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ANALYSIS OF IMPROVING THE RELIABILITY OF A 20 KV DISTRIBUTION NETWORK SYSTEM USING THE HOT-SPOT IDENTIFICATION METHOD IN THE CUSTOMER SERVICE UNIT (ULP) OF WOHA

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ABSTRACT

PT. PLN (Persero) is a company with an extensive distribution network system, which continues to expand in terms of the number of distribution networks. This company is known for its excellent efforts in improving the quality of service to its customers, particularly in meeting the electricity needs of customers in the West Nusa Tenggara region. With the existing distribution system network, reliability analysis can be determined by assessing the system's quality in relation to disruptions that occur. To improve the quality of electricity distribution, the performance of the distribution network system is a key aspect that will always be maintained to ensure electricity is delivered to customers. In enhancing the quality of the distribution system, the calculation of reliability indices, based on the average interruption frequency (SAIFI) and the average interruption duration (SAIDI), serves as a reference for the reliability of the distribution network.

Keyword : Reliability, Hot Spot Identification, SAIDI, SAIFI

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1. INTRODUCTION

An electric power system that generally consists of a line and load generator is a system that processes the empowerment and use of electrical energy. The need for electrical energy is a primary priority in supporting development activities in various aspects of life. The electric power system has the reliability performance of the distribution system is one of the achievements of the success of a network or of a distribution system to be able to produce better achievements in certain periods and certain conditions. In this particular period or condition, it is necessary to analyze and calculate a certain level of reliability and then compare it to existing standards and can be used as a reference or calculation in the future. (Rahmaniar 2021)

The existing reliability always increases in line with the results of the analysis that has been carried out. However, it is possible that there is still a potential for disruption or there is still an aspect of lack of reliability in the distribution network system. Reliability itself must not work incorrectly (false trip) or fail when needed. (Donny Ferdian Hutahuruk 2025) To evaluate the performance of the distribution network system, several parameters are needed to evaluate the distribution network system. The parameters in question are important points that have an impact on the quality of customer service. The most important parameter points are the System Average Interruption Frequency Index (SAIFI) and the System Average Interruption Duration Index (SAIDI).

The decline in the level of reliability in distribution network systems is largely caused by network disruptions both internally and externally. External disturbances are caused by trees, animals, foreign objects, third parties, lightning and other major forces. As for the internals themselves, it can be caused

by material breakdown, joint breakage in the conductor, flashover and termination. The decline in system performance is an important point to be immediately evaluated both with inspection and interference mitigation. (Pristial Wibowo 2018)

Interference caused by external interference can be more clearly seen and data is executed immediately. Meanwhile, for interference caused by the inter is an evaluation to maintain reliable performance. Therefore, preventive mitigation is carried out to get the right mitigation to reduce internal disturbances. The method that will be used is in the form of a thermal method or looking for hot spots in a material that has the potential to become a breakdown material. (Yahya Koto 2022)

