Analysis of Energy Consumption for Cost Saving Efficiency of Electric Energy use at PLN Belakang Padang using Internet of Thinks (IOT) Technology

Final Project

By:
Ristari Eka Putri (3222011012)

Electronics Manufacturing Engineering Study Program
Electrical Engineering Department
Polytechnic Negeri Batam
2025

Statement of Authenticity of Final Project

I, the undersigned, certify that the contents of part or all of my Final Project entitled: "**Analysis of Energy Consumption for Cost Saving Efficiency of Electric Energy use at PLN Belakang Padang using Internet of Thinks (IOT) Technology**" is my **own work, completed without the use of materials that are not permitted,** and **is not the work of other parties which I acknowledge as my own work.** All references cited or referred to have been written in full in the bibliography. If it turns out that my statement is not true, I am willing to accept sanctions in accordance with applicable regulations.

Batam, 23 Januari 2025

Ristari Eka Putri
NIM: 3222011012

Validity Sheet

The Final Project is structured to fulfill one of the requirements for obtaining a degree
Bachelor of Associate Engineer (A.Md.T)
in
Batam State Polytechnic

By:
Ristari Eka Putri (3222011012)

Session date: 23 January 2025

Approved By :

1. Budiana S.Si, M.Si.

NIK: 117194

2. Fitriyanti Nakul S.Pd, M.Si

NIK: 118197

1. Widya Rika Puspita, S.Pd. M.Si. Ph.D

NIK: 1119211

Analysis of Energy Consumption for Cost Saving Efficiency of Electric Energy use at PLN Belakang Padang using Internet of Thinks (IOT) Technology

Ristari Eka Putri[1], Widya Rika Puspita[2*]

[1]Politeknik Negeri Batam, Batam, Indonesia

[*]Email: Ristari.eka29@@gmail.com,Widya@polibatam.ac.id

***Abstract*— Electrical energy consumption at PLN Belakang Padang is in the wasteful category, this can be seen from the building which is inefficient and wasteful and the calculation of the intensity energy consumption of 18,19 KWh / m² / month which is included in the wasteful category. the purpose of this study is to upgrade the technology by using an electricity monitoring tool using the technology of thought and the Blynk platform in order to monitor remotely. as well as analyzing energy saving opportunities. the energy saving opportunities carried out are reducing the air conditioner temprature to 24-27°C and reducing the duration of AC 1, 2 PK, and computer usage by 1-2 hours. after implementing for 2 months the intensity energy consumption behind the field became 15,06 KWh/m²/month which fell into the efficient category with an increase in profit of 17%.**

Keyword: Konversi energy, Energy consumption intensity, Internet of thinks (IOT)

I. INTRODUCTION

Energy is an important resource that supports various human activities, both on an individual, industrial and institutional scale. Energy is one of the significant supporting factors in the operational scope of an organization or company, especially to support daily activities such as lighting, the use of electronic equipment, and technological operations. [1]. Good and sustainable energy management is key to maintaining the continuity of business activities and organizational operations without having an excessive negative impact on the environment [2]

Electricity demand in Indonesia continues to increase in line with economic growth and population growth. Indonesia's electricity demand is projected to increase more than 7 times to 1,611 TWh by 2050 [3]. Therefore, with conditions like this, efficiency in energy use is needed. Energy efficiency is a concept that prioritizes the optimization of energy use in order to achieve maximum results with minimum energy use [4]. Energy efficiency implementation includes measures to reduce electrical energy consumption in facilities such as lighting, air conditioning, and other electronic devices [5]. These energy efficiency improvements not only contribute to reduced operating costs, but also reflect the company's commitment to sustainability and environmental responsibility.

In industry, as well as households, electricity efficiency is rarely applied. For example, excessive use of electronic energy. One office that has challenges in implementing energy efficiency is PLN Belakang Padang, which is located in an archipelago with significant geographical challenges. As the main provider of electricity in the region, the PLN office plays an important role in supporting the operation of the electricity system. However, as part of efforts to improve efficiency and savings, the PLN office itself is faced with the challenge of high electrical energy consumption for daily operational activities. With equipment in constant use and supporting facilities running around the clock, the PLN office is one of the large energy consumers in the area.

The problem that arises is the high energy consumption at the PLN Belakang Padang office which is not in line with energy saving efforts. The use of electronic devices such as computers, air conditioners, and inefficient lighting systems causes energy waste that can increase the company's operational burden. In addition, the lack of application of energy-saving technologies and awareness among employees is also an obstacle in achieving energy efficiency targets.

Another problem faced was the absence of an integrated energy monitoring system to accurately measure energy use in various parts of the office. This makes it difficult to identify areas with significant energy saving potential. Without detailed data on energy consumption patterns, savings measures taken are often ineffective and misdirected.

