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SYSTEM BURNER LOW FLOW OF BIOGAS FOR CARBON CREDITS WITH DIRECT THERMOELECTRIC AND PHOTOVOLTAIC MICROGENERATION[1]

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ABSTRACT

This work involved the development of an innovative burner recorder low flow of biogas that promotes both sanitaria burning of methane in biogas and its carbon crediting in clean development mechanisms. The system is energetically autonomous and incorporates two emerging microgeneration technologies still under development for this application: a) the use of waste heat gases from combustion of biogas for generating electrical power by the Seebeck effect and b) of photovoltaic power through nanotechnology thin films of flexible system-based CdS/CdTe (cadmium sulfur/cadmium tellurium). The energy autonomy via the combination of photovoltaic and utilization of waste heat from the combustion of biogas, it is necessary to operate in regions devoid of the power grid and even in times of blackouts register carbon credits via MODEM. The system combines mechanical solutions to electronic solutions, is an innovative alternative, national and low cost compared with flares systems, industrial gas burners, which are complex, costly and demand for electricity and LPG (liquefied petroleum gas) to operate. The proposed system burns the biogas collected, promoting environmental sanitation and the crediting of carbon, thus aligning themselves with the guidelines of the Kyoto Protocol. Depending on the volume of biogas collected and burned up can get a considerable generation of electricity for other applications.

INTRODUCTION

The aim of study is to provide a form of alternative energy that makes the energy self-sufficient electronic control circuit mechanism biogas burner, installed 30 km away from a power grid, where it is not feasible to supply through this mechanism of conventional systems power generation. This mechanism makes the burning of biogas and generates CO2, recording the volume of biogas burned and providing carbon credit (Patented).

1 Artigo publicado nos Anais do Congresso Microgen 2013

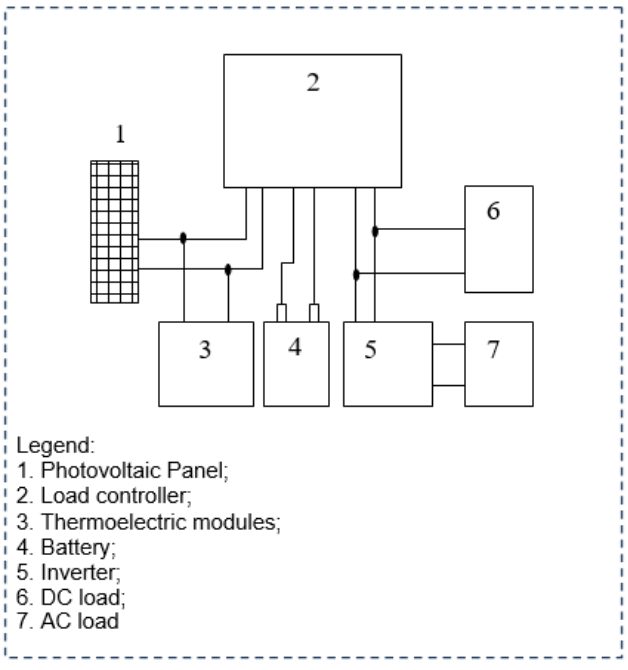
The electronic control circuit burner biogas engine is powered by a power generator circuit comprising the combination of photovoltaic and the thermoelectric technologies directly (Seebeck), where the PV system accounts for 95% of energy generated and the thermoelectric system contributes with 5% of energy generated. In this context, the thermoelectric modules serve only supplement the power generation, aiding in energy generation mostly at times when the photovoltaic generate little or no energy, which is the case of cloudy days and at night where the generator circuit energy would be totally dependent on the energy stored in the battery.

Every solar energy converted into electricity through the photovoltaic panel and also thermal energy converted into electricity via thermoelectric modules is controlled and stored in the battery through the charge controller, so that the battery can´t be charged or discharged too.

2. DESCRIPTION OF COMPONENTS AND OPERATION OF POWER GENERATOR

The Figure 1 illustrated a block diagram of the power generating circuit and the basic components.

