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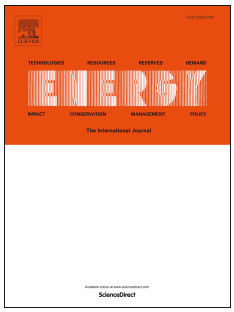

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Pavlos Dimitriou, Taku Tsujimura, Yasumasa Suzuki

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Hydrogen-diesel Dual-fuel Engine Optimization for CHP Systems

Pavlos Dimitriou*, Taku Tsujimura, Yasumasa Suzuki

National Institute of Advanced Industrial Science and Technology (AIST), Renewable Energy Research Center, 2-2-9 Machiikedai, Koriyama, Fukushima 963-0298, Japan

Abstract

Combined heat and power (CHP) systems utilizing an internal combustion engine benefit from improved energy efficiency, by capturing heat that is usually wasted, and reduced energy costs. The cogeneration systems can be used domestically and in remote areas for enhancing the energy security and reducing the national energy requirements.

In this paper, the study focuses on the combustion optimization of the compression-ignition engine of a CHP system using the organic chemical hydride (OCH) method for the dehydrogenation of a hydrogen energy carrier. An experimental investigation was performed on a single-cylinder hydrogen-diesel dual-fuel engine for optimizing its combustion performance and reducing the harmful emissions. The engine operated at a constant speed of 1,500rpm and 7bar IMEP under three different hydrogen rates representing low-, medium- and high-hydrogen energy share ratios.

The analysis showed that hydrogen fuel with high EGR rates and single diesel injection could provide a simultaneous reduction of carbon emissions up to 80% combined with a reduction in NOx of over 50% and an enhanced thermal efficiency. Total hydrocarbons were the only emissions deteriorated compared to the conventional diesel operation. Engine operation with 55% and 75% hydrogen energy ratios passing the Tier 4 Nonroad Compression Ignition emission standards was achieved.