Based on these problems, it is necessary to analyze energy consumption patterns at PLN Belakang Padang Office and identify efficiency savings that can be applied. Through the approach of analyzing electricity consumption data and energy use efficiency, this research is expected to provide comprehensive recommendations for PLN Belakang Padang in implementing a more optimal energy saving strategy. Then developing an IoT-based monitoring tool using the PZEM 004T sensor, ModemCu ESP32, and Blynk application is used to monitor real-time electrical energy consumption at the PLN Belakang Padang office. This technology allows the collection and monitoring of energy consumption data through the internet network, thus

providing the ability to make more informed decisions regarding energy saving efforts. Therefore, the author will plan a final project research with the title "Energy Consumption Analysis for Electric Energy Saving Efficiency at PLN Belakang Padang using internet of thinks (IOT) technology".

II. METHOD

The research that has been carried out follows a flow diagram which is shown in Figure 1.

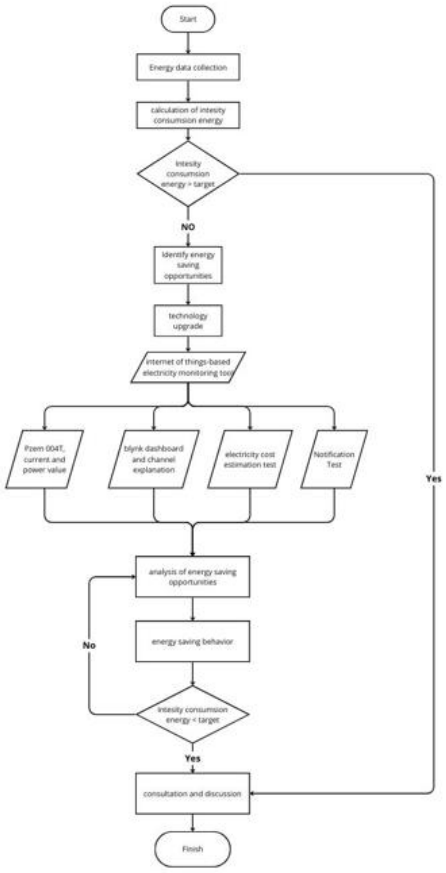


Figure 1. Research Step

A. Data Collection

1. Literature reference

In this case, search and read reference sources both from the internet and scientific articles that discuss the topic of the internet of thinks and energy audits..

2. Direct field visits

Seeing firsthand how the use of electrical energy in PLN in Behind the sword, as well as the hours of operating hours of electrical energy in use..

3. Energy Audit

An energy audit is a process that studies how equipment in a building uses energy, such as air conditioning, lighting, boilers, and motors. This is important for electrical energy efficiency programs and finding potential energy savings. Audit data is used to establish energy conservation and efficiency, set efficiency targets, and create action plans.[6]. The purpose of the audit is to get an overview of energy use issues, as well as their intensity and performance, potential savings, benefits, and steps that can be taken to reduce energy use[7].

4. Research Data

The data for this study was obtained from initial measurements taken at the PLN office in Belakang Padang. The data includes information about the area of the room, the type of equipment used, and the electricity usage of each room. The following are details of the data that has been collected:

Table 1. Space for each office

Room	Length (m)	Widht (m)	Broad (m^2)
Administration Room	10	5	50
Meeting Room	4	5.5	22
Engineering Room	4	4	16
Employee Room	4	4.5	18
Manager's Room	4	4	16
Toilets	1.8	2.2	3.96

The table below shows the use of electronic equipment used at PLN behind padang.

Table 2. Electrical Energy Consumtion

Electrical Energy Consumption	Unit
Air Conditioning 1 PK	6
Air Conditioning 2 PK	1
Pc and monitor	8
Televisi	1
Printer	5
Televisi 50 inch	1
Dispenser	1
Refrigerator	1
Lamp 5 Watt	2
Lamp 45 Watt	6
Lamp 24 Watt	4
Lamp 15 Watt	12

5. Intensity Of Energy Consumption

In this research, it is necessary to calculate the value of energy consumption intensity. To calculate the value of energy consumption intensity, first know the total KWh value of average energy consumption per month and the area of the PLN office in Belakang Padang. The average KWH per month for the PLN office in Belakang Padang from August 2024 to November 2025 is 2,292.17 KWh for buildings that use full air conditioning. With the building area in table 1 totaling 126 M², the calculation of energy consumption intensity can be done with the formula

$$intensity\ of\ energy\ consumption = \frac{Total\ Energy\ Consumption\ (KWh)}{Building\ area\ (M^2)}$$

and the calculation of energy intensity with the air-conditioned building of PLN Belakang Padang from August 2024 to November 2024

$$\text{is} Intensity\ of\ energy\ consumption = \frac{2.292{,}17 kWh}{126\ M^2}$$

$$= 18{,}19\ \text{KWh/M}^2\text{/Mounth}$$

Based on the results of the calculation of the intensity energy consumption , intensity energy consumption has been obtained at 18,19 KWh / M² / month. Which can be categorized as wasteful based on intensity energy consumption standards which are included in the category of buildings with air conditioning. Therefore the need for energy conversion.

