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# DESIGNING AND DEVELOPING AN HYBRID SYSTEM FOR ELECTRIC POWER GENERATION

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## ABSTRACT

This paper deals with the development of a prototype designed to produce electricity anywhere and that introduces mechanical and electrical innovations. First, gravitational potential energy (GPE) is stored in each half-turn of the system rotor and can be converted to electricity, only when necessary, by alternating linear movements of permanent neodymium magnets inside stationary electric coils with constant area.

***Keywords:*** micro-power, hybrid system, gravity, electricity.

## INTRODUCTION

Many texts like (Krishnan, 2001) address the multidisciplinary subject of electric motor/generator drives. Several micro scale power generation systems and hybrid power generation systems of wind turbines and solar (Stevens, 2005), or, (Mostafa, 2014) including other renewable energy sources, have been presented in order to reduce system operating costs and avoid air pollution caused by fossil fuels used in thermal engines driving electric generators. Other papers [Hossam, 2016) propose supervisor control for power management of hybrid AC/DC microgrids.

In this study a new type of micro hybrid portable electric power generator capable of working with muscular effort or, with other energy source, and using gravity is presented. The mechanical part is an innovative system for mass elevation proposed by author (Loureiro, 2016) and named PIR-2015 due to the use of mass rotation in a inclined plane. Thanks to the system configuration, the gravitational potential energy (GPE) which is stored in each half-turn of the system rotor, can be converted, only when necessary, in an almost constant torque by the organ called "shadoof" ("picanço" or, "wells" sweep) that drives an electric generator of linear type. The electromechanical generator converts the mechanical energy into electric energy according to Faraday's induction principle, but with alternating linear movements of permanent neodymium magnets inside stationary electric coils. It has the advantage of operating with constant values of area (A) and magnetic field (B) of a magnet which moves always perpendicular to each loop of wire as opposed to classical rotary electromechanical generators. The electrical energy obtained is accumulated and managed by a DC / AC load control / management system.

## RESULTS AND CONCLUSIONS

Although it can be used the pivot rotations of two " shadoofs/ picanços", with axes (X) and (Y), for successive movements of four rods / magnets inside the coils, the PIR-2015 was tested only with a magnet / coil, as shown in Fig.1, and two coils with different number of

turns were tested in order to demonstrate the principle of operation. Table-1 presents the main specifications and the results of tests performed with PIR-2015.

Table 1 - Specifications and main results of PIR-2015 testings

| Specifications | Values | Unit | Coil-1 | Coil-2 |
|---|---|---|---|---|
| Motor torque | 0,116 | Nm | - | - |
| Magnetic field | 15 | mT | - | - |
| Magnet Diameter | 13 | mm | - | - |
| Coil Diameter | - | mm | 26 | 26 |
| Lenght | - | mm | 30 | 30 |
| Turns | - | - | 18 | 300 |
| Inductance | - | mH | 0,016 | 3,17 |
| Resistance | - | ohm | 0,2 | 4,3 |
| Average emf | - | mV | 0,2 | 2,8 |
| Peak emf | - | mV | 10 | 100 |

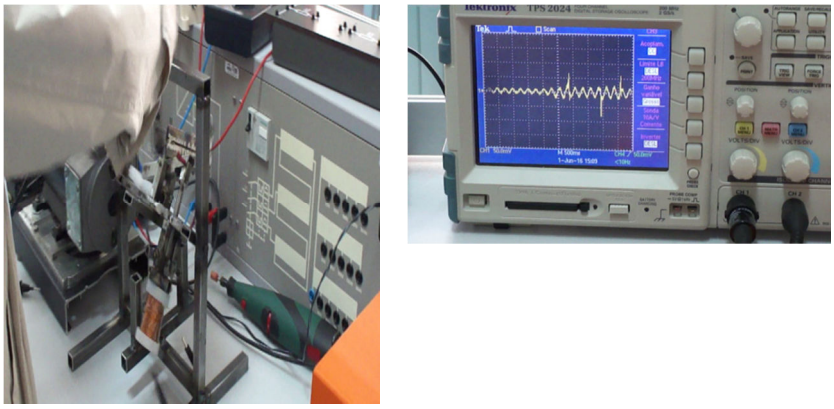

Fig. 1 - PIR-2015 under testings

The proposed system, in PIR-2015 configuration, works but needs some improvements. Future works include modeling of the PIR-2015 hybrid system, as well as, sizing for a 1 kW unit, and its construction and tests.

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