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Transfer of Balak Load Break Switch Motorized (LBSM) Function to Recloser as Additional Protection at PT PLN (Persero) ULP Rogojampi

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Abstract

Background: This field work practice requires that students be able to understand electricity systems in general, including generation, transmission, distribution, and load management processes
Identification problems: Balak LBS transfer to Recloser improves delivery system reliability, efficiency, equipment life, and supply availability by enabling automatic disconnection and circuit recovery.
Methods: Repairs to the LBSM system and replacement of feeders in Balak Village are urgently needed.
Results: The results of the analysis of disturbances in the LBSM system in the 20kV SUTM distribution network are a reference for developing and improving systems in the distribution network.
Conclusions:. The Balak LBSM system in the 20kV SUTM distribution network is susceptible to disturbances due to environmental factors, impacting reliability and efficiency during outages, with automatic Recloser system reducing losses.

Keywords: load break switch motorized; medium voltage overhead lines; recloser

Introduction

This Field Work Practices (FWP) is one of the mandatory activities that PGRI Banyuwangi University students must take because this activity is one of the graduation requirements for the undergraduate program. Therefore, PGRI Banyuwangi University implements Field Work Practices for all departments, including the Department of Electrical Engineering. Field Work Practice is a program of work practice activities carried out directly in the world of work for students, with the aim that students can learn and train themselves to adapt to the world of work either in factories or educational institutions appropriate to their field [1].

PT. PLN is one of the advanced state-owned enterprises and is very focused on knowledge management, as evidenced by the awards it has received and the implementation of a knowledge management system as a concrete form of knowledge management. Indonesia's rapid economic growth requires increasing the availability and reliability of electricity supply as one of the main infrastructure pillars to encourage development. As an economic entity responsible for providing state electricity, PLN (State Electricity Company) has a strategic role in meeting these energy needs. To optimize its operations, PLN continues to strive to improve the quality of its human resources through education and training programs. One of PLN's

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initiatives is to involve students in FWP training activities in the company environment. As the nation's next generation, students play an important role in developing understanding and skills in the industrial sector and actively contributing to the development of Indonesia's energy sector [2].

Students are expected to be able to understand electricity systems in general, including generation, transmission, distribution and load management processes. FWP at PLN is an ideal forum for exploring these various aspects practically. Students will gain direct experience in facing the challenges and dynamics of the work environment in the electricity sector. This will help them prepare to enter the world of work after completing their education. PFW at PLN is not only an opportunity to observe daily operations, but also to get involved in research and development projects [3]. Students can contribute to finding innovative solutions to certain problems in the electricity sector.

By considering this background, the implementation of FWP at PLN is expected to provide double benefits, namely improving the qualifications of PLN's human resources and providing students with valuable experience to face challenges in the world of work. The author has chosen a location for implementing FWP that is in accordance with the courses to be implemented as follows; robotics, analog design and signal mixers, noise in electronic systems, digital sound processing. So the location for implementing the courses to be converted is at PT. PLN (PERSERO) ULP Rogojampi.

In operating an electricity distribution system, system reliability and security are critical factors that must be considered. Load Break Switch (LBS) is a component commonly used in electrical distribution systems to control power flow and break or connect circuits. However, apart from the need for technological development and more effective protection, there is also a need to increase LBS capabilities. Recloser can quickly detect and respond to errors in the power distribution system [4]. Compared with traditional LBS, Recloser can provide additional protection such as automatic disconnection and automatic recovery of the circuit after the problem is resolved. Therefore, the functional transfer of Balak LBS to Recloser can be considered as a first step to increase the reliability of the delivery system and optimize its protection against failures.

Identification of Problems

Compared with traditional LBS, Recloser can provide additional protection such as automatic disconnection and automatic recovery of the circuit after the problem is resolved. Therefore, the functional transfer of Balak LBS to Recloser can be considered as a first step to increase the reliability of the delivery system and optimize its protection against failures.

This change is expected to provide significant benefits in responding to electrical disturbances such as short circuits or overloads more efficiently. Apart from that, the use of Reclosers as additional protection can also extend the operational life of equipment and reduce downtime, thereby increasing the availability of electricity supply for customers. The transfer of the LBS Balak function to a Recloser reflects a commitment to improving the performance of the electricity distribution system by adopting more sophisticated and responsive protection technology.