Figure 1 - Block diagram of the circuit power generator



All energy generated by both photovoltaic panel as the thermoelectric modules is administered by the Charge Controller that has the primary regulation of energy stored in the battery, allowing it to be loaded or discharged excessively, the charge controller is also responsible for maintain the stability

and regularity of the voltage level generated. The photovoltaic solar panel will converts ol arrays into electricity and send to the charge controller. The thermoelectric modules linked together and attached to the protective mechanism of flame burner biogas, will make the conversion of thermal energy into electrical energy, sending also for thecharge controller. The inverter has to transform the voltage level of direct current (DC) voltage in to alternating current (VAC), the circuit engine burner will use biogas AC voltage and also the DC voltage.

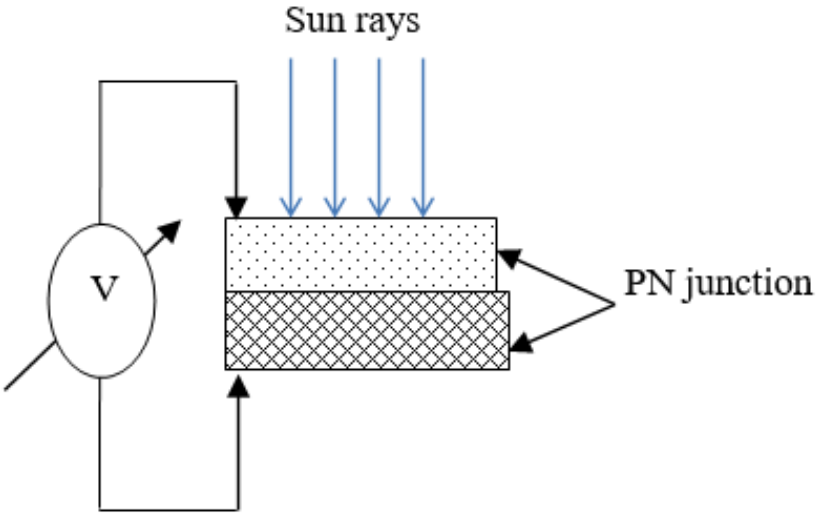
2.1 PHOTOVOLTAIC PANEL

The panel with photovoltaic cells associated so as to provide an output of 100Wp, sufficient to power the electronic control circuit and also the ignition circuit when requested by the control circuit.

The photovoltaic system is the main source of energy in this study, providing about 95% of the energy generated, providing power generation without risk or harm to the environment and depends solely on the sun's rays are present all over the planet, with greater or lesser irradiation, depending on the climate, topographyand location, among other factors. The generation potential of this system in Brazilis huge there for have insolation levels ranging from 4,500 to 6,100 Wh/m2/day (GAZOLI et al., 2012).

The photovoltaic panel receives the photons of electromagnetic radiation with a frequency within the spectrum of visible light (380nm to 760nm), electrons from the valence band of the semiconductor material leap off the conduction band, producing an electric current within the crystal structure of the semiconductor, as shown in Figure 2 (GAZOLI et al, 2012).

Figure 2 - Photovoltaic Effect



Source: Villalva et al. 2012, adapted.

The electrical characteristics of some photovoltaic solar panels are described in Table1, can be obtained systemically different electrical characteristics and / or suitable for use when the association made of photovoltaic panels.

Table 1 - Kiocera Solar Modules

Electrical Characteristics	SM 83	KD 135
Nominal Power (W/pico)	83	135
Tolerance	+15%/-5%	+5%/-5%
Power (W/dia)	415	675
Nominal Current (A/dia)	25,35	38,15
RatedCurrent (A)	5,07	7,83
Short circuitcurrent (A)	5,78	8,37
Nominal Voltage (V)	17,40	17,70
Open circuitVoltage (V)	19,70	22,10