6. Upgrade Technology

A device must be designed before it is used. Research flow, mechanical and electrical design for hardware, and software design are part of the design process. Research has several stages, one of which is the research flow. The research flow includes a systematic way of working the tool can be seen in figure 2

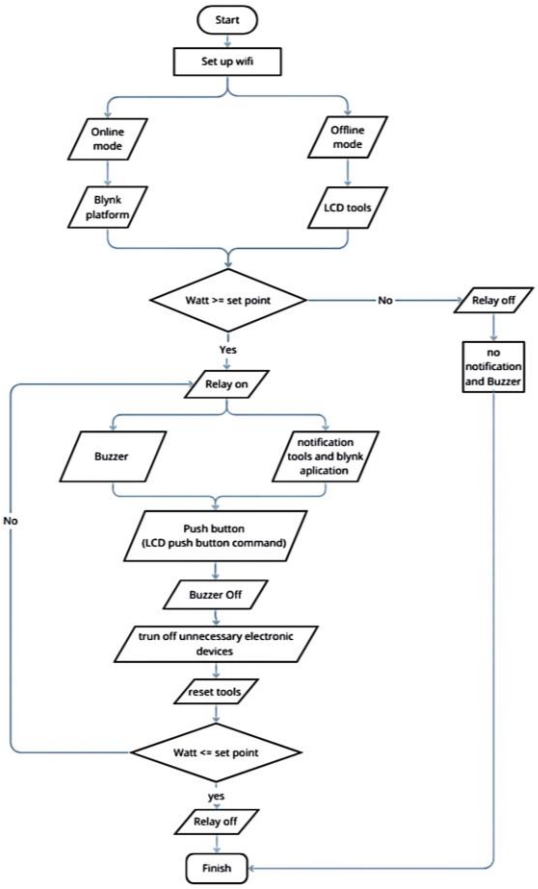


Figure 2.. Flowchart of tools design

In Figure 2 is the design of the electrical work system of the electrical energy monitoring tool. this monitoring tool uses ESP32 as a microcontroller equipped with a PZEM 004T current sensor as an energy reader, and uses a relay as an output and input current breaker, there is also a buzzer and notification in case of overload. can be seen in Figure 3 is the electrical design of the electricity monitoring tool.

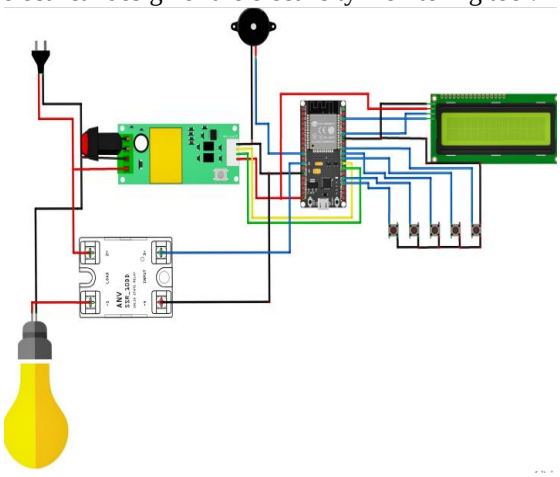


Figure 3. Electrical design

To make it easier to monitor, blynk is used as software that helps develop applications on smartphones. with program data sent by microcontrollers and event addresses to connect microcontrollers to notifications made [8].

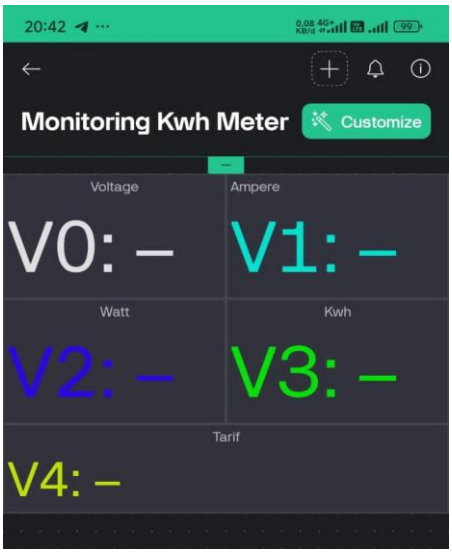


Figure 4. Mobile Dashbord View of the Blynk IOT App

The working principle of the device is to calculate the amount of electrical energy used by households, as shown in Figure 4, The reading data is sent to the Blynk platform by an internet-connected device. Then, smartphones connected to the internet and the web can see the monitoring of electricity usage data.

