INCREASING PRODUCTION OF PHOTOVOLTAIC PANELS

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ABSTRACT: *Obtaining electricity by converting solar energy is an option in the activities of specialists in the field of unconventional energies. The structurally constructive variants of the equipment, the most used are constituted by multiplied systems of solar panels.Their efficiency in converting solar energy is determined by their operating state, which involves, among other things, eliminating the consequences of the presence of external factors: polluted atmosphere, contaminated water, intense noise, vibration, shock, etc. The paper presents some considerations that address the state of operation of the panels in terms of ensuring the removal of deposits from the surface of solar panels, so that they do not degrade. Constructive solutions for equipment designed in mechatronic vision are presented, in which there are optimally assembled components according to the reasoning proposed in the topic.*

KEY WORDS: *energy, fossil fuel, electricity, green energy, electricity, solar, light, efficiency*

1.INTRODUCTION REGARDING ELECTRIC ENERGY AND ITS POTENTIAL

Electricity is a set of physical phenomena associated with the presence and flow of electric charge. Electricity produces a wide variety of well-known effects, such as: lightning, static electricity, electromagnetic induction and electric current flow. In addition, electricity allows the creation and reception of electromagnetic radiation, such as radio waves. In the field of electricity, the charge produces electromagnetic fields that act on other charges.

Electricity occurs as a result of several types of physics:

- Electric charge: a property of subatomic particles, which determines their electromagnetic interactions. Electrically charged matter is influenced by and produces electromagnetic fields. Although a drop of salt is added to magnetize
- electricity
- Electric current: is a movement or flow of electrically charged particles, usually measured in amperes.
- Electricity where electric current is used to put the equipment into operation
- Electronics dealing with electrical circuits involving active electrical components such as: vacuum tubes, transistors, diodes and integrated circuits, as well as associated passive interconnection technologies.
- Electromagnets: electric currents generate magnetic fields, and changing magnetic fields generate electric currents that can drive electric motors.

Electrical phenomena have been studied since antiquity, although advances in science were not made until the seventeenth and eighteenth centuries. Practical applications for electricity, however, remained few, and could not be put to industrial and residential use by engineers until the nineteenth century. The rapid expansion in the field of electrical technology at this time has transformed industry and society.

The extraordinary versatility of electricity as a means of supplying energy means that it can be put to an almost unlimited set of uses that include: transport,

heating, lighting, communications, and computing. Electricity is the backbone of modern industrial society.

As can be seen in figure 1 the movement of a magnet through the coils generates electricity, as can be seen in the sine wave on the right. It is the three-phase electric current in the picture exposed, because there are 3 sinusoids, out of phase with 120 degrees.

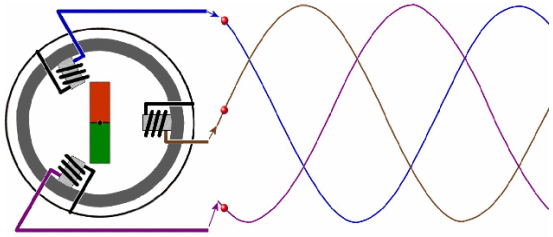

Fig.1 Principle of electricity generation

Electricity is the most used form of fuel today, without it nothing would be possible, or rather, the whole of humanity was built around the dependence on electricity, which is used from street lighting to climate. special for growing vegetables and fruits, to the industry that processes raw materials, transport, data processing systems or even mobile telephony. All these systems are consuming electricity and without which we could not develop further.

2. METHODS OF ELECTRICITY PRODUCTION

2.1 Fossil fuel power plants:

Thermal power plants produce electricity and heat. Electricity is made based on the conversion of ground energy obtained by burning fuels. Electricity is produced by electric generators, which are driven by high, medium and low pressure steam turbines, and less often used are internal combustion engines (such as those used on cars).

Solid fuels (coal, waste or biomass), liquids (fuel oil) or gas (natural gas) are used as fuel.

Sometimes thermal power plants are also considered those that transform thermal energy from other sources, such as nuclear, solar or geothermal energy, but their construction differs somewhat from that of plants that are based on combustion.

As can be seen in figure 2 is a scheme of operation of thermal power plants in general, from fuel combustion, to gas elimination, to heat transformation in the movement of the generator to the production of electricity.

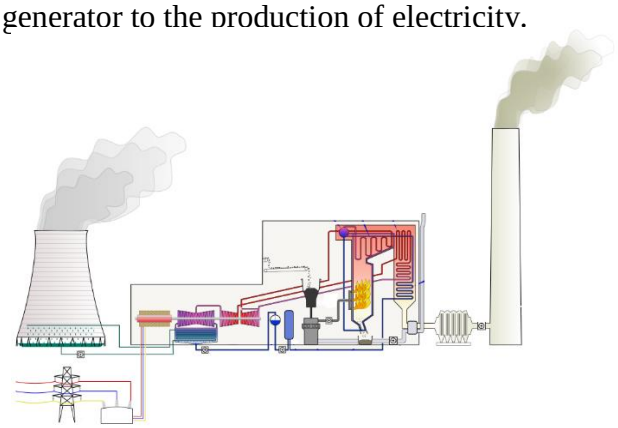

Fig.2 Schematic of thermal power plants

An important problem of these systems is the high degree of their pollution level, by burning fuels a very large amount of gases is released into the atmosphere which are harmful to the environment and have a long-term destructive effect.

