

ABSTRACT

Dependence on fossil fuels such as diesel and gasoline still dominates the energy sector, including in the use of small-scale generators. However, limited resources and the environmental impact of fossil fuels demand more efficient and environmentally friendly energy solutions. Hydrogen is one potential alternative because it has high calorific value and clean combustion characteristics. The main challenge in its implementation is how to improve combustion system efficiency without increasing the complexity of the generator system itself.

This research offers a solution in the form of integrating an HHO gas production system (a mixture of hydrogen and oxygen) into a fossil fuel-powered generator system. HHO gas is produced through direct water electrolysis without storage and is fed into the combustion chamber to improve combustion efficiency. The system is designed to be energy-efficient and practical, with the electrolysis reactor directly powered by the generator's output. Testing was conducted using three types of fuel (diesel, Pertalite, and Pertamina) to evaluate changes in system efficiency after the addition of HHO gas.

The test results show that the efficiency of the generator system increased for all fuels after the addition of HHO gas. The efficiency of diesel fuel increased from 20.50% to 23.40%, Pertamina from 8.56% to 10.72%, and Pertalite from 10.37% to 12.69%. Diesel fuel remains the most efficient fuel due to the characteristics of diesel engines, which have a high compression ratio and stable combustion. Meanwhile, in gasoline engines with low to moderate compression ratios, Pertalite provides better efficiency improvements compared to Pertamina because it is more suitable for the engine's characteristics. This study demonstrates that the addition of HHO gas directly enhances combustion system efficiency and is worthy of development as an alternative energy solution for small-scale power generation systems.

Keywords: Generator Efficiency, HHO Gas, Electrolysis Reactor, Fossil Fuel