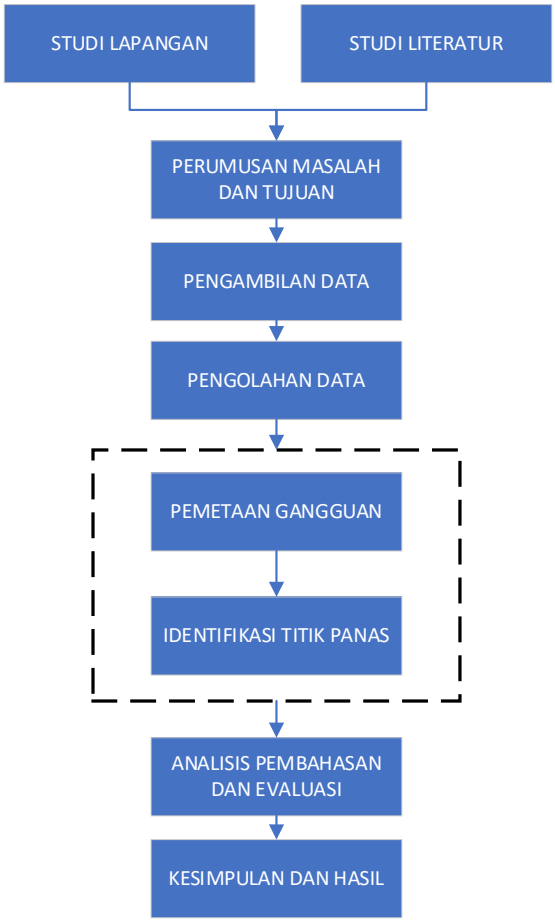
2. RESEARCH METHODS

The research with this hot spot identification method was carried out in the PT. PLN (Persero) UIW NTB UP3 Bima ULP Woha. This research was carried out and based on studying existing literature or references related to journal completion and supported by field studies with conditions from the level of disturbance at ULP Woha. This research is continued by formulating problems and the objectives of the research.

Furthermore, it was carried out by data collection from November 2024 to December 2024 and data processing. The results obtained from data processing will be re-calculated by dividing disturbances based on the cause of disturbances from certain categories and identifying hot spots for material categories when the feeder experiences temoprer and permanent disturbances. And continued with analysis and evaluation by calculating the results of the existing feeder disturbances in January 2025 with the calculation of SAIDI and SAIFI achieved.

Research licensing to PT. PLN (Persero) ULP Woha to collect data used for data needs in this journal is carried out within a certain period of time or period to obtain valid results. Data processing is carried out to minimize and suppress the number of potentials and disturbances in ULP Woha.

Steps taken to obtain data include:
1. Collect data from feeders who often have disturbances (sick feeders).
2. Map the disruptions that occur in the relevant feeder based on temporary and permanent causes and categories.
3. Identify hot spots to the distribution network to maintain good network conditions.
4. Conducting a study of the data obtained to determine the identification of the reduction of feeder disturbances at ULP Woha, especially in disturbances in the form of breakdown materials at the base to the end of the path.



Picture 1. Research Flowchart

The data collection used includes:

1. Data on feeder disturbances for November 2024 – December 2024 in feeders who are in the category of sick or have the highest disturbances in that period.

Feeder	**Moon**	
	November	**December**
Donggo	4	2
Scarlet	3	2
Madapangga	2	2
Karumbu	2	1
Stopped	3	1
Lambitu	2	2
Sum	16	10

Table 1. Feeder Disruption November and December 2024

2. SAIDI SAIFI data for November 2024 – December 2024 on feeders who are in the category of sick or have the highest disorders in that period.

Moon	SAIDI	SAIFI
Nov	14,31	2,20
Des	10,14	1,84

Table 2. SAIDI SAIFI November and December 2024

3. Data on the number of customers blacked out in the period November 2024 – December 2024 for feeders who were in the category of sick or had the highest disturbances in that period.

Moon	Deleted Customers	Total number of customers
Nov	35.644	108.472
Des	28.148	108.956

Table 3. Customers Delete November and December 2024

From the data collection period, the identification results were quite optimal and only got a few obstacles in the form of unfavorable weather so that rescheduling was carried out to get optimal results and data collection was carried out in stages due to the length of the existing feeders and gradual maintenance was carried out with the previous results that had been mapped.

3. RESULTS AND DISCUSSION

From the data obtained, it was found that several causes of disruption in the distribution network include:

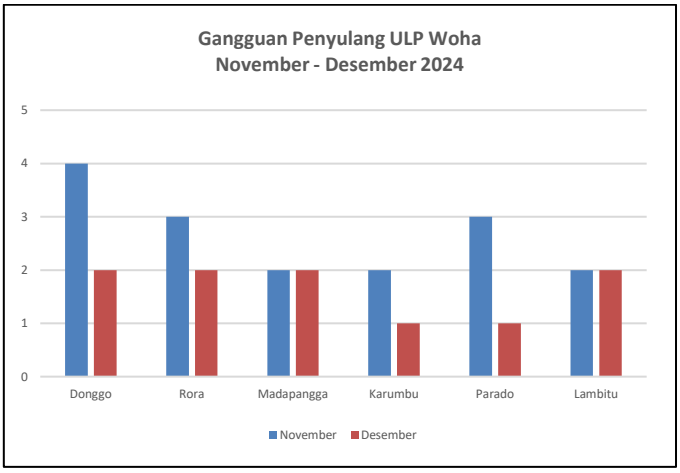
1. There was a heavy rainstorm that resulted in the collapse of the poles.
2. The discovery of kite yarn can be identified as a lack of public awareness of electrical hazards.
3. The breakage of the jointing in the distribution network was due to lightning strikes in areas prone to lightning.
4. Loosening of the bonds on the conductor.
5. Temporary and permanent disturbances were found due to material breakdowns both in insulator materials and other materials.

