Biogas Compression from Palm Oil Mill Effluent for Sustainable Rural Electrification

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Abstract

Electricity is a catalyst for sustainable economic development. Electricity supplied by the national electricity grid might not accessible in remote areas and therefore alternative energy supply is highly needed for rural electrification. The biogas generation from palm oil mill effluent in the rural areas could be effectively exploited to provide alternative source of energy for rural electrification. Due to logistic issue between biogas resource availability and its demand, biogas compression in gas cylinders is proposed for easy transportation in rural area. In this study, biogas produced from palm oil mill effluent is pressurised between 20 bar to 80 bar using reciprocating compressor and centrifugal compressor to run a gas engine coupled to a generator to satisfy the electricity demand. The optimum pressurised biogas to be stored in the gas cylinder is determine based on the trade-off with the total cost which includes biogas transportation cost, compression utility cost, and compressor capital cost. The result of the finding shows that increase the pressurised storage of gas cylinder will decrease the total cost. This implies that the decrease in transportation cost is more than the increase in compression utility cost as the pressure of gas cylinder increases. In conclusion, optimum pressure of compress biogas is selected to be 80 bar as further increase in storage pressure does not significantly increase the profit margin. The reciprocating compressor is selected because of the lower maintenance cost. The economic assessment of the necessity of biogas upgrading before compression and case study of different end user application of bottled biogas may be further investigated.