Implementation Methodology

PT. PLN (Persero) has many problems or problems in delivering and maintaining the quality of electrical energy in a sustainable manner in Indonesia. In conditions in the field, various problems are often encountered in the implementation of distribution of electrical energy, for example one of which is interference caused by internal or external problems in the system [5]. Of these various types of disturbances, quite a few can cause power outages. One of the obstacles that arises is the presence of power losses and power losses in transmission and distribution lines, resulting in energy not being distributed to customers and of course causing harm to customers.

In order to overcome some of these problems, it is necessary to repair and change the system in the distribution network, which in this topic is Load Break Switch Motorized (LBSM) to become a Recloser system. After observing and monitoring in the field, one of the LBSMs where a disturbance occurred was at the Load Break Switch Motorized (LBSM) Balak Pendarungan feeder. Balak is the name of a village in the Songgon area, Banyuwangi Regency, East Java Province, Indonesia. Therefore, the naming of LBSM Balak became the name of one of the LBSM in Balak village [6].

Results and Discussion

Table 1. Results of the Survey on Feeder Disturbances for September - December 2023

No	Date	PMT Hours After	PMT Hours Enter	Category	Long Outage (Minutes)	Information
1	25-Sep-23	10.14	10.17	Temporer	3	Change of FCO LBS Balak
2	28-Sep-23	13.10	13.14	Temporer	4	Activities of residents cutting branches regarding SUTM in Sumberarum Village
3	2-Okt-23	14.32	14.42	Temporer	10	Fallen tree hits SUTM in Sragi Village
4	7-Okt-23	09.16	09.18	Temporer	2	Arrester Breakdown In Bayu Lor hamlet
5	10-Okt-23	10.25	10.28	Temporer	3	Maintenance of LBSM Balak
6	16-Okt-23	16.24	16.27	Temporer	3	Squirrel Animals Regarding Networks in Bangunsari village
7	24-Okt-23	15.23	15.28	Temporer	5	Activities of building material (BAMBU) residents regarding networks in Parangharjo village

Basically, disturbances that often occur in the 20 kV line distribution system can be classified into two types, namely disturbances from within the system and disturbances from outside the system. Disturbances originating from outside the system are caused by leaves/trees touching the conductor, lightning strikes, humans, animals, weather and so on. Meanwhile, disturbances that come from within the system can be in the form of failure of network equipment functions, damage to network equipment, damage to load breaker equipment, and errors in detection equipment.

After updating the system from LBSM to Recloser, to find out the Recloser simulation system in ETAP, it is set as in Figure 1. The condition before installing the Recloser on the darungan feeder used 48 Buses in the ETAP simulation (LBSM Balak) because the system design system in the ETAP 19 application will automatically appear Buses when a tool or system is connected to another system, resulting in an LBSM simulation system design in Figure 2. After completing the LBSM Balak circuit in ETAP 19, the system which was originally an LBS was changed to a Recloser system to find out the comparison that would occur in the two systems, so that we could see the advantages of the Recloser system which reduces obstacles and disturbances in the LBSM system, the circuit after the Recloser was installed on figure 3.

