ISSN: 2720-989X
JEEE
JOURNAL OF ENERGY AND ELECTRICAL ENGINEERING

Load Performance Analysis of 630 kVA Mobile Substation Unit PGD067 Based on SAIDI and SAIFI Parameters

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[*submitted*: 18-03-2026 | *review*: 11-04-2026 | *published*: 20-04-2026]

ABSTRACT: *Maintenance of electrical distribution substations is an effort to maintain reliability and stability of power distribution system. Maintenance activity is routine activity of PT. PLN (Persero) to minimize unpracticable damage in future. Conventional maintenance methods often lead to power outages particularly in UP3 Serpong area which can disrupt electrical transactions as measured by SAIDI and SAIFI indices. To reduce interruptions cause by these indices, a maintenance method utilizing MSU is implemented to achieve downtime of 0 hours/customer. Implementation of MSU was tested at PGD067 substation in 2023 resulting value of 0 hours/customer during maintenance period. PT. PLN sets targets of SAIDI 2.34 hours/year and SAIFI 1.98 times/year. In comparation, the SAIDI and SAIFI values in 2022 were 3.22 hours/customer/year and 2.8 times/customer/year following to 1.13 hours/customer/year and 1.2 times/customer/year.*

KEYWORDS: *Distribution Reliability, Maintenance,Mobile Substation Unit, SAIDI, SAIFI*

I. INTRODUCTION

Electricity is primary necessity for all levels of society, generated by generators that convert mechanical energy into electrical energy. Electricity then transmitted via transmission line and circulated through distribution networks to end customers such as for businesses sector and general public. In delivering electrical energy, proper maintenance of distribution system is required without disrupting electrical business transactions [1]. A concrete substation is a type of distribution substation that utilizes a transformer with separable connectors (*Elastimold* type plug in) type with a capacity ranging from 250 kVA to 1000 kVA . this substation features a permanent building construction equipment with Low Voltage (LV) switchboard consisting with eight or more outgoing feeders, and is typically installed in areas with relatively high demand [2].

Routine maintenance is conducted on distribution substation. However, scheduled maintenance typically required a power interruption. This inevitably affect the reliability of electrical distribution system and disrupts electricity service transactions. To prevent customer outages during maintenance, PT.PLN (Persero) initiated to use a Mobile Substation Unit (MSU) to mitigate losses resulting from outrages during maintenance. A Mobile Substation Unit is a mobile distribution substation designed to function as a backup power supply during distribution system failures, ensuring that customers not experience outages while maintenance activities are being carried out [3].

Previous studies have investigated the implementation of MSU as an energy supply during maintenance to prevent power outages. For example an experimental application of MSU at Kramat Jati Service Unit (UP3) in East Jakarta with satisfactory results to prevent power outages during maintenance at distribution substation. However, the study did not utilize reliability indices in the analysis to evaluate the substation's performance during maintenance activities [4]. Therefore, free outage of maintenance method analysis required aiming to achieve System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) values of 0 minutes per year.

This study aims to analyze substation that have been indicated as abnormal during maintenance activities by applying SAIDI and SAIFI theoretical analysis to the load conditions of distribution substation. The research was conducted in UP3 Serpong area, South Tangerang – Indonesia, especially at PGD067 distribution substation with 630kVA transformer. This unit has been identified as experiencing frequent disturbances and outages which can impact the quality of electrical reliability in Serpong region. These issues are measured against the SAIDI dan SAIFI indices which PT. PLN (Persero) targets electrical system reliability during distribution substation maintenance with SAIFI index of 1.98 interruptions per customer and SAIDI index of 2.34 hours per customer for example case By the end of 2018, feeder failure reached 157 incidents, costing of 127 occurrences on Medium Voltage Underground Cable and 30 occurrences on Medium Voltage Overhead Line [5][6].

The objective of this study is to enhance power reliability especially at UP3 Serpong area by reducing SAIDI and SAIFI indices. This is achieved through the use of MSU as backup power during maintenance to prevent outages and ensure operational stability. Furthermore, this study compares SAIDI and SAIFI data from 2022 and 2023 by utilizing both historical records and direct field testing to evaluate compliance with PT. PLN (Persero) targets for achieving zero outages power system.

