

Performance of 3000 Watt PLTS at the Dompét Dhuafa Palembang Free Health Service Clinic Against Load Variations

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ABSTRACT

Since the system has been operational until now, the PLTS at the LKC wallet dhuafa Palembang clinic has never been analyzed on the system's performance, so it is not yet known whether this system is working well or not. The aim of this research is to analyze the performance of PLTS at the LKC Dompét Dhuafa Palembang clinic against variations in inductive and resistive loads. This research has 4 research stages, namely: 1). Literature study. 2). tool testing is carried out. 3). Data collection measurements. 4). Data analysis. From this research, the results obtained from testing tools and measuring data on PLTS performance at the LKC wallet dhuafa Palembang clinic with variations in inductive and resistive loads, when measuring the highest inductive input power was 449.8 W, the resulting efficiency was 83% at 12 :00, while the resistive input power is 546 W, the resulting efficiency is 80% from 12:00 to 15:00. From the research that has been carried out, the inductive load efficiency calculation results are 83% at 12:00 and the resistive load efficiency calculation results are 80% from 12:00 to 15:00. So it can be concluded that the performance of PLTS at the LKC Dompét Dhuafa Palembang clinic is optimal in terms of load calculations.

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1. Introduction

Humans are almost inseparable from electrical energy in everyday life. This is due to the increase in population which causes an increase in demand for electrical energy. However, the increase in demand for electrical energy is inversely proportional to the energy needed to be converted into electrical energy, where the use of electrical energy still comes from non-renewable energy sources, namely fossil energy and can run out over time, and it takes a very long time for the energy to These fossils are available and can be reused. Utilization of new and renewable energy is a very important issue in efforts to reduce the use of fossil energy which is currently increasingly depleting. New renewable energy has long been studied by researchers. An inventive problem-solving capacity analysis for renewable energy storage investments was researched by Meng [1]. Impact of tourist arrivals, tourism receipts and renewable energy consumption on quality of life: A panel study of the South African region researched by [2]. Renewable energy in Bangladesh: Status and prospects researched by Uddin [3]. The distribution of fish in tidal channels shows the behavioral impacts of marine renewable energy installations studied by Fraser [4]. The framing of opportunities for customer

engagement and renewable energy integration by electric utility representatives was researched by Stephens [5].

Renewable Energy Consumption, CO₂ Emissions, and the Economic Growth Nexus: Spatial Simultaneous Modeling Analysis of European Union Countries researched by Radmehr [6]. Exploring the gaps in the integration of renewable energy into the grid was researched by Ayamolowo [7]. The costs and carbon emissions of shared autonomous electric vehicles in Virtual Power Plants and Microgrids with renewable energy were researched by [8]. Efficient generation of unstructured meshes for marine renewable energy applications was researched by Avdis [9]. Failure & General recommendations towards sustainable management of renewable energy projects in Sub-Saharan Africa (Part 2 of 2) researched by Ikejemba [10]. Adaptive renewable energy generation (AREP) - To power local buildings and vehicles with 100% renewable energy researched by Boulaire [11]. Building integrated photovoltaics as a renewable energy tool at the GREENSHIP location was researched by Susan [12]. An assessment of on-site stable electricity generation from renewable energy sources in Chile was researched by Camargo [13]. Comparison of modern heuristic algorithms for loss reduction in power distribution networks equipped with renewable energy resources was researched by Ibrahim [14]. Promoting Community Renewable Energy as a tool for Sustainable Development in Rural Areas of Thailand was researched by Chaichana [15].

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Solar thermal energy in Indonesia is very abundant throughout the year, this is an alternative energy source for producing electrical energy. The deployment of alternative energy vehicles providing additional climate, air quality, and health benefits when combined with decarbonized power generation in China was researched by Peng [26]. Exploring public perceptions of renewable energy: Evidence from word network models in social networking services researched by [27]. Environmental and economic implications of energy efficiency in new residential buildings: A multi-criteria selection approach was researched by D'Agostino [28]. Is the 1.5°C target possible Exploring three areas of transformation was investigated by [29]. The Performance and Efficiency of the Organic Electrolyte Redox Flow Battery Prototype was investigated by Likit-anurak [30]. The development of heat transfer performance in a tubular heat exchanger with an improved NACA0024 vortex generator was investigated by Gururatana [31]. Changes in ostial dimensions after pulmonary vein isolation: pulsed field ablation vs radiofrequency ablation were studied by [32]. The life cycle environmental impacts of barley straw valorization were investigated by Garcia-Garcia [33]. Epitaxial Growth Modulation of Hollow Topology for High-Performance Electrocatalysts was researched by Feng [34]. A study of the energy performance of a ground source heat pump used in the refurbishment of a historic building: a comparison of different design options researched by Pacchiega [35].

