Abstract

The problem investigated in this research was that fixed-dome type biogas plant could not be adapted by the majority of rural farming community due to its investment cost ,difficulty of construction, operation and maintenance. The prime objective of this experimental research was to evaluate the efficiency of the biodigester, technological appropriateness, economical feasibility and environmental soundness of the geomembrane plastic biogas plant and fixed-dome biogas plant of 3m^3 capacity via measuring the amount of gas production, computing cost-benefit analysis and determining its environmental impact with the amount of substrate fed in relation to the volume of the digester. The mechanical method were employed to measure the amount of gas and slurry using calibrated standard size biogas burner and weight balance respectively. The qualities of the slurry were determined in the laboratory using Kjeldahl and ash method respectively. Economic evaluation and comparison of the biodigester was carried out using cost-benefit analysis techniques. Results signified that gas production and total-N was higher for a single layered and above ground plastic biodigester than others. Fermented slurry contained larger nitrogen content than fresh cow dung in both models of biodigester. The geomembrane plastic biogas plant gave higher net benefit than fixed-dome biogas plant. The biogas technology was found to increase income generation through increased crop production with the use of nutritive slurry as organic fertilizer and solve the problem of fuel shortage in the rural areas. Environmental impact assessment of the technology was studied and found that from the use of a geomembrane plastic biodigester, 360 m^3 of CO2 and 600 m3 CH4 was prevented from emitting in to the atmosphere and save 0.562 hectare of forest per year from being deforested and hence attributed towards the decrease in global warming. Generally, the geomembrane cylindrical film bio digester technology was found cheap and simple way to produce sufficient gas and fertile slurry in the study area in particular and to transform Ethiopia into climate resilient green economy (CGRE) in addressing issues of energy access, quality of supply and productive energy use particularly for rural communities focusing on women and girls in the context of new energy policies and planning while adhering to the low-carbon mission statement of the CRGE.

Keywords: *biomass fuel, climate resilient green economy, economical, environmental, feasibility, fixed dome, geomembrane, slurry and technological.*