

## **ABSTRACT**

*Currently on the island of Nusa Penida only electricity is supplied from the diesel electric power plant Kutampi. The plan is that in 2022 there will be an additional source of electricity that comes from PV solar energy. In addition to the two power plants already mentioned, this study will examine the option of adding wind power plant. The characteristics of renewable energy generators are intermittent and non-dispatchable, so a BESS (battery energy storage system) is also used as power smoothing and frequency control.*

*The planning for the optimal hybrid power plant in Nusa Penida aims to increase the contribution of renewable energy and reduce the COE (Cost of Electricity) lower than the existing COE of Diesel Power Plant in 2018, that is 19 cent\$/kWh. As well as testing the stability of the system frequency with the allowable range according to the Java, Madura, and Bali Grid Code, which ranges from 49.0 Hz – 51.0 Hz. The applications used to help in completing this research are HOMER and DIgSILENT. Where HOMER as an application that helps in designing and determining the optimal power plants composition in accordance with LCOE (Levelized Cost of Energy). Meanwhile, DIgSILENT is an application that helps in analyzing the stability of the system frequency.*

*This research produces the optimal hybrid power plant options that have the potential to be built in the Nusa Penida District, that is diesel electric power plant with a capacity of 11.9 MW, solar power plant with a capacity of 3.5 MW, BESS with a capacity of 3 MW, and wind power plant with a capacity of 4 MW. With the stability of the system frequency generated during wind fluctuations ranges from 49.51 Hz – 50.53 Hz and the result cost of electricity is 9.68 cent\$/kWh. Based on the research results, the optimal hybrid power plant system planning option can be applied.*

**Keywords:** *Nusa Penida, diesel electric power plant, solar power plant, wind power plant, BESS, hybrid power plant, renewable energy, optimal.*

