

ABSTRACT

Since Nusa Penida Island have a complete resource of intermittent and non-dispatchable energy resources such solar irradiation and wind energy then maximum integration of such power plant is possible to develop. However, the stability of the grid will be considerations of grid operator. On the research, based on stability of microgrid standard, which is endorsed by the Institute of Electrical and Electronics Engineers (IEEE) Smart Grid, the stability of the grid during possible disturbance had modelling and simulated. Hence, the maximum integration of intermittent and non-dispatchable power plant in the isolated island only possible and allowable if the advanced grid controller or defense scheme is applied in the grid. The results show without any stability controller and defense scheme, the grid will be face instability condition during part of disturbance and mitigations such as adding battery energy storage system (BESS) and virtual synchronous generator (VSG) will be proposed and carried out.

This study proposed an island grid in Indonesia that is electrified by renewable energy resource (RER's), especially wind power plant (WPP) and others variable renewable energy with system backup and control that capable ones such as BESS, VSG or full-scale power converter (FSPC). System modelling and simulation carried out by DIgSILENT Power Factory 2022. In one of the studies, which used type 4 turbine technology with a research object based on the Turkish Grid Code (TGC), the results showed an increase in grid code requirements. Followed by research that discusses VSG as a wind turbine, VSG solves the problem of low inertia and finite damping some extend.

Based on the temporary hypothesis and proposed solution above, this research has a major role in the integration simulation of the solutions offered. The simulation results show that adding BESS as smoothing and integration of synchronverter will improve grid stability problems on the Nusa Penida grid, but there are some disturbances that cannot be backed up with BESS and synchronverter. However, in the scenario of the largest generator pulls disturbance, the system with the BESS smoothing backup option will be preferable by 56% compared to the system with the synchronverter backup. Therefore, the further research is required.

Keywords—Intermittent, Isolated island grid, Microgrid, Grid controller, Grid stability