Figure 5. Design Of The Tool System

B. Preparation of Tools and Materials

To support the research activities, the following tools and materials were used:

Table 3. . Tools and materials

No	Materials	Amount
1	NodeMCU ESP32	1
2	PZEM 004T	1
3	Relay SSR	4
4	LCD	1
5	PCB	1
6	Connector PCB	11
7	Packing	1
8	Other Component	-

In addition to the above tools, the following tools are also needed:

1. Tank Amper used to measure voltage, current, and electrical power used in various office electronic devices.
2. Camera, used for field documentation.
3. Computer/laptop, used for data processing and analysis of energy consumption patterns with the help of Microsoft Excel software.
4. Stationery, to record the results of observations and interviews with related parties.
5. Historical energy consumption data, information about the use of electrical energy in the PLN Belakang Padang office within a certain period of time, taken from PLN's internal reports.
6. Office operational reports, data on the use of electrical devices and daily operational patterns related to energy consumption.
7. Observation sheet, to record field findings during data collection

C. Testing

1. Testing

testing on electricity monitoring tools using internet of thinks (IOT) technology, there are several tests, namely, Testing of MCU PZEM-004T, Testing Internet Of Thinks Based Monitoring, Electricity Cost Estimation Testing and notification test.

2. Place and Time

This research started in August 2024 until January 2025. The place used in conducting research is PLN Belakang Padang. to get efficient analysis results for the use of electrical energy in PLN Belakang Padang.

III. RESULTS AND DISCUSSION

A. Research Result Data

1. Testing of MCU PZEM – 004T

Testing of the PZEM-004T module was carried out to compare the module reading value with the reading value of a conventional measuring instrument. Digital ampere pliers are used as conventional measuring instruments.

Table 4. Testing Of Mcu Pzem 004T

Electrical Loads	Watt		Voltage Different	Current (A)		Current Different
	Modul	Multimeter Digital		Modul	Multimeter digital	
AC 1 PK	772,70	766,73	5,97	3,96	4,05	0,09
AC 2 PK	1416	1426,37	8,37	6,42	6,49	0,07
Dispenser	87,60	83,52	4,07	0,56	0,54	0,22
TV 50 Inch	79,93	75,22	4,91	0,38	0,31	0,07
Refrigerator	70,70	73,57	2,87	0,58	0,55	0,03
Lamp 45 Watt	43,70	39,91	4,09	0,30	0,17	0,12
Lamp 24 Watt	19,60	17,60	2	0,14	0,08	0,06
Lamp 15 Watt	12	14,40	2,40	0,08	0,08	-
Lamp 5 Warr	4,80	8,95	4,15	0,04	0,06	0,02
Computer	40,41	39,77	0,6	0,22	0,19	0,04
Printer	4,20	4	0,2	0,05	0,06	0,01
Handphone	8,90	9	0,1	0,08	0,06	0,02
Average			3,25 Watt			0,06 A

Based on the test results in Table 4, the PZEM-004T module in the electric power monitoring device has been effective in measuring the value of current (A) and power (Watt). power and current of each electrical load show different numbers. Of the entire PLN electrical load in Behind Padang, the average difference in power (Watt) is 3.25 Watt and the difference in current (A) reaches 0.06 A when compared to conventional measuring instruments used.

2. Blynk Mobile Dashboard Channel Explanation And

Table 5. Blynk mobile dashboard channel explanation and

NO	channel name	Exp	Success		Channel function
			Yes	No	
1	Status	1	√		Display the status of mains voltage detected or not detected
		2	√		
		3	√		
2	KWh Usage	1	√		Displays the amount of electrical energy that has been used in kWh. 
		2	√		
		3	√		
3	Watts of power consumption	1	√		Displays the current amount of electric power usage in watts 
		2	√		
		3	√		
4	Voltage speed (voltage)	1	√		Displays the mains voltage in volts 
		2	√		
		3	√		
5	Electric current (Amperes)	1	√		Displays electric current (Amperes)
		2	√		
		3	√		
6	Rupiah electricity consumption	1	√		Displays current electric power usage in rupiah perjam 
		2	√		
		3	√		
7	Power limit (Watt)	1	√		Excess wattage usage 
		2	√		
		3	√		
8	Voltage limit (voltage)	1	√		Use of excessive voltage 
		2	√		
		3	√		
9	Reset KWH	1	√		To repeat the calculation of KWH consumption 
		2	√		
		3	√		
10	Alarm mode	1	√		for markers of excessive power usage
		2	√		
		3	√		
11	Duration alarm	1	√		Duration of alarm sounding after excessive power usage
		2	√		
		3	√		
					
12	Wifi mode (Online)	1	√		Wifi mode works to connect with the blynk app and the web 
		2	√		
		3	√		
13	Offline mode	1	√		Unable to connect to the blynk app, but does not reduce the functionality of the appliance
		2	√		
		3	√		
14	Relay	1	√		Turning off household electricity with a relay
		2	√		
		3	√		
15	Notification	1	√		Notification when excessive power usage 