II. LITERATURE REVIEW

A. ELECTRICAL POWER

Electrical power is the amount of electrical energy flowing throught a conductor per unit time, resulting from the product of current and voltage. Power is classified into three types which are artive power, apparent power, and reactive power. Active power is the power required by resistive loads, indicating the presence of electrical energy flow that can be converted into other forms of energy such as light energy, thermal energy, mechanical energy, and others [7]. The unit of active power is Watt, and it expressed by the equation :

$$P = V\ x\ I\ cos\varphi \quad (1)$$

Or

$$P = V\ x\ I \quad (2)$$

P = Active Power (Watt)

V = Voltage (Volt)

I = Current (A)

Cos φ = Power Factor

Reactive power (Q) is the power required to establish a magnetic field in inductive winding (Magnetic Flux), and its unit is the volt – ampere reactive (VAR). Meanwhile, apparent power (S) is the power obtained from the product of the effective (Root Mean Square (RMS)) voltage and the effective current, represents the trigonometric (vector) sum of active power and reactive power. The unit of apparent power is the volt – ampere (VA).

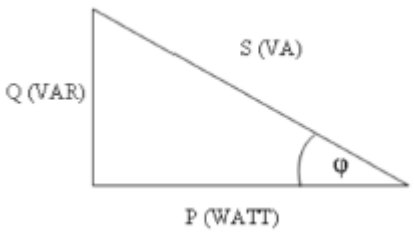

Fig 1. Power Triangle Diagram

B. LOAD ELECTRICITY

In an alternating current (AC) electrical system, there are three types of loads and they are resistive loads, inductive loads, and capacitive loads [8]. A resistive load is a purely resistive type of load in which the load absorbs only active power. The current and voltage waveform passing through the resistive load are always in phase.

The inductive load is type of load consisting of wire winding and magnetic core. Inductive loads absorb both active and reactive power, in which the current waveform lags behind the voltage waveform, commonly referred to as lagging power. The capacitive load is a load that contains components, in which the load absorbs active power and supplies reactive power, with the current waveform leading the voltage waveform, commonly referred to as leading power.

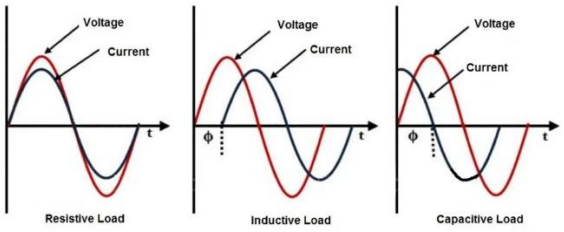

Fig 2. Voltage-Curranet Load Electricity Diagram

C. SUBSTATION

A substation is a facility that serves as the termination point of a transmission network. Within the substation, there are step – down transformers used to supply electrical power to the distribution network, protection equipment, and control device [2]. Substations serve several functions, such as stepping down the voltage form transmission network which ranges from 150 kV to 500 kV into medium voltage of approximately 20 kV which is then utilized for electrical power distribution network.

Fig 3. Substation

In addition to stepping down the voltage on electrical power transmission network, a substation also functions as a high voltage supply to other substation units and serves for measurement,

operational monitoring, and regulation of electrical power network's protection system.

D. SUBSTATION MAINTENANCE

Distribution substation maintenance or commonly referred to as revision, is a maintenance activity performed on both civil components such like the physical building and electrical components such like the equipment used for distribution delivery [9]. The objectives of this maintenance are to ensure that the distribution network installations operate safely for both people and the environment, and to achieve high reliability, high availability, good performance, a lifespan consistent with the design, effective maintenance downtime, and economical maintenance cost [1][5].

E. TRANSFORMERS

Transformer is an electrical device used to change voltage or current values from one level to another according to specific requirements. It operates based on Faraday's Law, utilizing the principle of electromagnetic induction through the primary winding and secondary winding coil [10].

When an alternating current (AC) flows through the primary winding, it generates an alternating magnetic flux along the core. This flux induces the secondary winding, resulting in a generated voltage due to electromagnetic induction. Distribution transformers generally operate at high voltages. At substation, they function to step down the Medium Voltage (MV) of 20 kV to Low Voltage (LV) of 380 V or 220 V.

