

A HYBRID SYSTEM MODELING AND ANALYSIS

***Drd.Ing. Ionela NEGREA, **Drd.Ing. Georgiana Dragusin**

* Faculty of Technological Engineering, Transilvania University of Braşov,
Eroilor, 29, 500068 Brasov (Romania), email: ionela_n@unitbv.ro

** Faculty of Technological Engineering, Transilvania University of Braşov,
Eroilor, 29, 500068 Brasov (Romania), email: georgianadragusin@yahoo.com

Keywords: solar collectors, small wind turbine, solar energy, wind energy, wind speed

Abstract : The renewable energy sources are very important for everyone, especially for Romania who need to promote this kind of sources of energy for living because the existent sources of energy will be over with the passing time and are polluting the nature, it is useful the used of renewable energy. The sources of energy which are used from ancient time are the wind and solar energy. Today this energies became again a real alternative in producing electric and heating energy. Are clean, free, inexhaustible in time and nonpolluting sources of energy. To promote energy from the wind and sun are need a small hybrid system, small wind turbine, photovoltaic panels and solar collectors, who are very used in present because are more efficient then the one with big capacity and are cheap in producing electric energy in isolated arias, especially in the mountains.

The paper present a modeling of an hybrid system, this system have a small wind turbine how have a cut in speed from 2m/s and a solar collector of small dimension, everything is made for area Brasov. With the hybrid system proposed we make electric energy and heat for gratis.

1. Introduction

For our country is very important an adaptability study for a small hybrid system which can be installed in different areas. Romania is situated in an area of interference of air masses, because of this is made a study of the climatic condition. In function with this study is designed a small hybrid system for Romania, who can be installed in every area of our country, The blades proposed for this small wind turbine are from textile materials, have different forms and must resist at big wind, storms and degradation. The solar collector is a small installation who can heat an isolated house. The design of the solar collector and of the small wind turbine is made with the soft CATIA V5 R15.

This small hybrid system is very suitable to supply with electric energy small houses, schools and vacation residence from isolated aria.

The systems of regenerating energies began to be the main activity of so many countries of the world because of decreasing of the existent sources. By combining the solar energy and the wind energy is obtained a hybrid system. A powerful hybrid system is an electric system where are combined different sources of regenerating energy, that generate electric energy and heating on an isolated network. This small hybrid system is implemented in the rural areas, isolated areas, faraway from the national electric energy network, and where such resources can be exploited. The most used hybrid systems are systems PV - Wind.

For our system that we want to design, we use a small installation with a solar collector and a small wind turbine which have a cut in speed from 2 m/s.

We must build systems which not only „ must keep the beak blazing”, to keep in function for milliard of people, satisfy the needs of this, protecting the medium in this way. In present the renewable energy sources ensure between 15 – 20 % from total demand of the world energy.

2. Hybrid system design

In designing a small hybrid system is important to be respected the following aspects:

- the aerodynamic profile of the blade of the small wind turbine,
- the operation conditions,
- the wind speed and the solar radiation,
- the rotor frequency for the small wind turbine and the direction of vibrations in the blade section,
- the movement of the blade section relative to the air current (draught),
- the water temperature from the pipe for the solar collector.

The hybrid system was designed with the software CATIA V5 R15. The virtual model for the solar collector and for the small wind turbine is presented in figure 1.

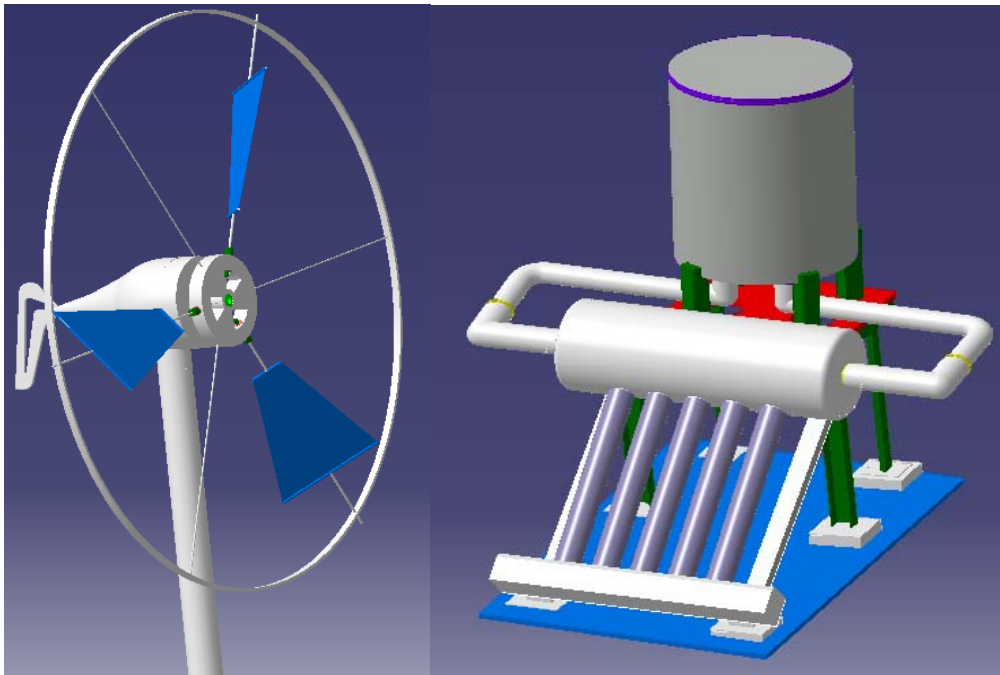


Figure 1: The hybrid system (solar collector and small wind turbine)