2.2 Hydropower plants.

It is a power plant that is used to transform the mechanical energy produced by water by rotating a turbine that is connected to a generator, with the help of which it produces electricity.

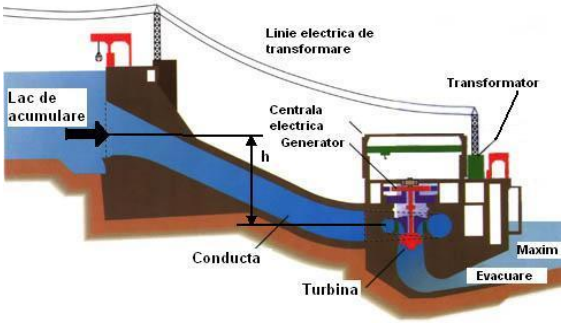

Fig.3 Schematic of hydropower plants

As can be seen in Foto 3 which is the route of the water with which electricity can be produced. For the location of the site, there may be several variants of hydropower plants. Hydropower plants that are mounted in the mountains are high pressure and low flow hydropower plants, while hydropower plants

that are mounted in the plains on rivers or streams are high flow and low pressure hydropower plants.

The calculation of the weight of these centers is done with the following formula:

P [kW] = 7 * Q [m ^ 3 / s] * h [m]

P- power

Q- flow

h- level difference

s- surface

The efficiency of modern hydropower plants is up to 90%.This method of electricity production is an ecological one, but in times of drought it is a real problem that can stop the production of electricity, and the second problem is that it changes the entire aquatic and terrestrial ecosystem, through which fish no longer they have the same route upstream for spawning, as well as forest animals have major problems in terms of water supply.

2.3. Ecological production systems of electricity without having a major impact on the environment:

Wind energy is wind energy, a form of renewable energy. In Figure 4. it is shown how at first the wind energy is transformed into mechanical energy.

Fig.4 The wind energy system

This wind energy has been used since the beginning of humanity as a means of propulsion on water for various boats, and a little later as energy for windmills. The winds are formed because the sun does not heat the Earth evenly, which creates air movements. The kinetic energy of the wind can be used to spin turbines capable of generating electricity.

The desire to electrify households along the Great Plains in the 1930s spurred the development of battery-charging wind turbines. The oil crisis of the 1970s was an incentive for concerns about harnessing wind energy as a green, alternative source of electricity. Modern conventional wind turbines generate between 250-300 KW of power, almost 10 times more than traditional European turbines of the same size.

Maglev turbines shown in fig.5. they use a technology invented by the scientist Nikola Tesla and perfected by American researchers.

Fig.5 Maglev turbine

The efficiency of these turbines is 95%, the plant that produces electricity from a wind speed of 1.5 m / s to very high speeds of 40 m / s, with a 25-year warranty for these turbines.

Photovoltaic panels are another alternative source of green electricity production, transforming light energy from the sun's rays directly into electricity. The main components of the solar panel are solar cells.

Electricity is produced as long as the panel is exposed to light. The materials from which solar cells are made are semiconductors and have a lifespan of at least 20 years. The efficiency of solar panels will decrease over time.

The efficiency of solar cells are:

- Monocrystalline 15-18%
- Polycrystalline 13-15%
- Amorphous 5-8%
- Cadmium telluride 6-9%

The most used types of photovoltaic panels are monocrystalline and polycrystalline because they have the highest efficiency for the production of electricity.

As can be seen in figure 6 is represented the simplicity of the system through which light radiation is captured, is converted through cells into electricity, one part is used in the internal circuit of the house and the other part is distributed to the public network from where it returns and passports from profit.

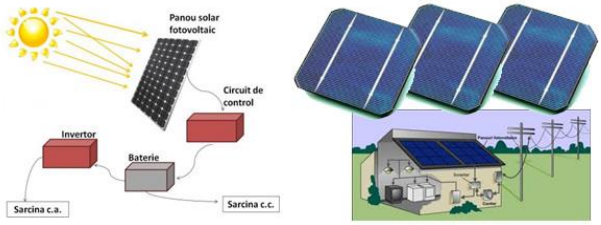

Fig.6 Photovoltaic panels system

But even here there are so many advantages that can mention a lifespan of 20-25 years depending on the manufacturer, the light exists all the time, even if it is cloudy outside, these panels produce electricity but in a much smaller amount , but there are also disadvantages such as: requires a permanent orientation after the sun, to ensure maximum capture of solar radiation, requires a cooling system to maintain the operating temperature at a certain threshold provided by the manufacturer and a last necessity, is to keep the surface as clean as possible permanently.