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Can the combination of efficiency initiatives give us a good rebound effect was researched by Sarasa [46]. An assessment of the techno-economic feasibility of a diesel exhaust heat recovery system for heating mine inlet air in remote cold climate areas was investigated by [47]. Composite Materials with Combined Electronic and Ionic Properties were researched by Ralbag [48]. Diversity-oriented catalyst-free synthesis of pseudopeptides containing rhodanine scaffolds via sequential one-pot isocyanide-based six-component reactions in water using ultrasound irradiation was investigated by Shaabani [49]. Techno-economic feasibility analysis of a 1 MW photovoltaic grid-connected system in Oman was researched by Kazem [50]. One of the power plants that uses new, renewable energy derived from solar energy is photovoltaic (PV). Energy that comes from solar energy does not cause carbon emissions because it is environmentally friendly energy that is free from pollution and can be obtained for free. Solar Power Plant (PLTS) is a generating technology that converts photons from the sun into electrical energy. PLTS can be designed according to needs from household scale to large scale with technology that is easily adopted by the community. This PLTS works by directly converting solar radiation into electricity.

Increasing use of fly ash in concrete: Ex-ante LCA on emerging electro-mass separation technologies was researched by Maes [51]. Opportunities and challenges of electrochemical water treatment integrated with renewable energy at the water-energy nexus were studied by Kumar [52]. Comparative study of grid-connected photovoltaic solar systems: Performance evaluation and economic analysis researched by ELAMIM [53]. Photonic materials for high temperature applications: Synthesis and characterization by X-ray tomography pticography researched by Furlan [54]. PVMAPS: Software and data for the estimation of solar radiation and performance of photovoltaic modules over large geographic areas researched by Huld [55]. Knowledge, participation and the future: Epistemic qualities in energy scenario construction researched by Baard [56]. Factorial design and response surface optimization for modeling photovoltaic module parameters was researched by Kessaissia [57]. Using life cycle assessments to inform urban climate mitigation planning was researched by Thorne [58]. Determining the amount of energy storage for the development of a new microgrid energy flow optimization system with photovoltaic energy generation was researched by Rubenis [59]. Energy Return on Energy Invested (ERoEI) for solar photovoltaic systems in areas with moderate insolation: Comprehensive response researched by Rauei [60].

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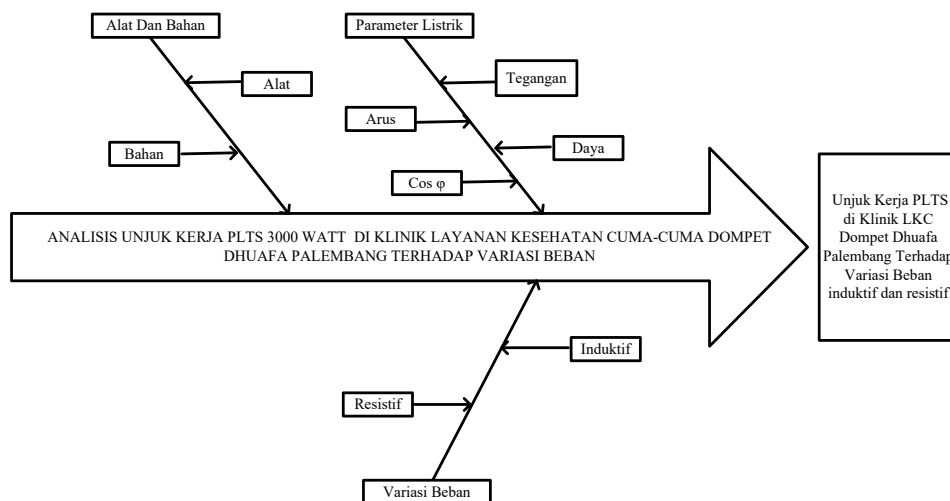
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The Palembang Dhuafa Free Health Service Clinic (LKC) has utilized PLTS to help reduce the cost of electricity bills caused by health equipment that uses very large amounts of electricity and power, including ultrasound (Ultrasonography) machines, dental machines, laser circumcision machines and several other health equipment, power saving devices in the form of inverters as solar power generators. Since the system has been operational until now, the PLTS at the LKC wallet dhuafa Palembang clinic has never been analyzed on the system's performance, so it is not yet known whether this system is working well or not. Therefore, a fishbone diagram is needed to identify, analyze, and visualize the root cause of a problem.