Based on the channel description data contained in Table 5, there are 15 types of channels and their respective functions. Based on the test data, all types of channels function according to their designation. For channels 1, 2, 3, 4, 5, and 6, which are monitoring channels, successfully display electricity monitoring values according to their category. In addition, channel numbers 7, 8, 9, 10, 11, 12, and 13, which have menu options, also successfully responded. as well as channel numbers 14 and 15 successfully disconnect the current if the power is excessive and successfully send a signal in the form of notification to the device and the blynk platform.Functionally, this electricity monitoring device has operated properly in accordance with its designation.

3. Electricity Cost Estimation Testing

Table 6. Electricity cost estimation testing

Electrical load	Exp	Electricity consumption rate IDR/hour	Test duration	KWH consumption	Rupiah electricity usage
AC 1 PK	1	Rp. 1.376	30 minutes	0,396	Rp. 673,00
	2	Rp. 1.346		0,396	Rp. 673.00
	3	Rp. 1.376		0,396	Rp. 673.00
AC 2 PK	1	Rp. .2.378	30 minutes	0,700	Rp. 1.189
	2	Rp. 2.378		0.700	Rp. 1.189
	3	Rp. 2.378		0,700	Rp. 1.189
TV 50 Inch	1	Rp. 134.00	30	0,040	Rp.

			minutes		67.00
	2	Rp. 134.00		0,040	Rp.67,00
	3	Rp. 134.00		0,040	Rp.67.00
Refrigerator	1	Rp. 124,00	30 minutes	0,037	Rp. 62.00
	2	Rp. 124.00		0,037	Rp. 62.00
	3	Rp. 124.00		0,037	Rp. 62.00
Dispenser	1	Rp. 182.00	30 minutes	0,054	Rp. 91.00
	2	Rp. 182.00		0,054	Rp. 91.00
	3	Rp. 182.00		0,054	Rp. 91.00
Computer	1	Rp. 70.00	30 minutes	0,021	Rp. 35.00
	2	Rp. 70.00		0,021	Rp. 35.00
	3	Rp. 70.00		0,021	Rp. 35.00
Printer	1	Rp. 6.00	30 minutes	0,002	Rp. 3.00
	2	Rp. 6.00		0,002	Rp. 3.00
	3	Rp. 6.00		0,002	Rp. 3.00
Lamp 45 Watt	1	Rp. 72.00	10 minutes	0,007	Rp. 12.00
	2	Rp. 72.00		0,007	Rp. 12.00
	3	Rp. 72.00		0,007	Rp. 12.00
Lamp 24 Watt	1	Rp. 28.00	10 minutes	0,004	Rp. 7.00
	2	Rp. 28.00		0,004	Rp. 7.00
	3	Rp. 28.00		0,004	Rp. 7.00
Lamp 15 watt	1	Rp. 18.00	10 minutes	0,002	Rp. 3.00
	2	Rp. 18.00		0,002	Rp. 3.00
	3	Rp. 18.00		0,002	Rp. 3.00
Lamp 5 Watt	1	Rp. 6.00	30 minutes	0,002	Rp. 3.00
	2	Rp. 6.00		0,002	Rp. 3.00
	3	Rp. 6.00		0,002	Rp. 3.00
Charger handphone	1	Rp. 14.00	30 minutes	0,004	Rp. 7.00
	2	Rp. 14.00		0,004	Rp. 7.00
	3	Rp. 14.00		0,004	Rp. 7.00

Based on the experimental results in table 6 with a total test time of 300 minutes, a usage of 2,790 KWh was obtained. Equivalent to Rp. 2,152 Electricity usage. If 12 loads are activated simultaneously for 1 hour, the total power obtained is 2561 Watt with an electricity usage rate of RP. Rp. 4,356 which has been adjusted to the token cost per KWh. That is for 3500 VA with a cost per KWh of Rp. 1,699.53. Notification Test

Table 7. Notification test

electrical loads	Exp	Watt discharging power	Power limit	Notification	Buzzer
AC 2 Pk	1	1416	2200 VA	Sent	Works
	2			Sent	Works
	3			Sent	Works
Ac 1 PK	1	775,67		Sent	Works
	2			Sent	Works
	3			Sent	Works
TV	1	79,93		Sent	Works
	2			Sent	Works
	3			Sent	Works
dispenser	1	87,60		Sent	Works
	2			Sent	Works
	3			Sent	Works
Refrigerator	1	85,33		Sent	Works
	2			Sent	Works
	3			Sent	Works

Based on the testing in Table 7, the five experiments of using wattage of electrical loads successfully sent notifications to the Blynk application on smartphones in the form of excessive power warnings in accordance with the predetermined power limit of 2200 Va, or 10 A. There are also other functions on the tool. In addition to the notification, there is also an alarm that indicates excessive power. Which will sound when the current exceeds the limit.