In performing transformer maintenance, it is necessary to evaluate efficiency and capacity of transformer by calculating load percentage. Load percentage is calculated by comparing actual measured current against rate transformer's rated capacity using following equation :

$$\%load = \frac{I_{avg} x V x \sqrt{3}}{S_{rate}} x100\% \quad (3)$$

Fig 4. Transformers

F. MOBILE SUBSTATION UNIT

Mobile Substation Unit is a distribution substation designed for temporary use, featuring a compact construction that is easy to relocate [3]. This makes the mobile substation unit a fast and precise solution for replacing the function of a distribution substation undergoing maintenance without causing an interruption or zero interruption [1]. The components of a mobile substation unit include a transformer, LBS (Load Break Switch) cubicle, transformer distribution panel, low voltage switchgear, NH – Fuses, NA2XSYBY 20 kV type cables, and NYY cable within the unit.

Fig 5. Mobile Substation Unit

The primary challenge with mobile substation unit is that synchronization must be performed when transferring the load from distribution substation to the mobile unit. This action is necessary to ensure that no outage occurs during the load transfer and to prevent overload on the mobile unit. Consequently, the transformer capacity of the mobile substation unit must be greater than the capacity of the distribution transformer within the substation it is replacing.

G. SAIDI DAN SAIFI INDEX

System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) are indices used to measure reliability parameters in electrical power distribution. SAIDI is an index that measures the duration of interruptions occurring over a specific period[11][12]. The SAIDI index can also be explained through the following equation :

$$SAIDI = \frac{\sum(r_i x N_i)}{N_T} \quad (4)$$

r_i = Restoration time (duration) for each interruption event

N_i = Number of customers affected by each interruption event

N_T = Total number of customers served by the system

Meanwhile, the SAIFI is a measurement used to evaluate reliability by determining how often interruptions occur within a specific period in electrical

power distribution. The SAIFI index can also be explained through the following equation :

$$SAIFI = \frac{\sum(\lambda_i x N_i)}{N_T} \quad (5)$$

Λ_i = Failure rate (the number of interruptions)
N_i = Number of customers affected by each interruption event
N_T = Total number of customers served

III. METHODOLOGY

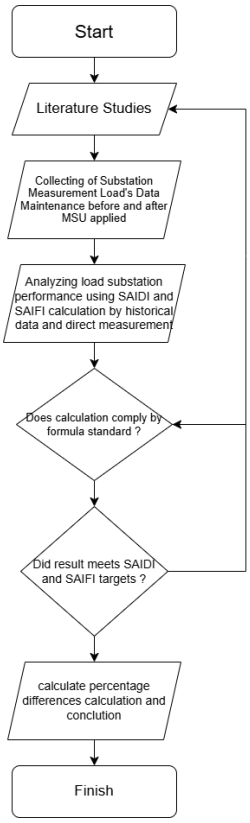

Fig 6. Research Flowchart Diagram

The flow of this research begins with a literature study relevant to establish a strong theoretical foundation and research methodology. This followed by collecting data from PGD067 distribution substation in UP3 Serpong area which utilizing both historical records and direct measurements for 2022 and 2023. This data covers the periods before and after implementation of Mobile Substation Unit during maintenance in 2023.

Once historical and field data are gathered, an analysis conducted through calculation based on literatre study and compliance with SAIDI dan SAIFI index standards. If any discrepancies occur during calculation or data is incomplete, process reverts to literature study stage.

After calculation align with theoretical framework, a comparative analysis is performed to determine if results significantly meet with PT. PLN (Persero) targets for reducing SAIDI and SAIFI indices. If any result were not meet these targets, process return to literate study. Final step involves calculating percentage reduction based on SAIDI and SAIFI metrics. This evaluates significance of reduction when maintenance is performance at 630kVA PGD067 distribution substation based on load performance while utilizing the Mobile Substation Unit (MSU).

IV. RESULTS

A. VOLTAGE AND LOAD MEASUREMENT DATA FOR SUBSTATION PGD067

Substation PGD067 distributes electrical power to the Milano Village area with total of 396 customers receive their electricity supply from PT. PLN (Persero). To measure single phase voltage, connect one probe to phase voltage and the other probe to the neutral busbar and phase to phase measurement are taken across busbars. The resulted of voltage measurements for PGD067 are represented in Tbl 1. Below :

Tbl 1. PGD067 Substation Voltage Result

No	Phase to Neutral Busbar	Voltage (V)	Phase to Phase Busbar	Voltage (V)
1	R – N	233	R – S	407
2	S – N	235	R – T	405
3	T – N	234	S – T	407

The voltage measurements for substation PGD067 were conducted and repeated four times. These measurements yielded stable results. For phase to neutral voltage at the substation, the results should fall within range of 220 V to 240 V and average voltage obtained at PGD067 was 234 V. Furthermore, the phase to phase voltage measurements yielded an average of 406 V.