2. Method

2.1. Fishbone Diagram



Source: Research document

Fig. 1. Fishbone Diagram

2.2. Data collection method

This research began with collecting literature from books, journals and sources needed for research according to the discussion. Retrieval of current, voltage and power calculation data is carried out by measuring directly at the load source using a multimeter, ampere pliers.

3. Results and Discussion

3.1. Solar panel data

A solar panel is a device consisting of solar cells that can convert sunlight into electrical energy. The PLTS at LKC Palembang's dhuafa wallet has a power of 600 watts peak (wp).

Table 1. Solar Panel Data

Solar Panel Data	Capacity
Module type	SP-100.36
Maximum power value (Pmax)	100 W
Working circuit voltage (Voc)	22.3 V
Short circuit current (Isc)	5.82 A
Maximum current (Imp)	5.49
Maximum voltage (Vmp)	18.2 V
Dimensions	1020×670×35
Number of cells	36
Maximum system voltage	700 V
Temperature	25-80°C

3.2. Inverter data

An inverter is a tool for changing DC electrical energy sources to AC. The inverter used is 3000 W.

Table 2. Inverter Data

Inverter Data	Capacity
Incoming voltage	12Vdc
Voltage out	220Vac
Sinusoidal wave	3000W

3.3. Data from PLTS measurements of load variations

3.3.1. PLTS measurement data on inductive load variations

Table 3. Data from Measurements of Inductive Load Variations

500 W Inductive load table					
Time	V_{in}	I_{in}	V_{out}	I_{out}	$\cos \phi$
8:00	13	34.6	227	0.186	0.8
9:00	13	34.6	227	0.186	0.8
10:00	13	33.1	227	0.182	0.8
11:00	13	32	227	0.180	0.8
12:00	13	27.7	227	0.165	0.8
13:00	13	30	227	0.174	0.8
14:00	13	32	227	0.180	0.8
15:00	13	33.1	227	0.182	0.8

3.3.2. PLTS measurement data on resistive load variations

Table 4. Data from Measurements of Resistive Load Variations

Resistive load data 550 W				
Time	V_{in}	I_{in}	V_{out}	I_{out}
8:00	13	42	226	0.186
9:00	13	42	226	0.186
10:00	13	39	227	0.176
11:00	13	39	227	0.176
12:00	13	37	227	0.170
13:00	13	37	227	0.170
14:00	13	37	227	0.170
15:00	13	37	227	0.170

3.3.3. Calculation

- Calculation of 500 W inductive load input power

Inductive load input power calculation hours 8:00

$$P = V_{in} \times I_{in}$$

$$P = 13 \times 34.6$$

$$P = 449 \text{ W}$$

For conditions from 9:00 to 15:00, see [Table 5](#) and [Fig. 2](#).

- Calculation of 500 W inductive load output power

Calculation of inductive load output power hours 8:00

$$P = V_{out} \times I_{out} \times \cos\varphi$$

$$P = 227 \times 0.186 \times 0.8$$

$$P = 337 \text{ W}$$

For conditions from 9:00 to 15:00, see [Table 5](#) and [Fig. 2](#).

- Calculation of 550 W resistive load input power

Resistive load input power calculation Hours 8:00

$$P = V_{in} \times I_{in}$$

$$P = 13 \times 42$$

$$P = 546 \text{ W}$$

For conditions from 9:00 to 15:00, see [Table 6](#) and [Fig. 3](#).

- Calculation of 550 W resistive load output power

Resistive load output power calculation Hours 8:00

$$P = V_{out} \times I_{out}$$

$$P = 226 \times 0.186$$

$$P = 420 \text{ W}$$

For conditions from 9:00 to 15:00, see [Table 6](#) and [Fig. 3](#).

- Calculation of the efficiency of inductive load variations

Calculation of efficiency of inductive load variations Hours 8:00

$$\eta = \frac{P_{out}}{P_{in}} \times 100\%$$

$$\eta = \frac{337}{449.8} \times 100\%$$

$$\eta = 75 \%$$

For conditions from 9:00 to 15:00, see [Table 5](#) and [Fig. 2](#).

