

Performance of biogas turbine generators from wastewater treatment system of the dairy farm ⁽¹⁾

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Abstract

This study aim to survey biogas power generation at the dairy farm and make a simple economic evaluation for assessing the feasibility of using biogas power generator. A micro gas turbine was used and the biogas was used as fuel. The rated output power of the generator was set at 30 kW. The results shewed that the annual power generation was 24.7 ± 1.4 kWh (range 23.0 ~ 27.3 kWh); the annual power consumption of the pre-treatment facility was 3.6 ± 0.2 kWh (range 3.3 ~ 3.9 kWh). The power consumption divided by the amount of electricity generated was $14.7 \pm 0.9\%$ (range 12.7 ~ 15.9%). The annual outside temperature was $23.7 \pm 4.7^\circ\text{C}$ (range 16.4 ~ 29.4°C). The CH₄ concentration in biogas was $57.9 \pm 2.1\%$ (55.2 ~ 62.0%) and the CO₂ concentration was $29.3 \pm 2.8\%$ (range 24.4 ~ 33.1%). The average thermal efficiency was $20.8 \pm 0.8\%$ (range 19.6 ~ 22.0%), and the biogas consumption was 373.3 ± 12.7 L/min (range 350.5 ~ 400.5 L/min). Generator consumed an average of 0.83 ± 0.03 m³ (range 0.77 ~ 0.88 m³) of biogas to generate 1 kWh electricity. During the whole test, the total power generation was 33,942 kWh, and the income was about 172,676 NT\$. A total of 18,091 kg CO₂e emissions was reduced. Biogas as fuel power generation can reduce both carbon emissions and consumption of other energy sources. It was worthy of promotion to farmers.

Key words: Biogas, Micro gas turbine, Biogas power generation, Thermal efficiency, Dairy farm.

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