Tbl 2. Load Switchgear Measurement PGD067 Substation

No	Line	Load and Fuses Installed on the Low Voltage Switchgear						
		R		S		T		N
		Current (A)	Fuse Current Rate (V)	Current (A)	Fuse Current Rate (V)	Current (A)	Fuse Current Rate (V)	Current (A)

1	A	39	250	39	250	30	250	14
2	B	9	250	10	250	27	250	22
3	C	14	250	25	250	10	250	11
4	D	31	250	35	250	28	250	27
5	E	17	250	16	250	7	250	7
6	F	50	250	53	250	41	250	40
Total		160		178		143		121

The capacity of transformer measurement equation is defined as follows :

$$\%load = \frac{I_{avg} x V x \sqrt{3}}{S_{rate}} x100\% \quad (3)$$

$$\%load = \frac{\left(\left(\frac{160+178+143}{3}\right)\right) x V x \sqrt{3}}{630000} x100\% = 17.8\%$$

Then load of transformers equation is defined as follow :

$$P = V\ x\ I = Watt$$

P = Load or Power (Watt)

V = Voltage (V)

I = Current (A)

Following data represents total active power recorded during daylight hours at substation PGD067 :

$$Pr = 233V\ x\ 160A = 37.280\ Watt$$

$$Ps = 235\ V\ x\ 178A = 41.830\ Watt$$

$$Pt = 234V\ x\ 143A = 33.462\ Watt$$

The cumulative power consumption across three phases is calculated as :

$$P_{Total} = P_R + P_S + P_T = 122{,}572\ Watt\ (122.5\ kW)$$

Based on the measurement result above, the current utilization rate by local consumers accounts for only 17,8% of the total transformer capacity. Consequently, there is significant overhead for customers served by substation PGD067 to request power upgrades without the risk of experiencing a voltage drop.

In conclusion, the transformer installed at this substation remains highly adequate and technically viable for distributing electrical energy to customers while maintaining optimal performance standards.

B. PARALLEL OPERATION RESULT OF THE MOBILE SUBSTATION UNIT DURING MAINTENANCE OF SUBSTATION PGD067

During the maintenance period, the electrical supply for consumers was redirected to a Mobile Substation Unit. This unit features a transformer capacity of 630 kVA, which is equivalent to the rated capacity of the stationary transformer at substation PGD067. The following table present the measurement data recorded during the UGB operation

Tbl 3. Voltage of Mobile Substation Unit Measurement during Maintenance

Mobile Substation Unit Voltage Measurement (Volt)			
R – N	236	R – S	408
S – N	236	R – T	407
T – N	235	S – T	408

Voltage measurement for the mobile substation were conducted using tap charger position 3. These measurements were performed in four continuous iterations, yielding consistent result across all trial. The voltage differential between the mobile substation original PGD067 transformer was minimal, raging only from 1 V to 3 V, indicating excellent performance in power distribution to consumers.

Following the load transfer from PGD067 transformer to mobile substation, there were no significant fluctuations in current measurements. However, a notable difference was observed in the voltage levels. The average phase to neutral voltage reached 235.6 V, which is slightly higher than PGD067 transformer. This superior voltage performance can be attributed to the variations in construction materials used by different transformer manufactures, which can result in output levels that are superior, equivalent, or slightly inferior to the baseline.

In conclusion, the maintenance process was executed without any power interruptions. The entire load was successfully backed up by mobile substation, ensuring a continuous and stable electricity supply for all consumers.

C. OUTAGE REPORT DATA FOR SUBSTATION PGD067

Following dataset details the interruptions within electrical distribution system at substation PGD067 during 2022 period. These outages were attributed to both technical faults and scheduled maintenance. In 2022, consumer served by substation PGD067 experienced four instance of service interruption, halting the transaction of electrical energy.

Tbl 4. PG39D067 Substation Interruption in 2022

No.	Date	Substation	Customer	Interruption Duration (Hours)	Number of Interruption	Event
1	January 2022	PGD067	396	1.13	66	NH-Fuse Failure
2	March 2022	PGD067	396	1.03	396	Substation Maintenance
3	June 2022	PGD067	396	0.83	48	NH-Fuse Failure
4	September 2022	PGD067	396	1.91	396	Secondary Cable Failure

Based on the calculation using SAIDI and SAIFI formulas, the results are summarized in table below.

