Self-Healing Mechanism Berbasis Fault Management Untuk Pengembangan Smart Grid Pada Jaringan Spindle 20kV Guna Peningkatan Kehandalan Sistem Distribusi di PLN UID Jakarta = Self-Healing Mechanism Based on Fault Management for Smart Grid Development on 20kV Spindle Networks to Improve Distribution System Reliability at PLN UID Jakarta

Lugito Nurwahono, author

Abstrak

Jakarta barometer mutu dan kehandalan listrik nasional sehingga perlu ditingkatkan customer experience menuju World Class Services, khususnya kawasan dengan revenue tinggi dan VIP. Kondisi saat ini penyebab dominan gangguan distribusi adalah Saluran Kabel Tegangan Menengah dan Jointing, sehinga diperlukan skenario evakuasi beban untuk pemenuhan contingency N-1 dalam rangka percepatan manuver pada saat terjadi gangguan. Sesuai roadmap service excellent PLN UID Jakarta target System Average Interruption Duration Indeks (SAIDI) di tahun 2033 sebesar 10,94 menit/pelanggan, dan realisasi di tahun 2023 sebesar 29,86 menit/pelanggan sehingga diperlukan strategi peningkatan kehandalan sistem distribusi. Tujuan dari penelitian ini untuk membuat studi kelayakan pengembangan smart grid dengan implementasi otomatisasi jaringan di sistem spindle untuk peningkatan kehandalan, revenue dan customer experience di kawasan prioritas PLN UID Jakarta. Penambahan Gardu Induk baru sesuai RUPTL akan berdampak adanya perubahan rekonfigurasi dan penambahan jaringan baru dalam rangka pembebanan penyulang dan menyebabkan topologi jaringan distribusi semakin kompleks tidak murni sistem spindle, di samping itu kondisi Jakarta yang macet juga berdampak semakin lama dalam pengusutan gangguan, serta keterbatasan anggaran investasi PLN belum mendukung pemasangan titik Keypoint baru di semua gardu distribusi. Penelitian ini dilakukan dengan pemodelan sistem di Distribution Management System SCADA untuk contingency N-1 dan dilakukan simulasi pengujian Self-Healing Mechanism berdasarkan parameter data statik dan dinamis secara realtime sesuai Load Flow dan Forecast beban di sistem SCADA. Selanjutnya dilakukan evaluasi kelayakan teknis dan finansial untuk dijadikan desain smart feeder yang akan diimplementasikan di sistem spindle PLN UID Jakarta dengan biaya investasi yang lebih ekonomis. Dengan melakukan Studi Kelayakan Pengembangan Distribution Automation System dengan Implementasi Fault Management fungsi Fault Location, Isolation and System Restoration (FLISR) diharapkan menjadi desain Distribution Grid Management yang layak diimplementasikan di sistem Spindle 20kV sebagai alternatif Zero Down Time untuk percepatan recovery time gangguan distribusi dan memperbaiki kinerja kehandalan dalam pengendalian operasi sistem distribusi di PLN UID Jakarta.

.....Jakarta is a barometer of the quality and reliability of national electricity, so it is necessary to improve the customer experience towards World Class Services, especially areas with high revenue and VIP. Currently, the dominant causes of distribution disturbances are Medium Voltage Cable Channels and Jointing, so a load evacuation scenario is needed to fulfill the N-1 contingency in order to accelerate maneuvers in the event of a disturbance. According to PLN UID Jakarta's service excellent roadmap, the target is the System Average Interruption Duration Index (SAIDI) in 2033 of 10.94 minutes/customer, and the realization in 2023 is 29.86 minutes/customer, so a strategy is needed to increase the reliability of the

distribution system. The purpose of this research is to make a feasibility study on the development of a smart grid by implementing network automation in the spindle system to increase reliability, revenue and customer experience in the priority areas of PLN UID Jakarta. The addition of a new main substation in accordance with the RUPTL will result in reconfiguration changes and the addition of new networks in order to load feeders and cause the distribution network topology to become more complex and not purely a spindle system, in addition to the congested conditions in Jakarta which also have an impact on the longer time it takes to investigate disturbances, as well as limited investment budgets. PLN does not yet support the installation of new Keypoint points at all distribution substations. This research was conducted by system modeling in the SCADA Distribution Management System for contingency N-1 and carried out a Self-Healing Mechanism test simulation based on static and dynamic data parameters in real time according to Load Flow and Load Forecast in the SCADA system. Furthermore, an evaluation of technical and financial feasibility is carried out to be used as a smart feeder design that will be implemented in the PLN UID Jakarta spindle system with a more economical investment cost. By conducting a Feasibility Study on the Development of a Distribution Automation System with Fault Management Implementation of the Fault Location, Isolation and System Restoration (FLISR) function, it is hoped that a Distribution Grid Management design that is feasible to implement in the 20kV Spindle system as an alternative to Zero Down Time to accelerate distribution disruption recovery time and improve performance reliability in controlling the operation of the distribution system at PLN UID Jakarta.