In designing the small wind turbine we take in count the wind speed in area Brasov, were is very low from 2 m/s till 4 m/s, the rotor area in which the wind is blowing and the cost of all installation, because of that the blades of the wind turbine are made from textile material, from tent and ship sale. The blades are assembled into a small rim in which are placed at an angle of 45 degree from the plane of rotor.

The solar collector is design with down fall of the water, because of that the installation have a small inclination at an angle of 10 degree, only in the right part.

In figure 2 is presented the sketch of the hybrid installation.

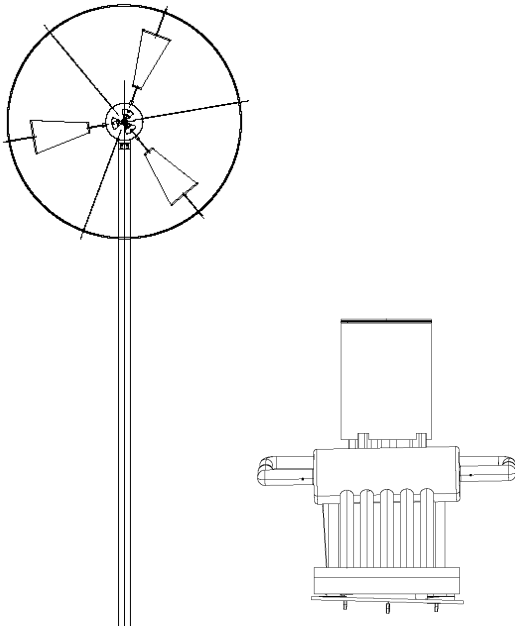


Figure 2. The sketch of the small hybrid system

3. Hybrid system analysis

In analysis the small hybrid system is important the wind speed and solar radiation. The cut-in speed will be 2m/s and this analysis will be done till the wind speed will reach 17 m/s. The three types of blades will be assembled into the rim at an angle of 45° degree.

The material from which are made the hybrid system is from solid material, (figure 1). Only the blades of the small wind turbine are made from textile material. Because we use textile material we need the density, the elasticity module and the Poisson coefficient.

All this coefficients were considered with the same values for each blade:

- The Poisson coefficient: $\mu = 0,15$;
- The Elasticity Module: $E = 400 \cdot 10^6 \text{ N} / \text{m}^2$;
- The Density: $\rho = 140 \text{ kg} / \text{m}^3$.

The hybrid system is tested at stress and distortion and the results are shown in the figure 3 and 4.

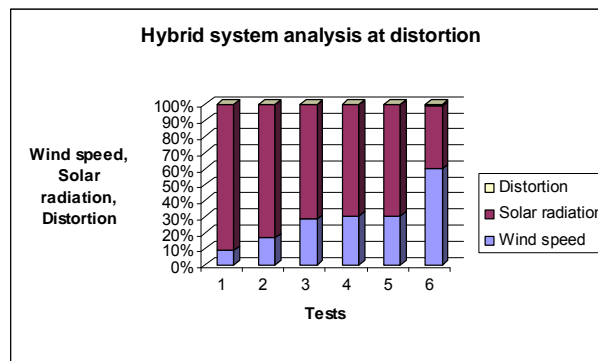


Figure 3. Hybrid system analysis at distortion

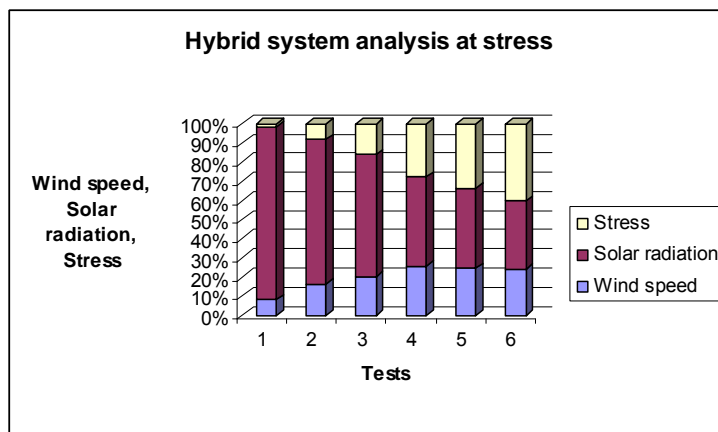


Figure 4. Hybrid system analysis at stress

From this analysis is found that hybrid system can be used for an isolated small house in area Brasov. From the results we found that when we have big wind and low solar radiation the stress is big and at distortion is more different because isn't so huge.

4. Conclusion

The paper presents a small hybrid system who can be installed in area Brasov. The results for the small hybrid system at distortion, stress are very advantageous and can be installed for an isolated house from area Brasov.

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