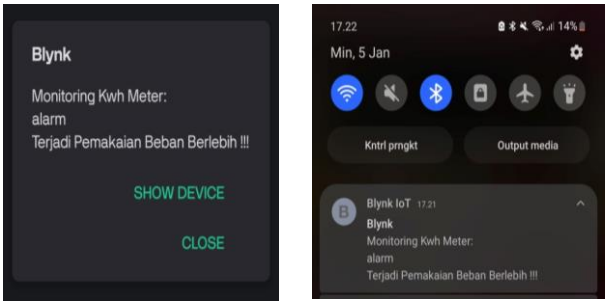


Figure 6. overload notification

Figure 7. dashboard blynk platform

IV. DISCUSSION

1. Energy Consumption Analysis

Analysis of electricity energy consumption can also be referred to as an energy audit which is an evaluation of energy utilization and identifies opportunities for savings and recommendations for increasing efficiency in the use of energy sources and energy use in the context of energy conversion at PLN Belakang Padang. In this case it is very useful to know the amount of energy used every day, as well as energy calculations that can show whether the use of energy in PLN Belakang Padang is classified as economical or wasteful.

Table 8. electricity consumption analysis

Electrical Load	Total	Daily Usage	max load power (Watt)
AC 1 pk	6	12 hours	800
AC 2 pk	1	18 hours	1450
Dispenser	1	24 hours	285
Computer	8	10 hours	24
Printer	5	12 hours	18
Tv 50 INCH	1	12 hours	125
Refrigerator	1	24 hours	220
Lamp 45 watt	6	16 hours	45
Lamp 24 watt	4	24 hours	24
Lamp 15 watt	12	16 hours	15
Lamp 5 Watt	2	24 hours	5
Charger Handphone	6	15 hours	20

In the table above, it can be seen that the excessive use of 1 and 2 PK air conditioners (AC) is one of the main factors in the waste of electrical energy at PLN Belakang padang. which is seen based on the number of units of electrical loads and operating hours of use, as well as the maximum wattage obtained from electrical load specifications. This needs to be considered in the long run can result in excessive waste of energy.

2. Energy Saving Analysis

To find out the amount of KWh per month can be done with the following calculations and formulas

$$KWh/Day = \ KWh\ X\ daily\ usage$$

$$KWh\ /mount = KWh\ Daily\ usage\ X\ 1\ Month$$

$$Persentase = \frac{KWh/Mounth}{Total\ KWh/mounth}\ x\ 100$$

With the following formula we can find out the average KWh per day and per month.

Table 9. Monthly Average Power Recapitulation

Electrical load	**Average Kwh**	**Average Kwh/mounth**	**Persentase %**
AC 1 PK	0,792	285,12 x 6 = 1710,72	43%
AC 2 PK	1,4	756	19%
Refrigerator	0,074	53,28	1%
Tv 50 Inch	0,16	57,6	1,5%
Dispenser	0,108	77,76	1%
computer	0,42	126 x 8 = 1.008	25%
Printer	0,004	4,32 x 5 = 21,6	0,5%
Charger Handphone	0,008	2,88 x 6 = 17,28	0,5%
Lamp 45 Watt	0,043	20,64 x 6 = 123,84	3%
Lamp 24 Watt	0,024	17,28 x 4 = 69,12	2%
Lamp 15 Watt	0,012	5,76 x 12 = 69,12	2%
Lamp 5 Watt	0,008	5,76 x 2 = 11,52	0,5%
Total		4079,97 KWh	100%

From the total average KWh per month, the result is 4079.97 KWh. the percentage value shows the comparison or proportion of electricity usage at PLN Belakang padang. with the highest percentage value of power usage lies in the use of 1 and 2 PK air conditioners, which are not optimal and exceed the intensity of use. Also included in the wasteful category. In this case the use of air conditioning needs to be considered. Temperature settings also affect the amount of AC power.

3. Energy Saving Opportunity Analysis

Analyzing the potential for energy savings can be an investment asset for the long term. Looking at the percentage of KWh per month, the highest value is in the use of AC energy, with the temperature setting always at 16°C. Therefore, it is necessary to analyze the right temperature and adjust the time of efficient AC usage.

According to the Indonesian National Standard (SNI), the standard cooling requirement is 500 BTU/h. The relative humidity temperature in the workspace ranges from 24-27°C, with a relative humidity of 60% ±5%. In this case, PLN Belakang Padang has not complied with SNI because it always uses a temperature of 16°C. Therefore, it is necessary to calculate BTU / h (British Thermal Units per hour) to determine the appropriate use of air conditioning. as well as optimizing air conditioning temprature and operating hours of air conditioning use.

