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DESIGN AND DEVELOPMENT OF AN HYBRID SYSTEM FOR ELECTRIC POWER DECENTRALIZED GENERATION

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ABSTRACT

Several micro scale power generation systems [Stevens & Belmans, 2005], and hybrid-wind turbines and solar [Mostafa & Sohair, 2014] or, 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 & Nobi, 2016] propose supervisor control for power management of hybrid AC/DC microgrids.

In this article the environmental problem is treated and a proposal of a portable electric power generator is presented. This hybrid and decentralized system [Loureiro, 2015] for the generation of electricity has mechanical and electrical innovations. The mechanical design is innovative because it can be operated manually or by any preferably efficient and clean motor and allows the accumulation of gravitational potential energy to be used for the production of electricity. The electrical innovation is the application of Faraday's principle of electromagnetic induction, but with linear movements of permanent neodymium magnets inside fixed electric coils.

Air pollution caused by transport, factories and power plants running on fossil fuels has led to the closure / reduction of factory production and the restriction of traffic in major cities around the world (Beijing, Shanghai, and even Madrid as reported in December 2016). When oil prices rise, and when people wear respirator masks on the streets of great cities (Figure 1), one can realize the importance of large environmental summits and the urgent need to improve life with policies that encourage the use of more efficient and friendly technologies for the planet.

While the production of clean electricity, although progressively increasing, fails to meet the needs, it is difficult to change the dominant situation of fossil and nuclear fuels on renewable energy. Even if oil reserves are continually reduced and operating costs increase, infrastructure for the supply of petroleum products to consumers and coal to power plants will still be able to respond more easily than the electricity grid combined with renewable sources, or, rather than an alternative infrastructure such as hydrogen - still at an embryonic stage.

In the field of transport, there are technological limitations on the supply of hydrogen and on the storage of electricity (low energy density, low capacity and high battery charge time). Although there has been progress that makes it possible to approximate half of the allowable range with a petrol / diesel tank (around 1000 km), without compromising safety or use, the "green" / alternative vehicle is still in reduced commercialization compared to the car classic.

There are also economic constraints to the expansion of Zero Emissions Vehicles such as the high cost of these efficient and clean vehicles (EVs and with Hydrogen Stacks) and the uncertainty of the price of supply, as this may increase if there is a growing demand on the nets that feed them. If this scenario materializes the consumer will have little economic

advantage but there will be enormous improvements to life, and a guarantee of sustainable development.

Finally, a proposal [Loureiro, 2016] for the production of decentralized electrical energy is presented and can work with any engine that is preferably efficient and clean. The main advantage of the proposed energy system is to be hybrid, in order to compensate for the lack of availability / seasonality of the hydraulics, and also to obviate the irregularity in the direction and intensity typical of renewable sources wind, and solar. The proposed system is different from those presented in the literature because it also harnesses a form of energy that exists anywhere in the earth - the gravitational potential energy (EPG) combined with the renewable energy sources, or with others available anywhere, especially in remote sites and in areas where cataclysms occur.

The technical specifications of the proposed hybrid energy system were presented by the author (Loureiro, 2014 to 2016). Tests conducted in 2015 with a portable and low-power prototype encouraged the introduction of improvements to increase the overall power and efficiency of the proposed hybrid power system, but these mechanical and electrical changes have not yet been introduced into the prototype.

Fig. 1 - Air pollution in great cities of the world.

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