ABSTRAK

ANALISIS ARUS HUBUNG SINGKAT PADA SISTEM PEMBANGKIT LISTRIK TENAGA SURYA (PLTS) INSTITUT TEKNOLOGI SUMATERA (ITERA) DENGAN MENGGUNAKAN APLIKASI ETAP

Oleh

SULISTIAWATI

Sistem Pembangkit Listrik Tenaga Surya (PLTS) di Institut Teknologi Sumatera (Itera) berkapasitas 1 MWp merupakan sistem terhubung ke jaringan (*grid-connected*) yang berfungsi mendukung kebutuhan listrik di lingkungan kampus sekaligus menunjang kegiatan penelitian di bidang energi terbarukan. Penelitian ini bertujuan untuk mengetahui besarnya arus hubung singkat yang terjadi pada sistem kelistrikan PLTS Itera, mengevaluasi pengaruh impedansi terhadap arus pada titik-titik kritis, serta menilai kinerja *circuit breaker* (CB) dalam merespons gangguan menggunakan *software* ETAP versi 19.0.1. Simulasi dilakukan pada tiga titik utama, yaitu Bus1 (20 kV), Bus2 (0.4 kV), dan Bus3 (0.4 kV), dengan berbagai skenario gangguan: satu fasa, dua fasa, dua fasa ke tanah, dan tiga fasa. Hasil simulasi menunjukkan bahwa nilai impedansi yang rendah (0,011 ohm) pada Bus2 menyebabkan arus hubung singkat tertinggi sebesar 25,742 kA. Sesuai dengan teori hukum Ohm dan teori impedansi, yang menyatakan bahwa arus meningkat saat impedansi rendah. Dikonfirmasi juga bahwa sebagian besar CB efektif, tetapi arus puncaknya (31,014 kA) hampir mencapai kapasitas maksimum (65 kA) di Bus3 sehingga CB11 berisiko. Insiden nyata yang terjadi pada 7 Agustus 2024 berupa gangguan dua fasa akibat kerusakan isolasi turut menguatkan hasil simulasi ini. Sebagaimana telah dijelaskan dalam teori sistem proteksi, penelitian ini menunjukkan bahwa perangkat lunak ETAP sangat baik untuk menemukan titik rawan dan merancang pengaturan proteksi yang andal untuk sistem PLTS

Kata kunci: Arus hubung singkat, *Circuit breaker*, ETAP, Impedansi.

ABSTRACT

ANALYSIS OF SHORT CIRCUIT CURRENTS IN THE SOLAR POWER GENERATION SYSTEM (PLTS) OF THE SUMATERA INSTITUTE OF TECHNOLOGY (ITERA) USING THE ETAP APPLICATION

By

SULISTIAWATI

The photovoltaic power system at Sumatera Institute of Technology (Itera) has a capacity of 1 MWp. This system is connected to the electrical grid, thereby providing electricity to the campus and facilitating research in the field of renewable energy. The objective of this study is to ascertain the magnitude of the short-circuit current that occurs within the PLTS Itera electrical system. The study will also encompass the evaluation of the impact of impedance on current flow at specific points, in addition to the assessment of the performance of the circuit breaker (CB) in response to these conditions. The software utilized for this analysis is ETAP version 19.0.1. The simulation was conducted at three primary locations: Bus1 (20 kV), Bus2 (0,4 kV), and Bus3 (0,4 kV). The simulation encompassed a range of scenarios, including one-phase, two-phase, two-phase to ground, and three-phase configurations. The results of the simulation indicate that a low impedance of 0,011 ohms at Bus2 leads to a maximum short-circuit current of 25,742 kA. In accordance with the established principles of Ohm's law and the theory of impedance, it is evident that an increase in current flow is concomitant with a decrease in impedance. It is imperative to ascertain the efficacy of CBs, as a substantial proportion of CBs are found to be effective. However, the primary concern lies in the maximum capacity of CBs, which is estimated at 65 kA. This observation, coupled with the findings that the CB11 is susceptible to risk, underscores the necessity for further investigation into the operational limitations of CBs. The incident that transpired on August 7, 2024, involved the implementation of two-phase isolation, thereby reinforcing the outcomes of the simulation. As previously outlined in the theory of system protection, the present study demonstrates that the ETAP software is highly effective in identifying vulnerable areas and designing reliable protection systems for photovoltaic (PV) power stations.

Keywords: Circuit current,ETAP, Impedance, Short circuit breaker.