From the data that has been taken in November and December 2024, data on sick feeder disorders or feeders that cause the highest disturbance at PT. PLN (Persero) ULP Woha is as follows

Feeder	Moon	
	November	December
Donggo	4	2
Scarlet	3	2
Madapangga	2	2
Karumbu	2	1
Stopped	3	1
Lambitu	2	2

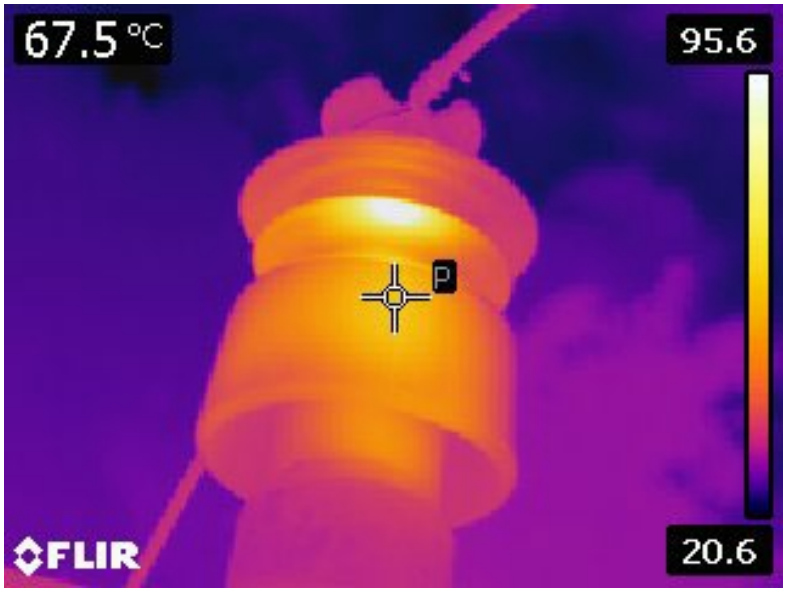
Sum	16	10

Table 4. Feeder Disruption November and December 2024

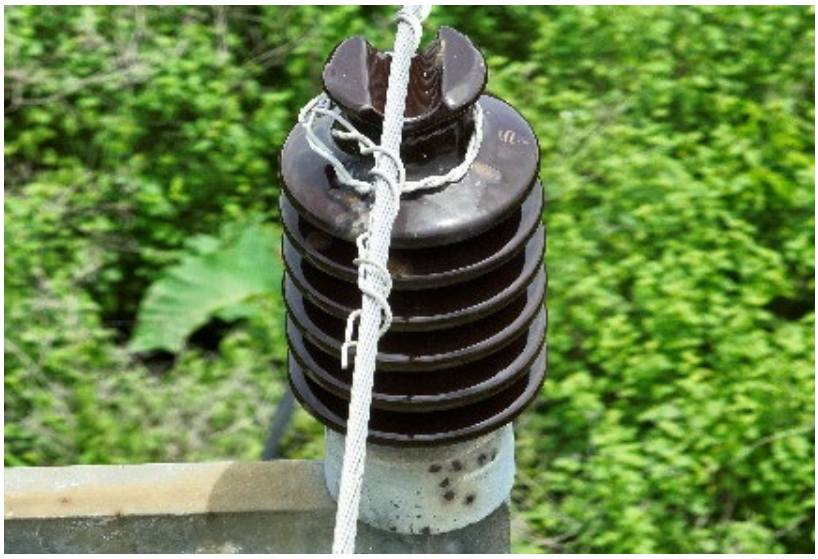


Picture 2. Ovember Disruption Chart and December 2024

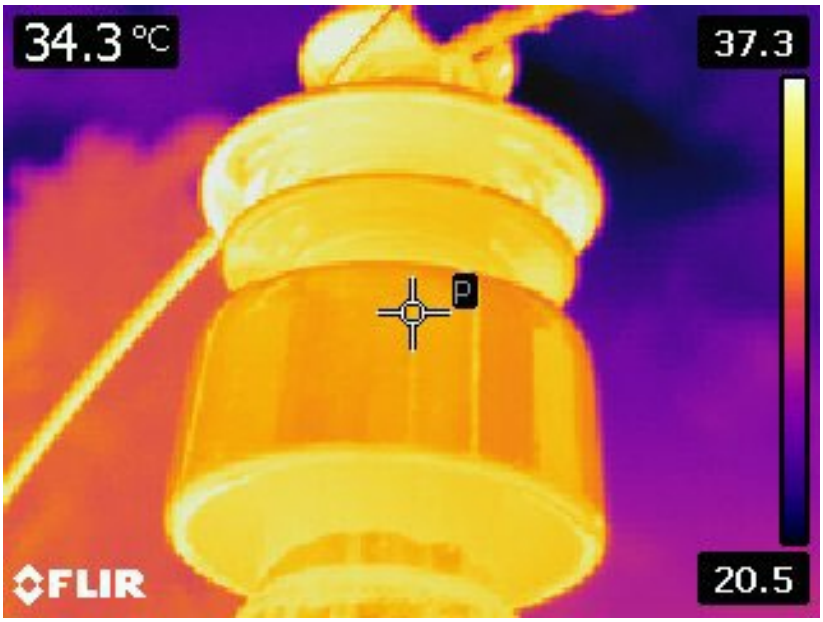
The following data has been obtained from the results of inspections with Thermal drone tools using the existing hot spot identification method so that different color levels can be seen at the time of inspection by showing brighter colors with different temperature levels.



Picture 3. Hot Spot Findings



Picture 4. Visual Findings and Hotspot Locations



Picture 5. Good Material Findings

Picture 6. Visual Findings and Good Material Location

In the comparison image above as an example of data, it can be identified that the insulator material on the distribution network system can be identified as an anomaly and experience a high temperature difference from the visual results also