945**	**11340,00**
Swimming pool	**Water pump**	2	2200	12	0,88	6,16	26,4	792,00
	Total				**0,88**	**0,88**	**6,16**	**792,00**
	All Total				**855,62**	**5989,34**	**25668,6**	**308494,8**

Furthermore, the cost calculation is based on the basic electricity tariff

Table 12. Lido Graha Hotel electricity payment

Room Type	Electrical energy (kWh)/days	Cost of electric energy		
		IDR/days	IDR/month	IDR/years
Suite Room	76,37	IDR 103,238.72	IDR 3,097,161.60	IDR 37,165,939.20
Superior	673,25	IDR 910,234.00	IDR 27,307,020.00	IDR 327,684,240.00
Standart	67,02	IDR 90,611.04	IDR 2,718,331.00	IDR 32,619,974.04
Restaurant	3,6	IDR 4,867.20	IDR 146,016.00	IDR 1,752,192.00
Kitchen	3	IDR 4,056.00	IDR 121,680.00	IDR 1,460,160.00
Office	31,5	IDR 42,588.00	IDR 1,277,640.00	IDR 15,331,680.00
Swimming pool	26.4	IDR 34,980.00	IDR 419,760.00	IDR 5,037,120.00
Total		IDR 1,190,574.96	IDR 35,087,608.60	IDR 421,051,305.24

Based on the amount of electrical energy consumption in accordance with the use of the Lido Graha Hotel which operates 24 hours a day, shown in table 11, it can be seen that the largest amount of electrical energy consumption is in the Superior room due to the number of rooms

reaching 50 rooms. And the smallest amount of electrical energy consumption is found in the kitchen room because the load used is only 3 HE bulbs.

The total electricity consumption needs based on the type of room with various types of loads used 855.62 kWh/days with costs that must be spent per day is IDR 1,190,574.96, 25,668.6 kWh/month with a monthly cost of IDR 35,087,608.60. Whereas for a year electricity demand is 308,494.8 kWh/year with a cost of IDR 421,051,305.24.

4. CONCLUSION

The conclusions that can be summarized from the measurements and calculations that have been made are as follows:

1. The results of inter-phase voltage measurements on the electrical system at the Lido Graha Lhokseumawe Hotel are worth between 225-231 V.
2. The measurement results of the measured current value are between 22.5-50.5 A, while the peak load occurs at 1018: 30-23: 45 WIB.
3. The results of the calculation of electricity consumption needs are 855.62 kWh/days, and 25,668.6 kWh/month, while for a year it is 308,494.8 kWh/year.
4. The cost of electricity that must be spent on average per month is IDR 35,087,608.60, and for a year is IDR 421,051,305.24.

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