

## ABSTRACT

This study aims to analyze the impact of integrating grid-following inverters on the electricity system in Bali Island. The research was conducted by modeling the grid-following inverter system using software to simulate its effects on voltage stability, frequency, and continuity of the power system. In addition, a simple inverter prototype was designed to further understand the technical characteristics and limitations of grid-following inverters under existing grid conditions. This study also highlights the importance of appropriate technical standards and regulations in the implementation of grid-following inverters to avoid disturbances in the power system. The analysis includes load flow, short circuit, and transient stability studies in accordance with the 2020 Grid Code of the Ministry of Energy and Mineral Resources (KESDM), which regulates voltage deviation limits of  $\pm 5\%$  from nominal and continuous frequency ranges of 49–51 Hz.

The load flow analysis results show that bus voltage profiles range from 153.2 to 154.5 kV (about 1.021–1.030 p.u.), which is still within the grid code tolerance. In the three-phase short circuit analysis, the initial short circuit current ( $I_{k''}$ ), steady-state current ( $I_k$ ), and peak current ( $I_p$ ) did not experience significant increases, for example, at Gilimanuk Substation where  $I_{k''}$  remained at 35.59 kA and  $I_p$  at 30.61 kA. Meanwhile, in the transient analysis during Banyuwangi grid disconnection, the frequency dropped to 45.24 Hz without GFL and improved to 46.08 Hz with GFL—still outside the grid code limit but showing improved frequency response. The GFL also supplied active power up to 41.76 MW and reactive power of around  $-5$  Mvar to maintain voltage stability. The limitations of this study include software-based simulation without considering economic and harmonic aspects, while the prototype only serves as a small-scale demonstration tool. This study recommends additional technological support such as grid-forming inverters to ensure that GFL integration can fully meet the reliability and stability standards required by the grid code.

**Keywords:** Grid-following inverter, Stability, Power System, KESDM Grid Code 2020, Load Flow Analysis, Short Circuit Analysis, Transient Analysis.