shows that the existing breakdown material is caused by flashover on the material. The temperature at which it was fired showed a high temperature above 70 degrees. Therefore, this hot spot identification method is used to find the potential for temporary or permanent disruptions caused by material breakdowns in the distribution network system. (Hamdani 2019)

Taking Identification of hot spots is carried out during the day due to the load on the existing tissue during the day (pond and office areas). The results of the data collection and processing that have been carried out at the sick feeder are obtained several results for several feeders, including:

Yes	**Feeder**	**Hot Spot Identification**		**Achievements**
		Already	**Not yet**	
1	Donggo	√		100%
2	Scarlet	√		100%
3	Madapangga	√		100%
4	Karumbu	√		100%
5	Stopped	√		100%
6	Lambitu	√		100%

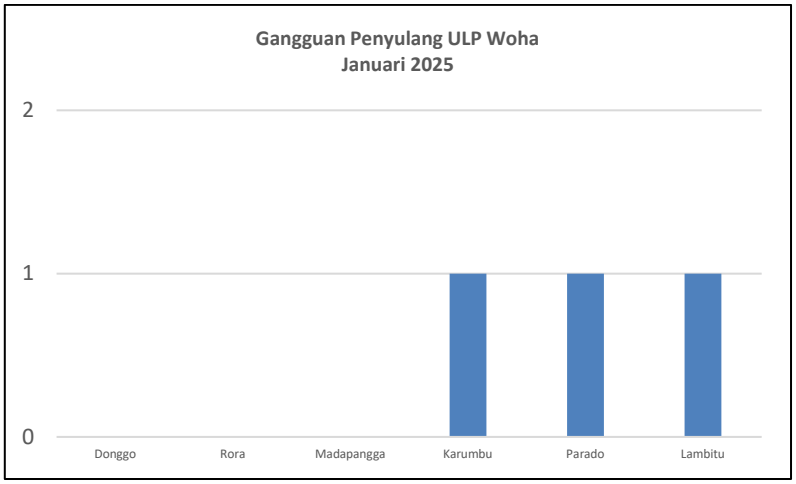
Table 5. Identification Achievements

From the results of inspections with the hot spot identification method that have been carried out and network maintenance has been carried out on the findings of potential disturbances and causes of disturbances, the results of the reduction of disturbances in January 2025 will be obtained.