- Calculation of the efficiency of resistive load variations

Calculation of resistive load variation efficiency Hours 8:00

$$\eta = \frac{P_{out}}{P_{in}} \times 100\%$$

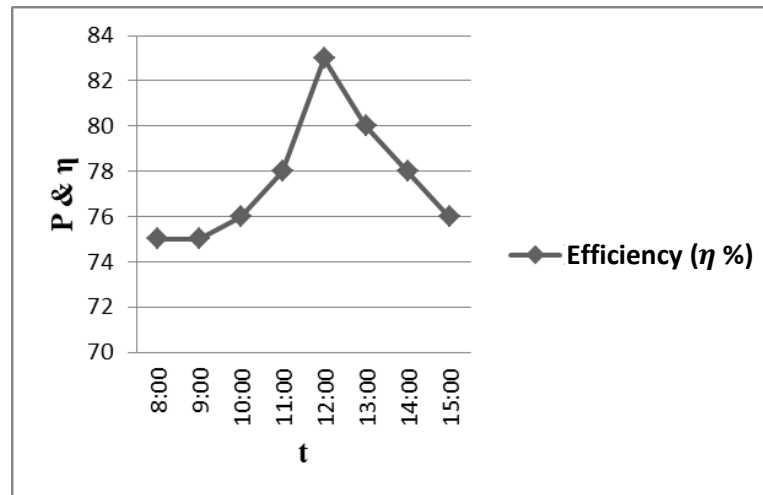
$$\eta = \frac{420}{546} \times 100\%$$

$$\eta = 76\%$$

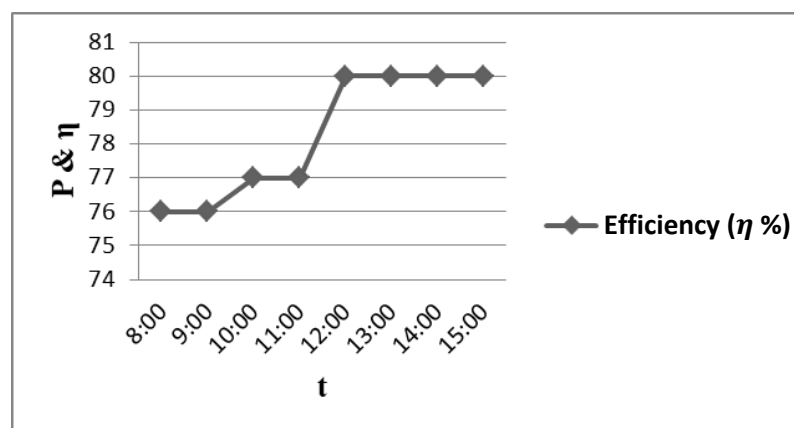
For conditions from 9:00 to 15:00, see [Table 6](#) and [Fig. 3](#).

Table 5. Inductive Load Calculation Results

Inductive load calculation results			
Time	P_{in}	P_{out}	η %
8:00	449.8	337	75
9:00	449.8	337	75
10:00	430	330	76
11:00	416	326	78
12:00	360.1	299	83
13:00	390	315	80
14:00	416	326	78
15:00	430	330	76

**Fig. 2.** Time vs Power and Efficiency Graphs on Inductive Loads**Table 6.** Resistive Load Calculation Results

Resistive load calculation results			
Time	P_{in}	P_{out}	η %
8:00	546	420	76
9:00	546	420	76
10:00	518	399	77
11:00	518	399	77
12:00	481	385	80
13:00	481	385	80
14:00	481	385	80
15:00	481	385	80

**Fig. 3.** Time vs Power and Efficiency Graphs on Resistive Loads

4. Conclusion

From the research that has been done, the calculation results of the inductive load efficiency are 83% at 12:00 and the calculation results of the resistive load efficiency are 80% at 12:00 to 15:00. It can be concluded that the performance of the PLTS at the LKC Dhompét Dhuafa Palembang clinic is optimal in terms of load calculations. For further research, the author suggests conducting research on capacitive load variations. From the research that has been carried out, the inductive load efficiency calculation results were 83% at 12:00 and the resistive load efficiency calculation results were 80% from 12:00 to 15:00. So it can be concluded that the performance of PLTS at the LKC Dhompét Dhuafa Palembang clinic is optimal in terms of load calculations. For further research, the author suggests conducting research on capacitive load variations.

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Conflicts of Interest: The authors declare no conflict of interest.

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