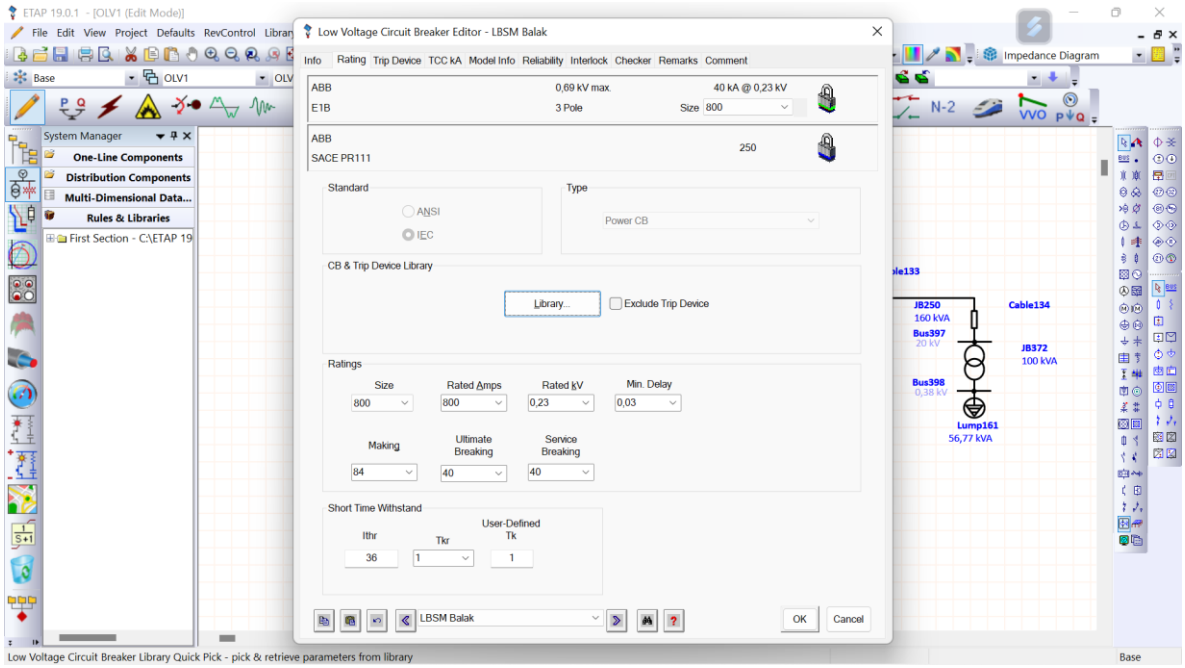

Figure 1. Recloser settings in ETAP 19

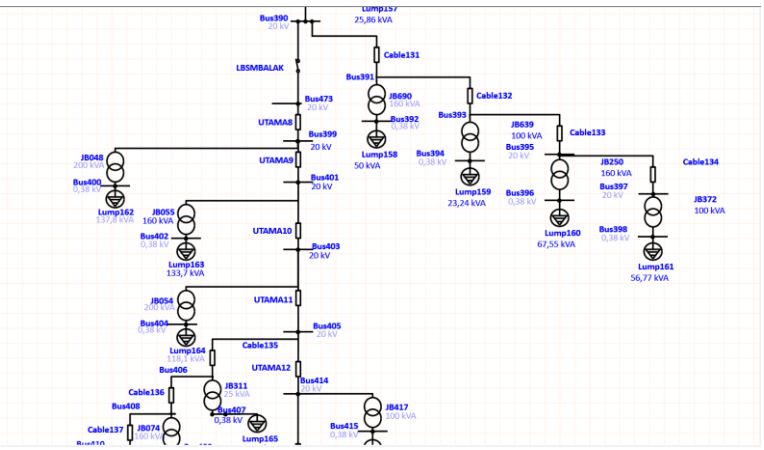

Figure 2. Condition of LBSM before the Recloser system was installed

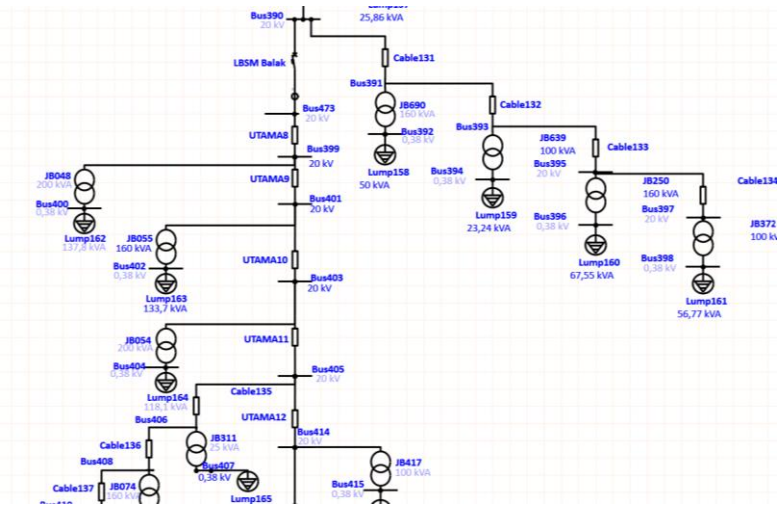

Figure 3. LBSM system circuit after being converted into a Recloser

Based on the test results of the Recloser System on the Medium Voltage Air Line (SUTM) feeder, as for the test results of the Balak LBSM system before being converted into a Recloser, the difference in power losses on the LBSM system is greater so that from a percentage of 100% at the Main Substation (GI) to 85.43 % on the transformer and initial load on the Balak LBSM system, the power loss on the Balak LBSM system from the Main Substation (GI) is 14.57%, test results in Figure 4. After seeing the test results of the Balak LBSM System on the Medium Voltage Air Line (MVAL) feeder, as for the test results of the Balak LBSM system

which has been converted into a Recloser system, the difference in power losses on the Recloser system is smaller so that from a percentage of 100% at the Main Substation to 85, 63% on the transformer and initial load on the Balak LBSM system, then the power loss on the Balak LBSM system from the main substation is 14.37%, test results in Figure 5.

