

# Performance of biogas turbine generators from wastewater treatment system of the dairy farm <sup>(1)</sup>

Hsiu-Wen Ou <sup>(2)(3)(4)</sup> Tzong-Faa Shiao <sup>(2)</sup> and Ming-Shean Chou <sup>(3)</sup>

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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  $24.7 \pm 1.4$  kWh (range 23.0 ~ 27.3 kWh); the annual power consumption of the pre-treatment facility was  $3.6 \pm 0.2$  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 CH<sub>4</sub> concentration in biogas was  $57.9 \pm 2.1\%$  (55.2 ~ 62.0%) and the CO<sub>2</sub> 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  $373.3 \pm 12.7$  L/min (range 350.5 ~ 400.5 L/min). Generator consumed an average of  $0.83 \pm 0.03$  m<sup>3</sup> (range 0.77 ~ 0.88 m<sup>3</sup>) 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 CO<sub>2</sub>e 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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(1) Contribution No. 2638 from Livestock Research Institute, Council of Agriculture, Executive Yuan.

(2) Animal Industry Division, COA-LRI, Tainan 71246, Taiwan, R. O. C.

(3) Institute of Environmental Engineering, National Sun Yat-sen University, Kaohsiung 80424, Taiwan, R. O. C.

(4) Corresponding author, E-mail: hwou@mail.tlri.gov.tw.