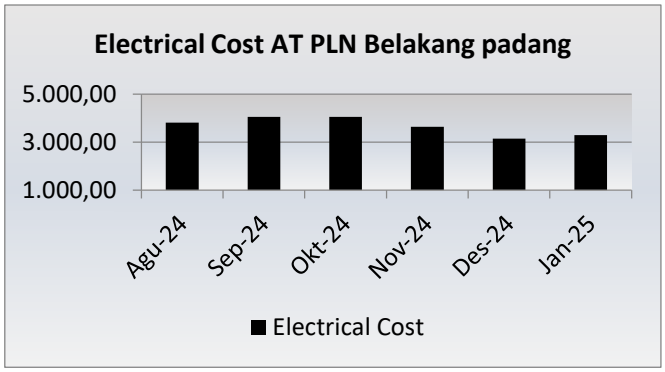
Table 10. energy saving opportunity analysis

Savings type	**PKAC**	**Watt**	**KWh savings/month**	**Rp/KWh Savings**	**Percentasse of savings %**
Setting Tempratur e 24°c	1	633,10	227,88 x 6 = 1.367,28	Rp. 583.686	3%
	2	1282,60	692,28	Rp. 108.176	1,5%
Reduced AC usage by 1 hour	1	633,10	208,90 x 6 = 1253	Rp. 777.908	4%
	2	1282,60	656,126	Rp.	2,5 %

				170.700	
Reduced AC usage by 2 hour	1	633,10	189,93 x 6 = 1139,58	Rp. 970.000	14%
	2	1282,60	615,64	Rp. 238.546	3%
Reduced computer usage by 1 hour	-	40,41	113,4 x 8 = 907,2	Rp 171.312	2,5%
Reduced computer usage by 1 hour			100,8 x 8 = 806,4	Rp. 342.970	5%
Average			868,457	Rp. 299.279	5%

From the table above it can be seen that by analyzing energy saving opportunities we can save 868KWh / month with an average reduction in electricity costs of Rp. 299,279 from an average profit of 5%.

So that after the application of energy-saving behavior, the following results were obtained from August 2024 to January 2025:



INFORMASI - HISTORI PELUNASAN PASKABAYAR

IDPEL :

OK Clear

DISTRIBUSI : UIW RIAU DAN KEPRI	TARIF : B2
RAYON / UNIT : ULP BELAKANGPADANG - UP3 TANJUNGPINANG	DAYA : 16,500 VA
IDPEL :	PEMDA : 22
NAMA : KTR PLN BLK PADANG	

BLTH	TGL JT. TEMPO	KDGERAK	RPTAG	RPBK	TOTAL TAG	MERCHANT	BANK - SWITCHING	TGL BA
2025-01	20-01-2025	11	3,301,544	0	3,301,544	-	-	--
2024-12	20-12-2024	24	3,151,758	0	3,151,758	-	-	--
2024-11	20-11-2024	24	3,647,926	0	3,647,926	-	-	--
2024-10	20-10-2024	24	4,061,398	0	4,061,398	-	-	--
2024-09	20-09-2024	24	4,052,037	0	4,052,037	-	-	--
2024-08	20-08-2024	24	3,821,116	0	3,821,116	-	-	--
2024-07	20-07-2024	24	3,953,740	0	3,953,740	-	-	--
2024-06	20-06-2024	24	3,309,346	0	3,309,346	-	-	--
2024-05	20-05-2024	24	3,599,557	0	3,599,557	-	-	--
2024-04	20-04-2024	24	3,752,464	0	3,752,464	-	-	--
2024-03	20-03-2024	24	3,632,323	0	3,632,323	-	-	--
2024-02	20-02-2024	24	3,729,060	0	3,729,060	-	-	--
2024-01	20-01-2024	24	3,562,110	0	3,562,110	-	-	--

Figure 8. Electricity bill pln belakang padang

After conducting energy-saving behavior and utilizing electricity monitoring tools based on Internet of Thinks (IOT) technology at PLN Belakang Padang for 2 months. PLN Belakang Padang has saved electricity costs of Rp.668,967 and a profit savings of 17%. with an energy consumption intensity of 15.06 KWh / m² / month which is already included in the efficient category.

V. CONCLUSIONS AND SUGGESTION

A. *Conclusions*

Based on the results of research conducted in this project, the electricity monitoring tool managed to work well in accordance with its function. and able to read power in real time. after analyzing the largest use of electricity falls on air conditioning so that PLN Belakang padang experiences energy waste with intensity energy consumption 18,19 KWh / M² / Month. after doing and applying the recommended energy saving efforts the intensity energy consumption figure of PLN Belakang padang dropped to 15.06KWh / M² / Month which is included in the effisient category with a 17% increase in profit.

