Effect of operation strategies on the economic and environmental performance of a micro gas turbine trigeneration system in a tropical region.

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Abstract

This study investigates the effect of employment of different operation strategies on the economic and environmental performance of a micro gas turbine trigeneration system (MGT-TGS). The MGT-TGS covers power, heating and cooling load of a selected building in a tropical region. The prime movers used were MGTs with electrical output capacity of 30 kW and 65 kW. Four operation strategies; Power-Match, Heat-Match, Mix-Match, and Base-Load were examined. The Net Present Value and Emissions Reduction Index throughout the life cycle of the MGTs were calculated. It was found that MGT-TGS can only generate positive NPV (Net Present Value) at the end of 25 years life time under unsubsidized electricity price. Mix-Match and Power-Match operation strategies can generate positive NPV because the systems can generate more electricity. However, these operation strategies cannot reduce emissions especially CO_2 and CO when they were compared to a CCGT (Combined Cycle Gas Turbine). Base-Load is the only operation strategy that can reduce all emissions even when it is compared to a CCGT. When the economic and environmental performance is fairly considered using CPERI (Cost Per Emissions Reduction Index), Mix-Match is the optimum solution because it can generate CPERI of US$16.0-92,407, based on NPV.

Keywords: Micro gas turbine, Trigeneration system, Operation strategy, Emissions, Economic

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