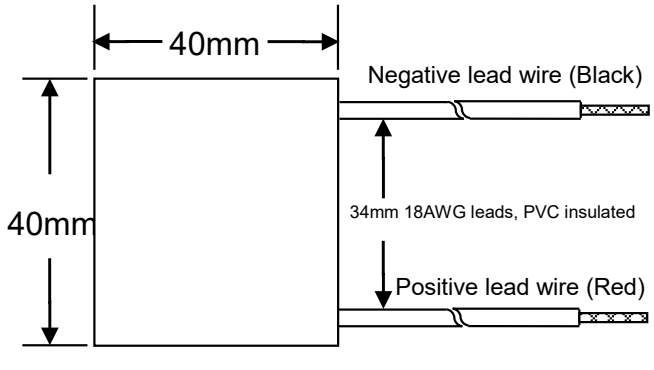
Source: www.solarbrasil.com.br (accesses made on06.04.2012and11.4.2012)
Note: Panels manufacturer Kyocera, valid values forideal conditions ofheat stroke.

2.1.1 GUIDANCEOF PHOTOVOLTAIC PANELS

Sun rays are electromagnetic waves parallel to each other who suffer the effects of the spread when they hit land in a straight line, this radiation comes from diffuses cattering of radiation passing through the atmosphere. The albedo radiation is the part of the solar radiation reflected by the earth surface. The total radiation is the sum of all radiation that would direct radiation + diffuse + radiation albedo radiation (Pereira et al. 2012).

In this context, the photovoltaic panel is to be installed so as to maximize the capture of the direct radiation, thereby improving the utilization of solar radiation.

Figure 3 - Top view of thermoeletric

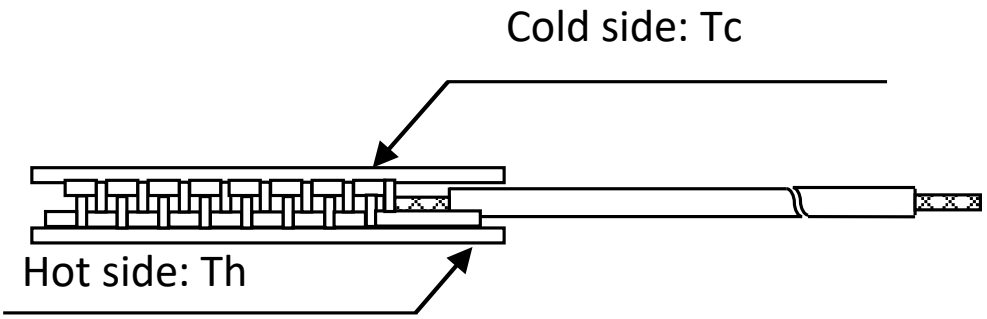


Source: ThermonamicEletronics, 2012

2.2 MODULES THERMOELECTRIC (SEEBECK)

The modules thermoelectric (Seebeck) convert thermal energy into electrical energy as a function of temperature difference applied to their faces. These thermoelectric modules will be established and associated with the mechanism of the protective flame burner biogas, the higher the Dt, the greater the power generated. Devices are manufactured in sheets of ceramic material (Alumina, AI2O3, White 96%) with different sizes, depending on the electrical characteristics that is desired in terms of generation and can work at constant temperature sup to 330 ºC or intermittent to 400 ºC generating voltages direct current (VDC), its efficiency depends on the contact surface of the thermoelectric module to the surface of the protective mechanism of flame burner biogas Figures 3 and 4 illustrate the thermoelectric module with a specific dimension for a condition generation, these measures may change depending on the desired voltage (Thermonamic Electronics, 2012).

Figure 4 - **Side view of the themoelectric module**



Source:ThermonamicElectronics, 2012

2.3 BATTERY

A battery is essential for the circuit electronics biogas burner works correctly because the photovoltaic cells do not provide power on a regular basis due to the intermittent and random characteristic of solar radiation over time. During the night, the photovoltaic panel and the generator does not workwill be dependent onthe energystored in the battery, because the thermoelectric modules serve only as a supplement power generation cannot serve as the main generators depending on the efficiency of this device does not achieve good results for this application.

2.4 INVERTER

The inverter is intended to convert the DC voltage (VCC) generated voltage to alternating current (VAC) is also very important to make the system, because the generating circuit feeds power loads and DC current alternating.