Tbl 5. Total of SAIDI and SAIFI in 2022

No.	Date (2022)	SAIDI (Hours/Customer)	SAIFI (Times/Customer)
1	January	0.18	0.16
2	March	1.03	1
3	June	0.10	0.12
4	September	1.91	1
TOTAL		3.22	2.28

PT. PLN (Persero) UP3 Serpong has established reliability targets of SAIDI ≤2.34 hours/customer/year and SAIFI ≤1.98 interruptions/customer/year. Furthermore, according to SPLN 68 – 2: 1986, the standards for medium voltage underground cable system with decentralized automated system are 3.33 hours/year for SAIDI and 1.2 times/year for SAIFI.

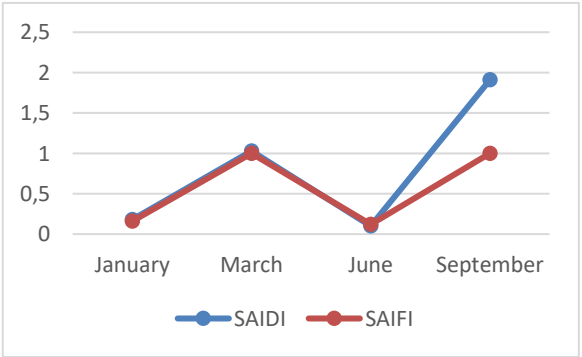

Fig 7. Comparation of SAIDI and SAIFI in 2022

The calculation results for 2022 yielded a SAIDI of 3.22 hours/customer/year and a SAIFI of 2.28 times/customer/year. These figures indicate that the system reliability during this period did not meet the targets set by PT PLN UP3 Serpong or the general PLN standards.

In 2023, PGD067 recorded three outages due to system faults and one instance of scheduled maintenance. The following data details in the interruptions for 2023.

Tbl 6. Interruption Event in 2023

No.	Date (2023)	Number of Customers	Interruption Duration (Hours)	Customer Interrupted	Substation	Event
1	May	396	0	0	PGD067	NH Fuse Failure
2	June	396	0.5	39	PDG067	Interruption – free maintenance
3	September	396	0.83	396	PGD067	Earthing Plate Burnout
4	December	396	0.76	46	PGD067	NH Fuse Failure

Using same methodology, the 2023 SAIDI and SAIFI values were obtained as shon in table 7. The results show a SAIDI of 1.13 hours/customer/year and a SAIFI of 1.2 times/customer/year. Consequently, the system reliability in 2023 successfully met the performance targets established by PT PLN UP3 Serpong.

Tbl 7. Calculation of SAIDI and SAIFI in 2023

No.	Date (2023)	SAIDI (Hours/Customer)	SAIFI (times/customer)
1	May	0	0
2	June	0.04	0.09
3	September	0.83	1
4	December	0.08	0.11
TOTAL		1.13	1.2

Referring to PT. PLN (Persero) UP3 Serpong, the target SAIDI is ≤ 2,34 hours/year and the target of SAIFI is ≤ 1,98 times/year. Based on the calculations, resulting SAIDI is 1.13 hours/customer/year and the SAIFI is 1.2 times/customer/year. From these results, the system reliability is in accordance with the target set by PT. PLN UP3 Serpong.

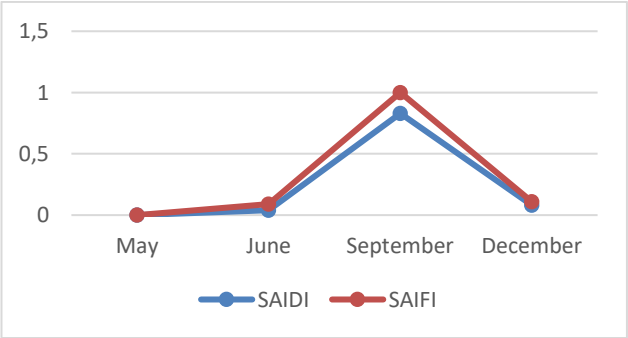

Fig 8. Comparation of SAIDI and SAIFI in 2023

The feasibility results for substation maintenance testing using a Mobile Substation Unit, based on a comparison of measurements and calculations, can be seen in the table below :

Tbl 8. Maintenance Feasibility Result with Mobile Substation Unit

PGD067 Maintenance report results with Mobile Substation	
Total active current before maintenance (A)	481
Average voltage before maintenance (V)	234
Total active current during maintenance with mobile substation (A)	481
Average voltage during maintenance with mobile substation (V)	235

From the voltage and load current measurement results above, it is concluded that the PGD067 active load can be supported throughout the maintenance period.

