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Recloser Placement on Distribution System Reliability at PT. PLN (Persero) City of Subulussalam Aceh

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ABSTRACT

Security of the electric power distribution system is one element of service fulfillment. The automatic return breaker or recloser is one of the 20 kV Medium Voltage Air Line safety equipment which functions to anticipate momentary disturbances so that power outages can be anticipated, the current use of electricity has expanded to almost all regions. The 20 kV distribution network often experiences disturbances both externally and internally. External disturbances are in the form of surges caused by lightning, tree branches or twigs that are exposed to the transmission line, while internal disturbances are caused by circuit breakers due to the opening and closing of circuit breakers. Interference can be temporary or permanent. Temporary interference will disappear by itself, while permanent interference requires the operator to neutralize the interference. Based on the results of the analysis of recloser placement in the distribution channel at PT. PLN (Persero) Subulussalan PK Calendar can be calculated in comparison using SAIDI, SAIFI, and FITNES. The results obtained after calculating the placement of the recloser in the front transformer position of the Koramil Sp Left with SAIDI values (0.287), and SAIFI (0.000517) and FITNES values (746268.657).

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1. INTRODUCTION

The distribution network is a channel or network that connects large power sources (substations) with consumers or electricity users, be they factories, industries or households. This distribution system is useful for distributing electricity from large power sources (bulk power sources) to consumers. Therefore, the distribution system is always required to have good reliability. This level of reliability is affected by the disturbance that occurs. This disturbance is usually caused by natural conditions and animals around the lines that distribute electrical energy. The more often a distribution network is disrupted, the continuity of the distribution of electrical energy will also get worse. To overcome this required protection equipment that can overcome interference. No matter how well the distribution channel is installed, it always requires protection devices, including a recloser that coordinates to secure the network. Recloser is a protection equipment that serves to minimize the area affected by disturbance. The placement of the recloser in the distribution network greatly affects the level of reliability so that an optimization is needed so that the maximum level of reliability is obtained. The purpose of securing the electric power system is to ensure the distribution of electric power, meaning that if there is a disturbance (for example a disturbance in the distribution system that frequently occurs) it should not cause a power outage, or if it is forced, the disconnection is kept as short as possible. In writing the thesis, the writer uses the calculation of the recloser placement index by using

details of the disturbances experienced by consumers which are collected from annual data. The data is calculated using the SAIDI, SAIFI, and FITNES equation formulas. Optimization is a process to achieve ideal results (effective value that can be achieved).

Optimization can also be interpreted as a form of optimizing something that already exists, or designing and making something optimally. The equipment whose job is to give orders to cut or connect the power automatically is the Automatic Reverse Breaker (PBO) or recloser. With the addition of a reverse relay, temporary disturbances do not result in a complete power cut, or only a power cut occurs in a very short time (a few seconds). A recloser is a protection device that functions to minimize the area affected by a disturbance.

The placement of the recloser in the distribution network greatly affects the level of reliability so that an optimization is needed so that the maximum level of reliability is obtained. Power outages that are too frequent with long outages and unstable power supply are a reflection of poor electricity quality, the consequences of which can be felt directly by customers.

Reliable electric power systems and electrical energy with good quality or meet standards, have a very important contribution to the life of modern society because of their dominant role in industry, telecommunications, information technology, mining, public transportation, and others, all of which can be operate due to the availability of electrical energy. Companies engaged in various fields as mentioned above, will experience substantial losses if there is a sudden power outage or an unstable electric voltage, where their activities will stop or the products they produce will be damaged.

2. METHOD

In this study, data collection was carried out at PT. PLN (Persero) Subulussalam City District, Aceh. Research on Recloser Placement Analysis was conducted for 14 days. The research data obtained in writing thesis Optimization of Recloser Placement Against Reliability in the Distribution System at PT.PLN (Persero) Subulussalam, Aceh is in the following table. The research data at the network substations for each transformer.

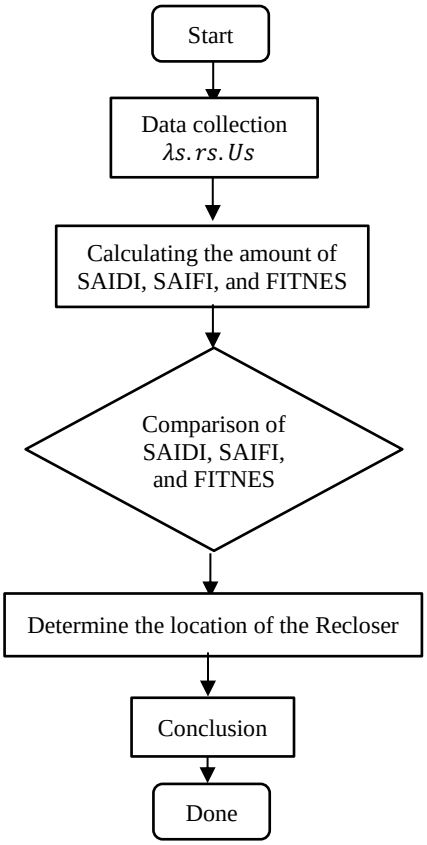

Figure 1. Research Flow

3. RESULTS AND DISCUSSION

SAIDI, SAIFI and FITNES calculation analysis

SAIDI, SAIFI, and FITNES calculations are performed to determine the optimal Recloser location in the distribution network. Calculations are made for each transformer in the existing distribution network at the P.K Calendar of Subulussalam City.

