Analisis Tekno-Ekonomis pada Pembangkit Listrik Tenaga Hibrida Diesel-PV-Baterai dan Hibrida Diesel-PV-Angin-Baterai di Indonesia Timur = Techno-Economic Analysis of Hybird Diesel-PV-Battery System and Hybrid Diesel-PV-Wind-Battery System in Eastern Indonesia

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Abstrak

Umumnya, daerah terpencil di Indonesia mengaplikasikan pembangkit listrik tenaga Diesel untuk menyediakan energy listrik dikarenakan mahalnya biaya grid extension. Hal yang menjadi perhatian dari penggunaan standalone generator diesel adalah fluktuasi harga bahan bakar minyak, serta gas emisi yang dihasilkan dari sisa-sisa pembakaran. Dalam upaya mengurangi penggunaan bahan bakar fosil diperlukan penggunaan energy terbarukan yang memiliki potensi untuk dikonfigurasikan secara hibrida dengan generator diesel. Studi ini akan membahas tentang analisis dari segi techno dan economic pada konfigurasi hybrid diesel PV baterai system dan hybrid diesel PV wind baterai system dengan menggunakan perangkat lunak HOMER. Jika dibandingkan dengan system generator diesel existing yang mempunyai nilai COE sebesar $0.1968/kWh, hasil optimasi dari hybrid diesel PV battery system dan hybrid diesel PV wind battery system mendapatkan penurunan cost of energy menjadi $0,1554/kWh dan $0,1555/kWh. Kemudian didapatkan hasil berupa penurunan konsumsi bahan bakar untuk kedua konfigurasi hybrid systems sebesar 53,83% dan 53,58% jika dibandingkan dengan standalone generator diesel existing. Sehingga, kedua hybrid system memiliki nilai Net Present Cost yang lebih rendah 21,04% dan 20,99% apabila dibandingkan dengan standalone diesel generator system existing. Di sisi lain, emisi CO2 yang dihasilkan kedua konfigurasi hybrid system telah mengalami penurunan dibandingkan dengan standalone diesel generator yakni sebesar 53,83% dan 53,57%.

.....Generally, remote areas in Indonesia apply diesel power plants to provide electricity due to the high cost of grid extensions. The concern of the use of standalone diesel generators is fluctuations in the price of fuel oil, as well as gas emissions resulting from the remnants of combustion. To reduce the use of fossil fuels, it is necessary to use renewable energy which has the potential to be configured hybrid with a diesel generator. This study will discuss the techno and economic analysis of two different hybrid system configurations using the HOMER software. Those hybrid systems are consisting of diesel-PV-battery system and diesel-PV-wind turbine -battery system. There is a reduction in the cost of energy (COE) as the proposed hybrid system is compared with the existing diesel generator system. The COE of the existing system is $ 0.1968 / kWh, whereas the proposed hybrid diesel-PV-battery system and the hybrid diesel-PV-wind turbine-battery system are $0.1554/kWh and $0.1555/kWh, respectively. These optimized results show a reduction in fuel consumption for both hybrid systems configuration by 53.83% and 53.58% when compared to the existing standalone diesel generators. Thus, both hybrid systems have a lower Net Present Cost value of 21.04% and 20.99% when compared to the current standalone diesel generator system. On the other hand, CO2 emissions generated by the two-hybrid system configurations have decreased compared to standalone diesel generators, which were 53.83% and 53.57%, accordingly.