B. *Suggestions*

Suggestions for further development of this research are that it is advisable to carry out a thorough energy audit, develop an economic analysis, assess the need for electrical power after conservation and the potential for energy savings in the long term. Also, be more concerned about saving electrical energy, turning off electrical devices that are not in use, and implementing energy-saving behavior again for the future.

REFERENCES

[1] Nisrina, S. F., & Sari, C. K. (2023). Upaya Hemat Energi Listrik Rumah Tangga Di Rudenim Semarang. *Jurnal Pengabdian Kepada Masyarakat Nusantara*, *4*(2), 1420–

[2] Juwita, U. M., Admizal, I., & Mandala, I. (2023). REVITALISASI KONSERVASI LINGKUNGAN DI ERA MODERN; TELAAH HADIST PENGELOLAAN ENERGI DALAM PENDEKATAN KONTEKSTUAL ABDULLAH SAEED. *Jurnal Studi Islam*, *12*(2), 166–181.

[3] Al Hakim, R. R., Ariyanto, E., Arief, Y. Z., Sungkowo, A., & Trikolas, T. (2022). Preliminary Study of Juridical Aspects of Renewable Energy Draft Law In Indonesia: An Academic Perspectives. *ADLIYA: Jurnal Hukum Dan Kemanusiaan*, *16*(1), 59–72. https://doi.org/10.15575/adliya.v16i1.14063.

[4] Rizki, R. (2022). Pengaruh Efisiensi Energi dan Air pada Bangunan dalam Penerapan Eco-Green. *Sinektika: Jurnal Arsitektur*, *19*(2), 120–128. https://doi.org/10.23917/sinektika.v19i2.17059

[5] Nugroho, M. F., Pramudito, W. A., & Prayogi, S. (2024). Audit Energi Pada Gedung Universitas Pertamina Menggunakan Metode AHP (Analytical Hierarchy Process). *I-Com: Indonesian Community Journal*, *4*(2), 761–772. https://doi.org/10.33379/icom.v4i2.4379

[6] Sunarto, S., Khotimah, K., & Santosa, S. (2022). Pelaksanaan Konservasi Energi di Batan melalui Penerapan Sistem Manajemen Energi Berbasis ISO 50001. *Pertemuan Dan Presentasi Ilmiah Standardisasi*, *2021*(December), 37–44.

[7] Syafiq, M. I., Andriawan, A. H., & Wardah, I. A. (2024). *Audit Energi Listrik Gedung Tower 1 Institut Teknologi Sepuluh Nopember Surabaya Penelitian oleh Niken Adriaty Basyarach , Izzah Aula Wardah , Puji Slamet , dan Aris berdasarkan penggunaan energi per satuan luas per bulan . Di CV . Wana Indo Raya Lumajang*. *2*(3).

[8] Parihar, Yogendra Singh. "Internet of things and

nodemcu." *journal of emerging technologies and innovative research* 6.6 (2019): 1085.

FORMULIR LOOGBOOK BIMBINGAN DAN PENGAJUAN
SEMINAR PROPOSAL/SIDANG TUGAS AKHIR*

Nama : Ristari Eka Putri
NIM : 3222011012
Pembimbing I : Widya Rika Puspita, S.Pd., MS1., Ph.D
Pembimbing II* :
Judul : Analysis of Energy Consumption For Cost Saving Efficiency Of Electric Energy Use At PLN Belakang Padang Using Internet Of Thinks (IOT) Technology

No	Hari/Tgl	Rincian Kegiatan	TTD Pembimbing I & II	
1	Rabu, 9-10-2024	melaporkan rencana untuk penyusunan TA (Tugas Akhir) Bab-4 danmohon bimbingan		
2	Senin, 28-10-2024	Melaporkan rancangan penyusunan laporanTA Bab-4		
3	Selasa, 5-11-2024	Melaporkan hasil revisi TA Bab-4 dan mulai		
4	Selasa, 12-11-2024	Melaporkan penyusunan laporan TA Bab-5		
5	Selasa, 19-11-2024	Melaporkan hasil revisi TA Bab-5		
6	Senin, 25-11-2024	Melaporkan hasil revisi TA Bab-5		
7	Rabu, 27-11-2024	Diskusi table pengujian		
8	Selasa, 3-12-2024	Revisi terkait pengolahan data		
9	Selasa, 17-12-2024	Review data analysis		
10	Kamis, 2-1-2025	Review hasil pengolahan data		
11	Senin, 6-1-2025	Review laporan,jurnal, ppt untuk maju siding akhir		

Berdasarkan hasil bimbingan yang telah dilaksanakan selama 4 bulan dan telah disetujui oleh dosen pembimbing, maka dengan ini saya mengajukan diri sebagai peserta Seminar Proposal /Sidang Tugas Akhir*.

Batam, 9 Januari 2025
Peserta

Ristari Eka Putri
NIM: 3222011012