

S1-6 Operation of Wind turbine, Photovoltaic and Diesel engine on 20 KV Distribution System in Small Island in Indonesia

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Abstract

There are many island in Indonesia depend on diesel engine in power generation. This situation give impact to increase spends money or deficit to the Electric Company, because the price of electric energy is lower than the cost of electric energy production. Equally with effort to reduce CO₂ emission and also reduce fuel oil consumption, using renewable energy is a choice to be implemented in electricity for scattered islands in Indonesia.

In the mid year of 2006, the first wind turbine has installed in Nusa Penida island and connected to grid by 20 kV distribution line which has supplied by two diesel power station existing. Further In the end of 2007, the second wind turbine have installed and connected to grid. The diversity of renewable energy also increased in 2007, with the installation of Photovoltaic Plant 1 x 30 KWp which located near the wind turbine and connected to 20 KV system. In February 2009, the capacity Photovoltaic Plant has increase to 2 x 30 kWp.

During operation this hybrid power generation in several years, there are some problem with power system operation and control. In the day time, the system have light load relatively, meanwhile there are possibility the wind turbine have high penetration in the system. This condition has potentially make fluctuation of electric power from wind turbine give impact also fluctuation in power outputs of diesel engine which operated by manually. Improvement of stability power supply can be achieved by using load sharer which gives command to reduce or increase the power from engine automatically. This condition need replacement some equipment of the diesel engine from manually operated in to automatic operated. If the penetration of wind turbine capacity will be increased to the system, so improving the power system stability only can be achieved by using energy storage.

Meanwhile in the night or start from the evening until 10 pm, another problem is voltage condition in the systems. The requisite of reactive power is relatively high because at this time are peak load duration. In this time, the amount of diesel engine which operated are increase to give reactive power in order to keep the voltage in the range according requirement of grid code.

Until now, In Nusa Penida Island systems have not energy storage. This condition to result in performance stability of the electric power system. The performance of the power stability can be improved by limited the penetration electric power from the wind turbine. This condition would be happened especially at the strong wind condition.