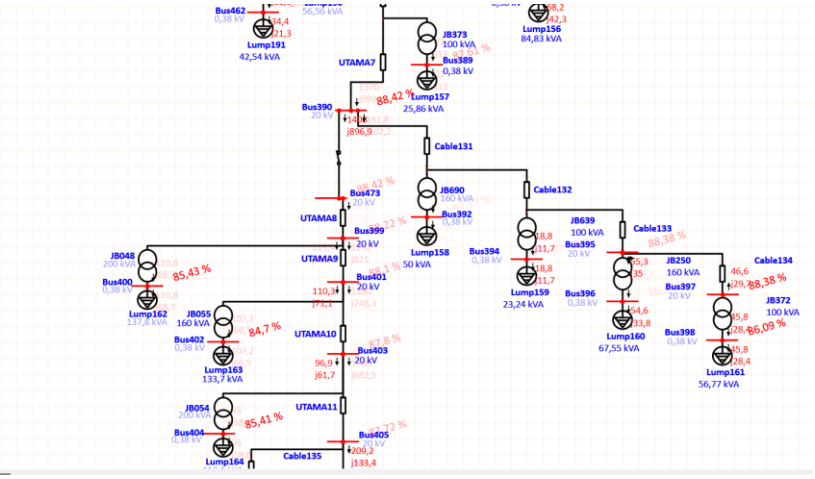

Figure 4. Test results using the LBSM system

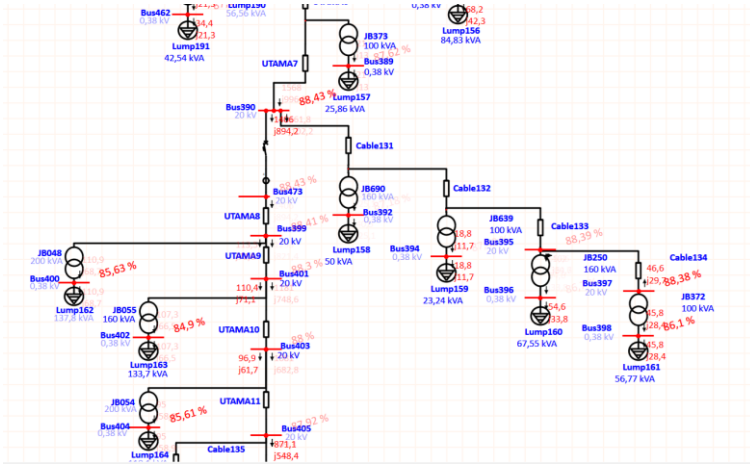

Figure 5 Recloser Installation test results

After looking at the system test results before and after using the Recloser system, you can see the difference between the test results and the results of the Recloser system being more effective in reducing one of the problems with the LBSM system, namely power losses in the load and transformer, even though it is only a difference of 0.20%, but the system has reduced the problem at one of the SUTM points in the pendarungan feeder.

Table 2. Transformer data and test results after and before using the Recloser in the LBSM Balak Feeder Pendarungan area

Transformer Number	Bus Number	Information	Condition	
			Before (LBSM)	After (Recloser)
JB048	399	Power	85.43%	85.63%
	400	Burden	137, 8 kVA	137, 8 kVA
JB055	401	Power	84,7%	84,9%
	402	Burden	133,7 kVA	133,7 kVA
JB054	403	Power	85,41%	85,61%
	404	Burden	118,1 kVA	118,1 kVA
JB311	405	Power	85,30%	85,45%
	407	Burden	15,16 kVA	15,16 kVA
JB074	406	Power	85,03%	85,18%
	409	Burden	106,9 kVA	106,9 kVA

Conclusion

The results of the analysis of disturbances in the LBSM system in the 20kV medium voltage overhead lines distribution network are a reference for developing and improving systems in the distribution network. With 5 disturbances to the Pendarungan feeder in November-December 2023, it is necessary to identify areas of disturbance by looking at old records of permanent disturbances in a Motorized Load Break Switch (LBSM) system and it is known from the identification results that the Balak LBSM is prone to experiencing disturbances due to Several factors include frequent environmental disturbances. Apart from that, the difference between the manual LBSM system and the automatic Recloser system greatly affects system reliability and time efficiency when an outage or maneuver occurs, so an automatic system is needed to be able to restore medium voltage overhead lines performance after a disruption occurs on a particular network. In the ETAP 19 simulation, the test results show differences in power and voltage delivered from the substation to the transformer, this results in losses for PLN because it is susceptible to power losses of up to 15%. So the use of the Recloser system is considered quite good and its automatic performance can reduce power losses and power losses that occur in the darungan feeder.

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