Tbl 9. SAIDI and SAIFI Comparative Analysis

SAIDI and SAIFI Comparative Analysis			
No	Year	SAIDI	SAIFI
1	2022	3,22	2,28
2	2023	1,13	1,2

Based on the table above, the SAIDI and SAIFI values for 2022 did not meet the standards set by PT. PLN UP3 Serpong. However, in 2023, both SAIDI and SAIFI decreased significantly successfully reaching the targets.

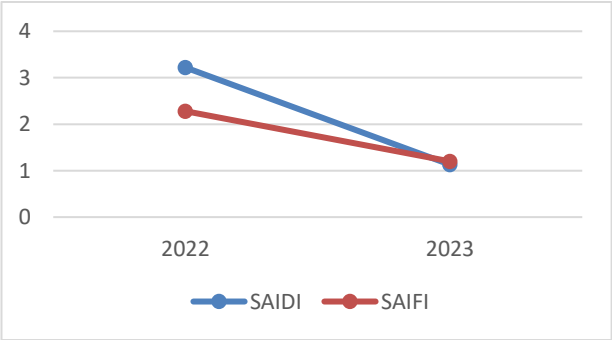

Fig 9. SAIDI and SAIFI in 2022 and 2023

In 2022, substation maintenance was still conducted using conventional methods, which involved power outages during the maintenance period, in contrast by 2023, maintenance was performed using a zero – outage method by utilizing a Mobile Substation Unit.

The results of Mobile Substation Unit trial were successful as the SAIDI and SAIFI for PGD067 substation in 2023 met the requirements and targets of PT. PLN UP3 Serpong. For comparison, the total SAIFI in 2022 was 2.28 times/customer/year. In 2023, the total SAIDI was reduced to 1.13 hours/customer/year and the total SAIFI was 1.2 times/customer/year.

V. CONCLUSION

Based on the results of the study and analysis conducted, it can be concluded that the PGD067 distribution substation has an active power utilization level of 122.572 Watts or only 17.8% of its total capacity. In 2022, the total SAIDI was 3.22 hours/customer/year and total of SAIFI was 2.28 times/customer/year. In 2023, total of SAIDI improved to 1.13 hours/customer/year and total of SAIDI was 1.2 times/customer/year.

Mobile Substation Unit (MSU) produces an average voltage of 235.6 V. This value indicates that voltage output from MSU implementation during distribution substation maintenance is capable to improving voltage quality. Furthermore, implementation of MSU is proven to reduce SAIDI dan SAIFI indices in accordance with PT. PLN (Persero) targets by achieving SAIDI value of ≤2.34 hours/year and SAIFI value of ≤1.98 times/year.

ACKNOWLEDGEMENTS

Author would like to express sincere gratitude to Mr. Syopian Akbar and PT. Haleyora Powerindo for their invaluable support, guidance, and the resource provide throughout the duration of this research. Special thanks are also extended to all colleagues for their cooperation and technical assistance, which significantly contributed to the completion of this research.

REFERENCES

[1] O. A. Rozak, T. Raharjo, A. Triyanto, and F. W. Saputra, “Dampak Metode Zero Downtime Maintenance terhadap Penurunan Saidi pada Gardu Distribusi Tipe Beton,” *Journal of Electrical Power Control and Automation (JEPCA)*, vol. 5, no. 2, p. 38, Dec. 2022, doi: 10.33087/jepca.v5i2.73.

[2] D. F. Iman, P. Khaerunnisa, H. M. Fitri, and D. Aribowo, “Analisis Operasional Sistem Distribusi Tegangan Menengah ke Tegangan Rendah di Gardu Induk Serang,” *Journal of*

Electrical Power Control and Automation (JEPCA), vol. 7, no. 2, p. 66, Dec. 2024, doi: 10.33087/jepca.v7i2.119.