2.5 STORER AND AUTOMATIC BURNER BIOGAS

2.5.1 Functional Features

It is Astore and automatic burner biogas, low cost, and high reliability. This mechanism can be installed on systems of sewage treatment and anaerobic digesters with low and variable production, where energy use is not viable economically and burning of biogas cannot be constant (Patented).

2.5.2 BASIC OPERATION

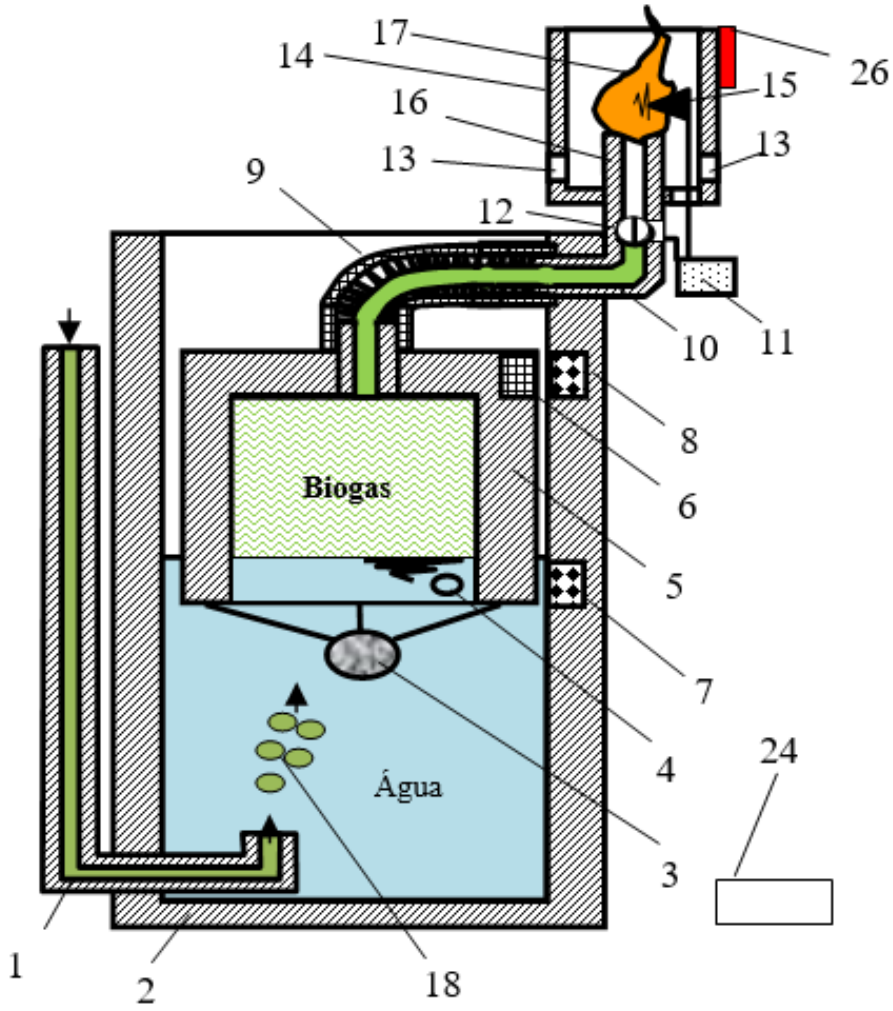
Table 2 describes the major components of the mechanism.

Table 2 - Components Engine Burner Biogas

Item	Description
1	Inlet pipe
2	External Glass
3	Floatingballast
4	Inner boreof theinner cup
5	Inner cup
6	Permant magnet
7	Microswitch(empty)
8	Microswitch(full)
9	Flexible tube
10	Rigid tube
11	Ignitor
12	Electromechanicalvalve
13	Air intake
14	FlameShield
15	Electrode
16	Toe-cap
17	Flame
18	Biogas storage
19	Flip-flop
20	Current amplifier
21	Gate Trigger's Fototriac
22	Microcontroller
23	Photo Triac
24	MobileMeter(optional)
25	Energy generator
26	Modulethermoelectric(Seebeck)