The following are the results of the achievement of disruptions at ULP Woha in January 2025 based on the results of the identification of hot spots and maintenance has been carried out on network lines that have been inspected with this method. The management of inspection results is carried out as soon as possible to ensure that the identified related materials do not increase and become valid results to evaluate the results on the reduction of disturbances in January 2025.

Feeder	**January**	**Follow-up**
Donggo	0	100%
Scarlet	0	100%
Madapangga	0	100%
Karumbu	1	100%
Stopped	1	100%
Lambitu	1	100%
Sum	3	100%

Table 6. Follow-up of Feeder Disruption

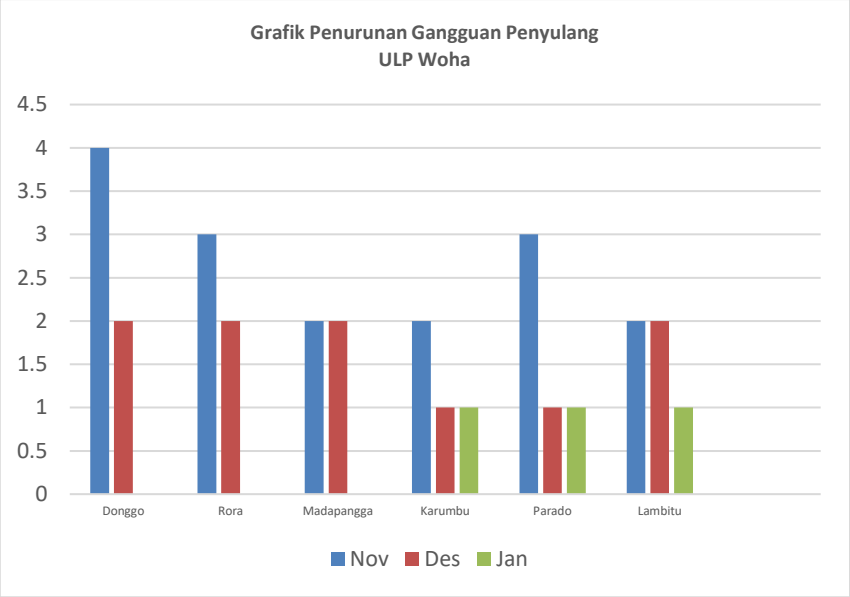


Picture 7. January 2025 Achievement Chart

The results of mapping the disturbance and identifying hot spots in the material in each feeder, obtained the results of the sampling from November and December to January experienced a significant decrease, this was based on the absence of explosion findings and other material breakdown findings in the same network path. Then a decrease table and comparison chart are obtained as follows:

Feeder	**Nov**	**Des**	**Jan**
Donggo	4	2	0
Scarlet	3	2	0
Madapangga	2	2	0
Karumbu	2	1	1
Stopped	3	1	1
Lambitu	2	2	1
Sum	16	10	3

Table 7. Disruption Reduction Achievement



Picture 8. Woha ULP Feeder Disruption Decline Chart

From the graph above, it can be seen that the reduction in feeder noise can be maximized by using hot spot identification and get quite optimal results in terms of noise reduction. From the previous one to dozens of delays to three interruptions in one month in January.

Moon	SAIDI	SAIFI
January	0,44	1,02

Table 8. SAIDI SAIFI January 2025

The calculation of SAIDI and SAIFI was carried out with calculation results that were in accordance with the results of PT. PLN (Persero) ULP Woha in January 2025

Moon	Deleted Customers	Total number of customers
January	7.691	109.720

Table 9. Customers will be deleted in January 2025

4. CONCLUSION

From the research carried out, the results were obtained, including:

1. The decrease in the number of feeder disturbances at PT. PLN (Persero) ULP Woha experienced a decrease from November to January with network maintenance using the method of identifying hot spots in the materials in the ULP Woha distribution network system.
2. A significant decrease occurred in January due to the large number of material replacements that have been broken.
3. Significant changes in the achievement of SAIDI and SAIFI numbers are due to the reliability of the feeder that is getting better and not affected by the outage due to disturbances.

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