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Tesis

**Automated Biogas Production for Electricity  
Supply at CEPAP**

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# Automated Biogas Production for Electricity Supply at CEPAP

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**Abstract**— According to INEI, 42% of rural areas in the Peruvian jungle do not have electricity. This work develops the production of automated biogas to supply CEPAP with electricity. For the development of biogas production, 84 tons/month of organic matter was used, which degrades the matter with anaerobic digestion with a hydraulic retention of 40 to 60 days, modelling the architecture of the system using SolidWorks considering the biodigester, servovalves, pressure sensor, valves, jeanbacher motor while the programming was done in TIA PORTAL to improve the behaviour of biogas production and saw through a PLC S7-1200 1214 DC/DC/DC and a HMI TP700 this allows the operator to control what happens inside the biodigester. Finally, the Jenbacher 1xJ208 engine runs on biogas, for which it was supplied with 3360 m<sup>3</sup>/month of biogas, covering the electrical requirement of 37.84 Kw/day, which will be able to supply CEPAP with electricity for 15 days. In addition to this, there is the use of biol, which will be packaged for use as fertiliser in agriculture.

**Keywords**— Biogas, Biodigester, Electric Energy, Biol, Servovalvulas

## I. INTRODUCTION

According to the National Institute of Statistics and Informatics (INEI), 42% of rural areas in the Peruvian jungle do not have electricity [1]. Around 3 million people lack electricity and a third of the population uses firewood for cooking, emitting polluting fumes and causing acute respiratory diseases [2]. The organic waste generated by the population causes environmental problems such as bad smells, pollution in rivers, fields, etc., a practical alternative is the generation of biogas from human excreta, biodegradable municipal waste as a main source of clean energy through the process of anaerobic digestion to produce biogas and subsequently generate electricity to charge electric vehicles [3-4].

Anaerobic digestion (AD) is a valuable method to produce biogas for the treatment of degradable organic waste by mesophilic and thermophilic systems, which uses a biodigester for mixing conditions to treat the matter by degradation, which

had a hydraulic retention of 17 days [5-6]. The organic solid waste from households is made up of 80.4% organic matter, which was processed using the DA methodology, which is the product of the activity of the degrading microorganisms. In 70 days, 9 litres of biogas were produced, which according to the reading of the components was 57.35% methane, 32.4% carbon dioxide, producing 1235.27 kWh of energy per tonne of household waste treated [7-8].

In the Czech Republic, biogas stations were supplied with a voltage of 22kv, for which, thanks to technological progress, data analysis was automated to verify the long-term stability of the power supply, obtaining the functionality of the biogas station as a source of renewable energy for power supply during power outages [9]. In Ireland, the feasibility of replacing natural gas with biogas by using waste biomass from livestock, poultry and agricultural waste as a renewable fuel source for the turbines that run the Irish electricity grid was examined and is feasible with the right incentives from the government [10].

Scientific advances regarding the use of biogas focus on the production of bioenergy through the use of organic materials such as waste from flowers, fruits, food, cow manure, through the degradation of matter to obtain methane, the calorific value within 20 days in the process of codigestion, in food waste was 333.6 kWh/m<sup>3</sup> while manure only 275.4 kWh/m<sup>3</sup>, it is convenient to produce electricity by using food waste to produce biogas [11-12].

This work was carried out to take advantage of the organic matter waste obtained by the "Centro Ecoturístico de Protección ambiental Pangoa (CEPAP)", to produce biogas and supply the jenbacher machine with renewable energy, producing electrical energy to be used in the electric pump, light poles, spotlights and embroidery machine. The programming was done in TIA PORTAL to improve the behaviour of biogas and biol production by means of a PLC S7-1200 1214 DC/DC/DC and a HMI TP700 which allowed the operator to control what happens inside the biodigester.