

INTISARI

Penelitian ini bertujuan untuk mengimplementasikan relai *rate of change of frequency* (ROCOF) sebagai proteksi *anti-islanding* pada distributed generation (DG). Peningkatan penggunaan *distributed generation* sebagai upaya pemanfaatan *distributed energy resource* (DER) menimbulkan risiko terjadinya *unintentional islanding*, di mana EPS terisolasi dari jaringan tenaga listrik utama, tetapi tetap menerima daya dari DG lokal. Kondisi ini dapat menyebabkan masalah kualitas daya, membahayakan petugas pemeliharaan, dan merusak peralatan. Untuk memitigasi risiko tersebut, relai ROCOF diterapkan sebagai metode deteksi lokal pasif untuk mengisolasi EPS lokal dari EPS. Penelitian ini menggunakan sistem IEEE 33 bus untuk memodelkan berbagai skenario *unintentional islanding* yang disebabkan oleh *loss of mains* (LoM), menguji selektivitas relai ROCOF, dan menganalisis sensitivitasnya terhadap berbagai parameter, seperti variasi pembebanan dan variasi *inertia time constant* DG (H).

Pengaturan nilai *pickup* dan waktu tunda relai ROCOF dilakukan dengan mengamati karakteristik respons transien ROCOF sistem saat kondisi *unintentional islanding* dan studi kasus pembanding dalam rentang waktu mikro, kurang dari 2 detik. Respons transien ROCOF sistem didapat melalui simulasi stabilitas transien pada perangkat lunak ETAP 19.0.1 untuk berbagai kondisi yang didefinisikan. Hasil penelitian menunjukkan bahwa relai ROCOF secara selektif mengisolasi EPS lokal, DG dan beban lokal, dari EPS dan membentuk *island* yang stabil. Selain itu, perbedaan *inertia time constant* (H) DG dan besar beban EPS juga memengaruhi sensitivitas relai ROCOF dalam mendeteksi *unintentional islanding*. Penelitian ini menyimpulkan bahwa pengaturan relai ROCOF sebagai proteksi *anti-islanding* yang selektif dan sensitif perlu memperhatikan standar yang berlaku, karakteristik respons transien ROCOF EPS saat terjadi *unintentional islanding*, serta karakteristik relai ROCOF yang digunakan.

Kata kunci : *Distributed Generation*, Proteksi *Anti-Islanding*, *Rate of Change of Frequency*, Relai ROCOF, IEEE 33 Bus, *Loss of mains*

ABSTRACT

This study aims to implement a rate of change of frequency (ROCOF) relay as anti-islanding protection for distributed generation (DG). The increased use of distributed generation as an effort to utilize distributed energy resources (DER) poses a risk of unintentional islanding, where the EPS is isolated from the main power grid, but still receives power from local DG. This condition can cause power quality issues, endanger maintenance personnel, and damage equipment. To mitigate these risks, the ROCOF relay is applied as a passive local detection method to isolate the local EPS from the EPS. This study uses an IEEE 33 bus system to model various unintentional islanding scenarios caused by loss of mains (LoM), test the selectivity of the ROCOF relay, and analyze its sensitivity to various parameters, such as loading variation and DG inertia time constant (H) variation.

Setting the pickup value and delay time of the ROCOF relay is done by observing the ROCOF transient response characteristics of the system under unintentional islanding conditions and comparative case studies in the micro time range, less than 2 seconds. The system ROCOF transient response is obtained through transient stability simulations on ETAP 19.0.1 software for various defined conditions. The results show that the ROCOF relay selectively isolates the local EPS, DG and local load, from the EPS and forms a stable island. In addition, the differences in inertia time constant (H) of DG and load size of EPS also affect the sensitivity of ROCOF relay in detecting unintentional islanding. This study concludes that setting the ROCOF relay as a selective and sensitive anti-islanding protection needs to pay attention to the applicable standards, the characteristics of the ROCOF EPS transient response when unintentional islanding occurs, and the characteristics of the ROCOF relay used.

Keywords : Distributed Generation, Anti-Islanding Protection, Rate of Change of Frequency, ROCOF Relay, IEEE 33 Bus, Loss of mains