Table 1. Research Data on Reclosers.

No	Information	Research Data on Transformers	
		λ / Year	Ni (Consumer)
1	Mayor's Hall	0,0073	133
2	Bank Mandiri	0,026	35
3	In front of the SP. Kiri Koramil	0,009	135
4	Double O	0,01	135
5	Indosat Front Koramil	0,005	43
6	In front of R.M Azizah	0,0064	123
7	Front Yamaha	0,0075	112
8	In front of the AT TAUBAH mosque	0,0083	255
9	Front of the Police	0,0063	130
10	Sp. SKPC	0,01	72
11	In front of TVRI (Lae Clean)	0,0097	133
12	Lae Clean	0,0075	75
13	Profit	0,0093	77
14	Grand Mitra Hotel	0,0079	170
15	Clean Lae SD Intersection	0,0098	73
16	Calendar Vocational School	0,0087	71
17	Bill	0,0096	210
18	Kasman gas station	0,0078	130
19	PLN Office	0,0063	98
20	Griya Bidadari housing	0,0083	132

SAIDI, SAIFI, and FITNESS values, which will be used to determine the optimal Recloser placement point.

Table 2. Comparison of SAIDI, SAIFI, and FITNES Values

No	Sections (Positions)	SAIDI (hours/year/customer)	SAIFI (times/year/customer)	FITNESS
1	Mayor's Hall	0,283	0,00041	8620,689
2	Bank Mandiri	0,074	0,0038	35714,285
3	In front of the SP. Kiri Koramil	0,287	0,000517	746268,657
4	Double O	0,287	0,000575	6059,687
5	Indosat Front Koramil	0,091	0,0000916	119967,368
6	In front of R.M Azizah	0,262	0,000335	11393,414
7	Front Yamaha	0,238	0,000357	11769,413
8	In front of the AT TAUBAH mosque	0,543	0,000901	2043,974
9	Front of the	0,276	0,000348	1041,146

	Police			
10	Sp. SKPC	0,153	0,000306	21359,306
11	In front of TVRI (Lae Clean)	0,283	0,000549	6436,373
12	Lae Clean	0,159	0,000239	26315,096
13	Profit	0,164	0,000305	19992,003
14	Grand Mitra Hotel	0,362	0,000572	4829,424
15	Clean Lae SD Intersection	0,155	0,000304	21222,410
16	Calendar Vocational School	0,151	0,000263	25180,671
17	Bill	0,447	0,000858	2607,385
18	Kasman gas station	0,276	0,000432	8387,010
19	PLN Office	0,208	0,000263	18280,198
20	Griya Bidadari housing	0,281	0,000466	7636,735

Recloser Positioning Analysis:

In determining the placement of the recloser, it can be seen through a comparison of SAIDI, SAIFI, and FITNES from each section (position). The optimal placement of the recloser is taken from the smallest SAIDI and SAIFI values, or the largest FITNES values.

Therefore, here the author determines the location of the recloser taken from the largest FITNES, namely the position of the transformer in front of the Left Sp Koramil with FITNES values (746268.657), SAIDI (0.287), and SAIFI (0.000517)

Recloser Work When a Disruption Occurs

1. Normal state Switch S closes. If there is a ground phase disturbance, the relay will work and give a trip command to the PMT. At that time the recloser starts working (when it gets a positive voltage from the relay), the elements that start are the dead time (DT) and block time (BT) elements.
2. After some time (according to the setting) the dead time element closes its contact and gives the PMT command to enter (reclose), at the same time it energizes the block time element.
3. This block time element immediately opens the PMT closing coil circuit so that the PMT will not be able to reclose again.
4. After the block time element time has been exceeded according to the settings, the block time element will reset again. Then the recloser is ready to return to reclose the PMT if a new disturbance occurs. In general, the dead time setting is 1 second and the block time is 40 seconds.

4. CONCLUSION

Based on the analysis that has been done, it can be concluded that:

1. Optimal recloser placement at PK. Dating is done on the position of the Front Koramil Sp Left transformer with a SAIDI value (0.287), and SAIFI (0.000517) and a FITNESS value (746268.657).
2. Optimization of recloser placement by calculating SAIDI, SAIFI, and FITNESS analysis can produce some of the best solutions in the distribution network

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