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Theoretical estimation of the production of biogasfrom the landfill of Batna city and its electricalconversion by a SOFC

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Abstract: Amongst the interests in fuel cells is exploring the possibility of using different fuel types;one of them is biogas or Landfill gas (LFG) from landfills or from controlled digesters.Biogas; a gas produced by an anaerobic digestion of organic waste represents an environmentalproblem that could turn to a renewable energy source. The valorization ofbiogas into energy (electricity, heat, fuel) will save other sources of energy. The authors ofthe study are interested in evaluating three technologies: fuel cells, micro turbines andinternal combustion engine.In this paper, we discussed the conversion of biomass into electricity in two steps: thefirst step (biomass-to-biogas) is based on an evaluation of biogas potential generated bysolid waste of landfill the Batna city (Algeria) by the kinetic model (U.S.EPA, 1993). In thesecond step (biogas-to-electricity), the paper considers the technology of a stack of standardsolid oxide fuel cells (Ni-YSZ/YSZ/LSM) SOFC; this allowed us to determine the besttemperature, hydrogen concentration and electrolyte thickness for maximum powerdensity in the fuel cell SOFC. At a temperature T = 1273 K and thickness of electrolyte of theorder of 0.1 mm and at higher hydrogen concentration, a maximum power density ofP = 1.4 W/cm2 was obtained.

Keywords : LFG, Biogas, Anaerobic digestion, Electricity, SOFC