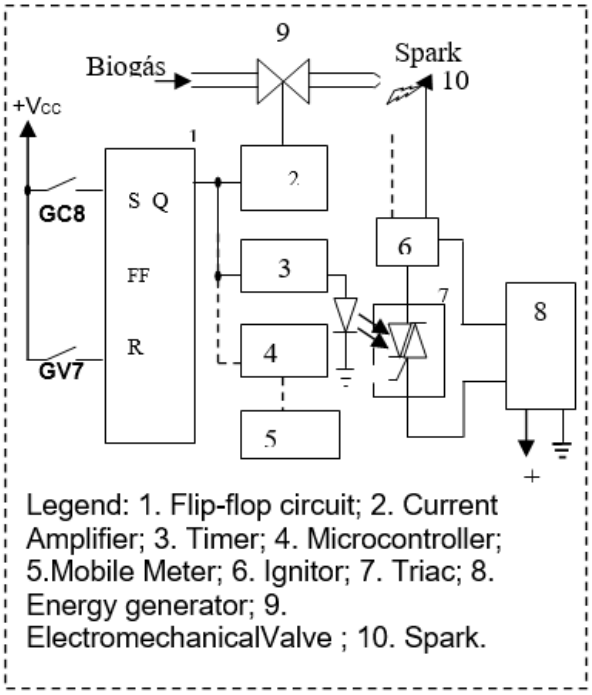
The Figure 5 depicts sectional profile of the engine assembly and burner gas tank filled in the starting position of the biogas combustion, respectively.

Figure 5 - Biogasburner (Full)



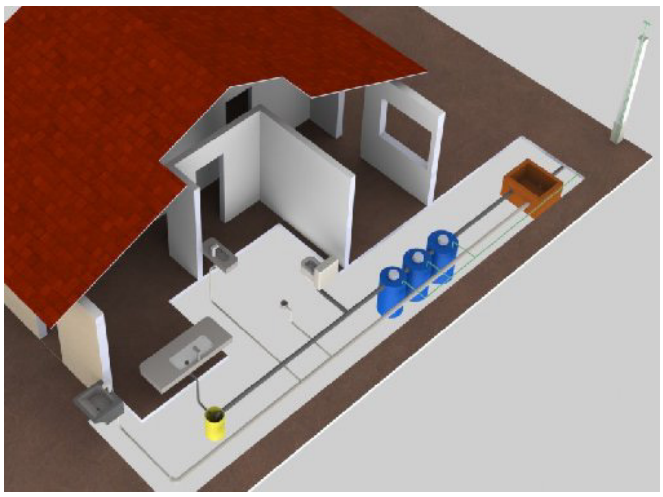
The Figure 6 illustrates the block diagram of the electronic control circuit of the mechanism burner biogas, which is mounted on a single printed circuit board, powered by the voltage supplied by the power generator circuit (PV association thermoelectric+). Provided the full electronic control circuit is triggered, causing the "start" of the igniter to burn off the gas engine. The microcontroller (22) that allows the recording of volume burned and records the number of times the gas tank was emptied and filled, enables communication with serial external loop recorder (24), since the power generator (25) feeds the electronic circuitry of the mechanism of biogas burner together with the ignitor (11).

Figure 6 - Electronic Circuit



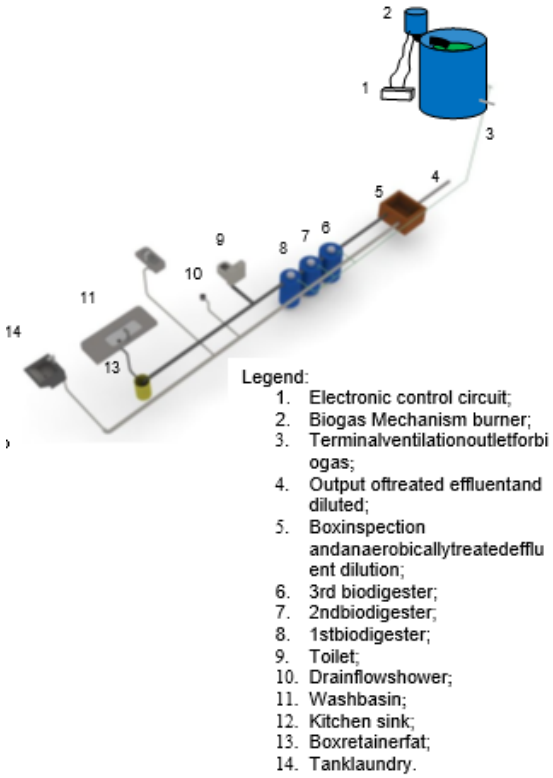
The mechanism of biogas burner will be installed at a point of capturing waste about 30 km from the power grid, however, is a mechanism that can be installed in industries, industrial or residential condominiums, urban or rural communities, Figure 7 illustrates an example setup for collection of biogas in a residence, a model that could be used, with adaptations, residential condominiums, industrial as well as urban and rural communities.

