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A RELIABILITY IMPROVEMENT OF MANAGEMENT DISTRIBUTION SYSTEM

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ABSTRACT

The problem of load imbalance in the power distribution network system always occurs, and the cause of the imbalance is in the arrangement of single-phase loads on low-voltage network customers. As a result of the load imbalance, a current appears in the transformer neutral. Where the current flowing in the neutral of this transformer causes losses, namely losses due to the neutral current in the neutral conductor of the transformer for the distribution of electrical energy in the distribution system where voltage losses will affect the distribution of electrical energy to consumers where if there is a voltage loss in the distribution system, the electrical energy that will be distributed to consumers will be non-standard again in accordance with SPLN no. 72 of 1987, the analysis in writing this paper is to cover the extent of the voltage drop in the Palu City Rayon area, considering that the spread is an old extension. based on annual data from 2019 to 2021.

1. INTRODUCTION

In the industrial era 4.0, electrical energy technology is a basic human need that continues to increase in line with the level of life. The large demand for electrical energy requires finding various alternative electrical energy to meet these energy needs for living needs.

Where the need for electricity in Indonesia continues to increase in accordance with the rate of economic and industrial growth and population growth. Electricity is the most useful and appropriate form of energy for modern human life as it is today, where electrical energy has a fudamental function that can provide a need and electrical power services that are needed by consumers. By increasing the need for electrical energy that is actually supported by the quality of its distribution to customers, namely technical services that are able to provide the flow of electrical energy.

To get a good power quality value can be said if the voltage of a power has a constant power with the aim of reducing power losses at the end of the channel. One very important aspect in the distribution of electrical energy is system reliability. System reliability is the ability of a system (electricity distribution system) to perform work based on its function during a certain period of time. The reliability of a distribution network system can be judged by the number of disturbances that occur and the amount of time it takes to repair the disturbance.

To determine the reliability of a repeater, a reliability index is determined, which is a quantity to compare the appearance of a distribution system. Reliability indices that are often used in a distribution are SAIFI (System Average Interruption Frequency Index) which occurs every year, the length of outages or SAIDI (System Average Interruption Duration Index), CAIDI (Customer Average Interruption Frequency Index), ASAI (Average Service Availability) and ASUI (Average Service Unavailability) informs about the average outage frequency for each consumer within a year.

The object of research on the evaluation of the calculation of the level of reliability in the Medium Voltage Network (JTM) is carried out in the Repeater to determine whether the Customer Service Unit (ULP) has provided satisfactory service to consumers. This research was conducted in the Imbon repeater because when I lived in the area around Imbon there were frequent disturbances, so that's why I researched the evaluation of the reliability of the medium voltage network in the East Medan repeater.

2. LITERATURE REVIEW

System.

Distribution System is part of the electric power system. This distribution system is useful for distributing electricity from a large power source (Bulk Power Source) to consumers. So the function of electric power distribution is; 1) division or distribution of electric power to several places (customers), and 2) is a sub-system of electric power that is directly related to the customer, because the power supply at load centers (customers) is served directly through the distribution network.

Along with the increasing number of consumers PLN, a method or way that is effective and efficient by using modern technology for measur in energy used by these consumers. In addition, the method used is expected to obtain energy measurement results that are accurate and can reduce the number of shrinkage / losses, where the losses very influential on the performance of PLN. Losses or better known as shrinkage is a parameter that must always be PT PLN (Persero) must always pay attention to, because parameter that shows how efficiency of a system. The greater the the shrinkage value, the smaller the system efficiency of the system. Therefore, it is necessary to make various efforts to reduce the shrinkage value, in order to achieve good efficiency in the power system, in order to fulfill customer satisfaction customers and secure the revenue of PT. PLN (Persero)'s revenue which is seized due to shrinkage. Director General of Electricity has determined PLN distribution shrinkage target, which is 6%. But currently PLN has not been able to achieve the target, where the distribution shrinkage in 2013 still amounted to 8.52%. This of course of course, can affect the value of PLN's performance among SOEs.

Primary Distribution System Network

The primary distribution system is used to distribute electricity from distribution substations to load centers. This system can use air ducts, air cables, or ground cables according to the desired level of reliability and environmental conditions and situations. This distribution channel is stretched along the area that will be supplied with electricity to the load center.There are various forms of primary distribution network circuits including.Radial NetworkIf between the source point and the load point there is only one channel (line), there is no other alternative channel. This form of network is the basic, simplest and most widely used form.

It is called radial because this channel is drawn radially from a point which is the source of the network, and is branched to the load points served.Loop NetworkWhen at the load point there are two alternative channels originating from more than one source. This network is a closed form, also called a "loop" network form. The arrangement of the repeater circuit forms a ring, which allows the load point to be served from two directions of the repeater, so that the continuity of service is more guaranteed, and the power quality is better, because the voltage loss and power loss on the line become smaller.NET NetworkNet Distribution Network (NET) Is a combination of several mesh channels, where there is more than one source so that it is in the form of an interconnection channel.