[3] A. Syakur, G. A.-J. (Jurnal T. E. Terapan), and undefined 2020, "Sinkronisasi Trafo Unit Gardu Bergerak (Ugb) Dengan Trafo Distribusi Di Lingkungan Pln," *jurnal.polines.ac.id*, Accessed: Mar. 18, 2026. [Online]. Available: https://jurnal.polines.ac.id/index.php/jtet/article/view/2081

[4] M. A. Firmansyah and R. Rahmadewi, "SISTEM PEMELIHARAN TANPA PADAM DENGAN MENGGUNAKAN UNIT GARDU BERGERAK (UGB) DI UNIT PELAKSANA PELAYANAN PELANGGAN KRAMAT JATI," *Jurnal Ilmiah Wahana Pendidikan*, vol. 9, no. 12, pp. 326–334, Jun. 2023, doi: 10.5281/ZENODO.8078928.

[5] R. J.-E. dan Kelistrikan and undefined 2019, "Analisa Nilai SAIDI SAIFI sebagai indeks keandalan penyediaan tenaga listrik pada penyulang Cahaya PT. PLN (Persero) area Ciputat," *neliti.comRT JurnalEnergi dan Kelistrikan, 2019•neliti.com*, Accessed: Mar. 18, 2026. [Online]. Available: https://www.neliti.com/publications/389629/analisa-nilai-saidi-saifi-sebagai-indeks-keandalan-penyediaan-tenaga-listrik-pad

[6] B. Husodo, A. A.-J. T. Elektro, and undefined 2018, "Penerapan Metode Minim Padam Untuk Pemeliharaan Gardu Distribusi 20 kV Di PT PLN Area Bulungan (KL224)," *neliti.comB Husodo, AP AkbarJurnal Teknologi Elektro, 2018•neliti.com*, Accessed: Mar. 18, 2026. [Online]. Available: https://www.neliti.com/publications/328506/penerapan-metode-minim-padam-untuk-pemeliharaan-gardu-distribusi-20-kv-di-pt-pln

[7] A. M. J. Marindra, H. Aprillia, H. Wicaksono, and N. D. Prasetio, "Pengantar Teknik Elektro - ITK," no. Institut Teknologi Kalimantan (ITK) Press, pp. 1–110, Dec. 2023.

[8] P. Penambahan Kapasitor Terhadap Tegangan, F. Daya, dan Daya Aktif pada Beban Listrik di Minimarket Fachry Azharuddin Noor, H. Ananta, and dan Said Sunardiyo, "Pengaruh Penambahan Kapasitor Terhadap tegangan, arus, faktor daya, dan daya aktif pada beban listrik di minimarket," *journal.unnes.ac.idFA Noor, H Ananta, S SunardiyoJurnal Teknik Elektro, 2017•journal.unnes.ac.id*, Accessed: Mar. 18, 2026. [Online]. Available: https://journal.unnes.ac.id/nju/jte/article/view/11358

[9] N. Pasra, P. R.- Sutet, and undefined 2016, "Pelaksanaan Manajemen Pemeliharaan Gardu Distribusi," *neliti.comN Pasra, PP RuswandiSutet, 2016•neliti.com*, Accessed: Mar. 18, 2026. [Online]. Available: https://www.neliti.com/publications/538954/pelaksanaan-manajemen-pemeliharaan-gardu-distribusi

[10] I. Bagus and P. Widja, "Sistem Pengukuran Listrik dengan Sensor Current Transformer TA12-100," vol. 9, no. 1, pp. 36–43, 2022.

[11] M. Harjian, … S. S.-… dan T. E., and undefined 2025, "Analisis Saifi Dan Saidi Sebagai Indeks Keandalan Pada Gardu Induk Kuta Menggunakan Metode Section Technique and Failure Mode Effect & Analysis (Fmea)," *journal.eng.unila.ac.idMR Harjian, S Supriyatna, AB Muljono, RRE PutraJurnal Informatika dan Teknik Elektro Terapan, 2025•journal.eng.unila.ac.id*, vol. 13, no. 2, pp. 2830–7062, doi: 10.23960/jitet.v13i2.6450.

[12] F. Funan, W. S.-J. I. T. Elektro, S. dan, and undefined 2020, "Evaluasi Keandalan Sistem Distribusi Tenaga Listrik Berdasarkan Indeks Keandalan SAIDI dan SAIFI pada PT PLN (PERSERO) Rayon Kefamenanu," *journal.undiknas.ac.idF Funan, W SutamaJurnal Ilmiah Telsinas Elektro, Sipil dan Teknik Informasi, 2020•journal.undiknas.ac.id*, vol. 3, no. 1, p. 836, 2020, Accessed: Mar. 18, 2026. [Online]. Available: https://journal.undiknas.ac.id/index.php/teknik/article/view/2888

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