Figure 7 - Installationof the device tocapturebiogas



The figure 8 illustrates the pickup device adapted to biogas burner mechanism with the description of each of the system components.

Figure 8 - Connection of biogas burner system with biogas capture the gases.



3. CASE STUDY

The circuit power electronic control mechanism biogas burner with loads of 100W, 30 Km installed energy network, proposed in this work, it is totally impractical to power by conventional means, the power grid.

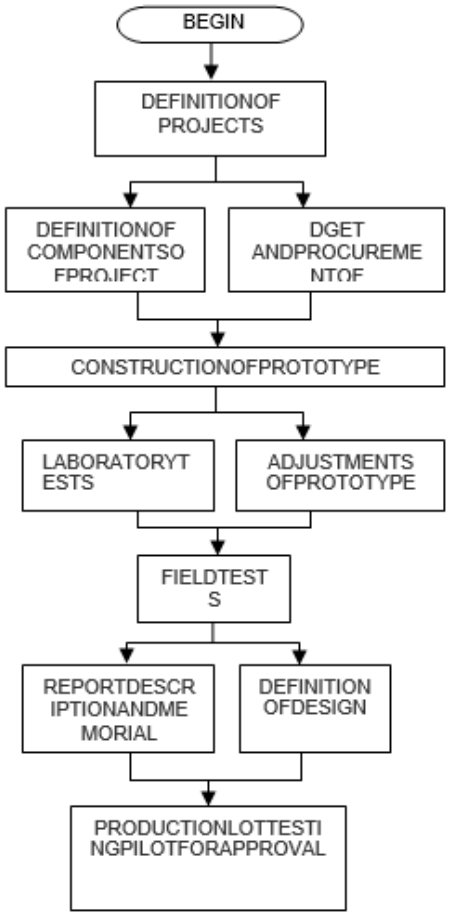
Costs arising from the power utility to answer a charge of this nature with poles duplo T, L Band key 10 KVA transformer, totaled R$ 802,680.00. The final cost of the biogas engine burner, already with the circuit power generator making itself-sufficient is around R$ 3000.00.

The purpose of the mechanism is to contribute biogas burner by burning methane gas at stations where the amount of funding generated is small and insufficient for energy.

In this context, it is noteworthy the feasibility of using an alternative power generation, because a load of 100 W installed at great distance, as is the case would have an extremely lower cost of installation, compared with the installation in the manner traditional, as the figures above,do not justify the investment or long-term.

4. SETTING PROJECT

Figure 9 - Flowchart of project development



5.CONCLUSIONS

The deployment of the alternative energy to power the biogas burner mechanism is viable for technically and economically.The combination of photovoltaic and thermoelectric technologies provides power to the satisfaction of the circuit power electronic mechanism biogas burner, making this mechanism energetically self-sufficient. The "Burner Biogas Engine" [patented] turn contribute sefficiently by burning methane gas generating CO2 in processes where the amount of gas generated is low volume and volatile and is not viable for energy generation.The use of alternative power generation, also contributes to the economy of the electricity generated by conventional generation, since the circuit power generator engine burner biogas may even provide power, if required, a point lighting on site that can be made the basis of the LED luminaire, intending to lower power consumption of the circuit power generator.

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