This network is in the form of a net, a combination of radial and loop.Spindle NetworkThis network is a combined primary distribution network of radial structures whose ends can be put together at substations and there are express feeders. This express feeder must always be in a state of voltage, and ready continuously to ensure the operation of the system in delivering electrical energy to the load in the event of a disturbance or maintenance. Under normal circumstances this type operates radially.

Factors Affecting Distribution.

Distribution of electrical power from the generator to the consumer through a long distribution system, there are parameters that affect the amount of electricity received. External influencesExternal influences are environmental influences that often result in disturbances in the system that cause power outages, decreased voltage levels, and voltage swings caused by natural factors such as wind, earthquakes, storms and volcanic eruptions. While the influence of animals and humans occurs destruction of nature such as felling trees near the electric jarring. Internal InfluenceInternal influence is the influence experienced by medium voltage power lines as a result of the conditions of electric power distribution. internal influence can cause changes in electricity sent from the generation center to power consumers. So that to improve it needs to be compensated with distribution auxiliary equipment.

The influence of internal influences in question is resistance, inductance, and capacitance Resistance Conductor resistance has a dominant effect on medium voltage overhead lines 20 [kV], which is caused by the resistance possessed by the conductor material. In certain conductors, the resistance is good, so that if used as a conductor material it will be very good, because the losses due to the small conductor but to be used as a conductor of the electric net requires a lot of material so it is not

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economical, as an alternative, aluminum and copper conductors are used in direct comparison with the length of the line, the longer the line, the greater the influence that is not compensated for by other equipment except by replacing the type and cross section of the conductor.InductanceThe effect of inductance on the length of the electric power ring is a result of the conductor being given electricity so that there is mutual influence between the conductors themselves.

If the conductor is electrified, then the amount of voltage generated is a result of changes in the magnetic flux that occurs. The inductance generated by the conductor is the amount of flux that arises (flux coupled) per unit in the conductor.CapacitanceThe effect of capacitance on power lines can be defined as the charge between two conductors per unit potential difference. The effect of capacitance between two conductors with neutral (earth) for a long channel distance greatly affects the amount of change in electric power so that it can be compensated by performing the transposition method.

Voltage Drop Calculation.

The calculation of voltage drop in the distribution net is the difference between the voltage of the sending end and the voltage at the receiving end. Voltage drop occurs due to the influence of resistance and reactance of the line, the phase angle difference between current and voltage and the magnitude of the load current, the voltage drop on the alternating line depends on the impedance, load, and distance. An alternating current system, the amount of voltage drop can be calculated based on Figure 3 of the secondary distribution net voltage phasor diagram.

The maximum voltage drop at full load, which is allowed at several points on the distribution net (SPLN 72.1987) SUTM = 5% of the working voltage for radial systems, distribution transformers = 3% of the working voltage, low voltage lines = 4% of the working voltage depending on the load density, house connections = 1% of the nominal voltage.Figure 3.Fasor Diagram (source.Zuhal, 1998. Basic Electric Power Engineering and Power Electronics).

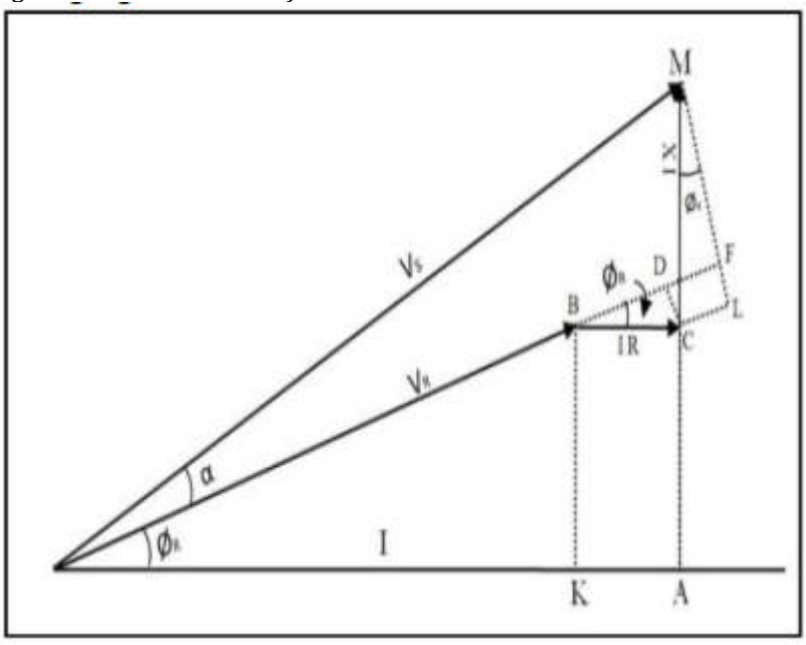

Figure 1. Diagram Fasor

AMR DATA UTILIZATION

In the AMR system, it is possible to know historical energy usage of consumers or what is called a load profile. Load profile for TM & TT customers will be recorded per 15 minutes, while for TR customers customers (41.5 - 197 kVA) per 30 minutes. From the data load profile data can be known some indications of abnormalities or violations, for example:

a. Indication of customer usage exceeds contract power based on KVA max data which indicates a violation or abnormality on the the limiting side.
b. Indication of CT and or PT saturation so that the ratio is no longer in accordance 100% with nameplate based on current and voltage data below below average

c. Indications of violations or abnormalities in side of the wiring meter, CT or PT based on zero current and voltage data In addition to the load profile, the Phasor Diagram shows the usage condition of electrical energy as measured by the AMR METER. In use, the meter AMR meters do not always show the S, R, or T phase meters correctly. A number of AMR vector needle conditions that were not appropriate were found.

3. METHOD

The type of research used in this research is a case study of the Electricity System in North Sumatra, where in the research to be studied is the east field Medium Voltage network protection system using the Electrical Transient Analyzer Program. This research data is primary data obtained from the east field of North Sumatra, especially data that has to do with research in the form of the following data:

1. Electrical system network data
2. Electrical equipment data
3. Electrical network connection data
4.Data on generating units, transformers, line lengths and loads from PLN east field.

In the AMR system, historical energy usage at the consumer or what called load profile. Load profile for customers TM & TT customers will be recorded per 15 minutes, while for TR customers (41.5 - 197 kVA) per 30 minutes. for TR customers (41.5 - 197 kVA) per 30 minutes. From the load profile data, it can be known some indications of abnormalities or violations, for example:

a. Indication of customer usage exceeding the power contract based on KVA max data which data indicates a violation or abnormalities on the limiting side.
b. Indication of CT and or PT saturation so that ratio is no longer 100% in accordance with nameplate based on current and voltage below the average.
b. Indications of violations or abnormalities on the wiring meter, CT or PT based on zero current and voltage data. In addition to the load profile, the Phasor Diagram shows the condition of electrical energy consumption measured by the AMR meter. In use, AMR meters do not always show the meter needle of Phase S, R, or T correctly. A number of vector needle conditions AMR meters were found.

4. RESULT AND DISCUSSION

Simulation planning carried out in ETAP 12.6 software, namely using the Protective Device Coordination simulation option. The main purpose of this research is to analyze the settings of protection devices on the Non Priority network, with a disturbance in the Non Priority Medium Voltage network of Kualanmu Airport. The scenario is done, by giving a short circuit fault at a certain point which results in disconnection of the load due to the operation of the relay and the sequence or coordination of the relay that will work. The things that will be observed in this study are:

a. Protection time settings
b. The sequence of relays that work

In PLN standards, the characteristic curve for overcurrent relays commonly used is the inverse time characteristic (standard / normal inverse).

Table 1. Inverse Relay Characteristics

	A	β	T10
Standard Invers (N)	0.02	0.14	3.0
Very Invers (V)	1.0	13.5	1.5
Extremely Invers (E)	2.0	80.0	0.8

Here are some scenario variations that will be carried out in this study:

A. For the Right Side Non Priority Open Ring Network system (RSaNPSST9 to PLN2KNG)
   a. Simulation of Star- Protective Device Coordination with a 3-phase fault on the cable between RSb8NP and RSa9NP
   b. Simulation of Star- Protective Device Coordination with a 3-phase fault at the 20 KV SST switchgear busbar RSb14NP

B. For Left Side Non Priority Open Ring Network system (RSaNPSST8 to PLN1KNA)
   a. Simulation of Star- Protective Device Coordination with a 3-phase fault on the cable between RSa8NP and RSb10NP

b. Simulation of Star- Protective Device Coordination with a 3-phase fault on the 20 KV SST switchgear busbar RSb17NP

Based on the simulation of Star-Protective Device Coordination with a 3-phase fault in the east field, the results of the Star-Protective Device Coordination simulation on the Kualanamu International Airport medium voltage network protection system time grading tends to be the same. In the graph of the relay results that work / trip based on time and fault current is very thin after a disturbance has an impact on load shedding which is almost the same. So based on this research, it can be concluded that the setting of the protection relay of the eastern field Medium Voltage power network has not been set properly from the time grading and setting of the fault current value in terms of fault analysis.

5. CONCLUSION.

For 3-phase disturbances that occur on buses and cables located in non-priority networks, have a very short time interval and tend to be the same after a disturbance. The impact of 3-phase disturbances that occur on buses and cables results in blackouts in areas or parts of equipment that have not been minimized.

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