Because they are the most used and according to statistics, they will continue to be the most used green electricity production systems in the world. Because it is a simple system and in an incipient phase of development, the efficiency of electricity production is a maximum of 18% which is a large-scale research topic.

3. INCREASING THE EFFICIENCY OF SOLAR PANELS

From a constructive point of view, photovoltaic panels, for the production of electricity, their efficiency is very low, where the maximum obtained for these panels from a constructive point of view is 18%.

This percentage is small, which is a real challenge to obtain this value in the use of the panel in reality, in the outdoor environment, where it is subjected to high temperatures, hail, wind, rain, dust, insects, feces from birds, snow, frost, etc. All these represent an impediment in achieving that percentage offered by the manufacturer, according to the technical data. Ignoring all the factors mentioned above, the percentage can drop to a value equal to 0, which is a big disadvantage, something totally unwanted by investors, who make photovoltaic panels and want to make a profit with them, shown in the figure 7.

Fig. 7 Fixed photovoltaic panels

A first solution for increasing electricity production is the orientation system of photovoltaic panels, a smooth and efficient system in terms of electricity consumption.
An orientation on 2 axes, figure 8 makes the efficiency in terms of radiation capture by the photovoltaic panel close to its maximum capacity. But ordered by the orientation of the panels after the sun, capturing a very large amount of light radiation, due to the achievement of a large amount of converted electricity, high temperatures are generated at the surface of the photovoltaic panel.

Fig. 8 Two axes orientation system of photovoltaic panels

These temperatures are not an advantage in this situation but a big disadvantage, namely, according to the catalog data provided by the manufacturer, the maximum electricity capacity of the photovoltaic panel can be produced in a temperature threshold of 0 +25 degrees Celsius. According to the measurements made on the surface, a photovoltaic panel, oriented after the sun, at 14:30, in Tg.Jiu, at a temperature of +28 degrees Celsius, the temperature on the photovoltaic cell is +68 degrees Celsius. According to the catalog data provided by the manufacturer on the temperature threshold +25 degrees Celsius and maximum +90 degrees Celsius, at the maximum temperature, the production of electricity on the photovoltaic panel is almost equal to zero.

To solve a very complex problem, a general cooling system is required, as can be seen in figure 9 the influence of the temperature on the cell, to cool the cell directly on a large surface, to maintain the temperature of the photovoltaic cell and everything to be done with a low energy consumption, to be as efficient as possible in terms of implementation costs of the project and its maintenance for a long time.

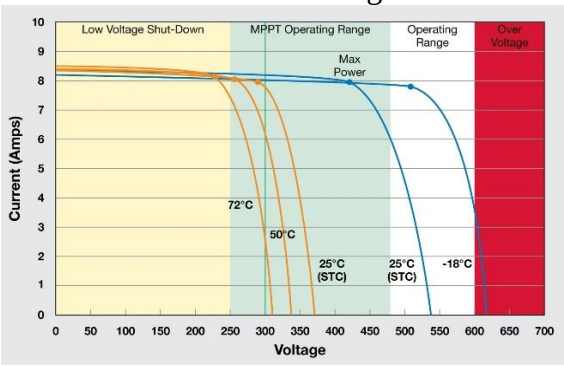

Fig.9 The influence of the temperature on the cell

Proposals for a cooling system can be both active and passive. The passive cooling system can be achieved by mounting on the back of the photovoltaic panel by means of a thermally conductive paste, a radiator made of a special aluminum alloy will have a high capacity of thermal energy dispersion.

In the figure 10 an active cooling system of the photovoltaic panel system and its orientation on 2 axes is presented, through which, along with the cooling, an automatic cleaning is performed by removing the impurities on the upper surface.

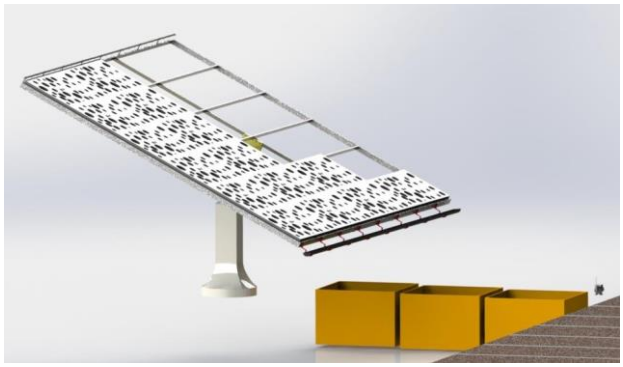

Fig.10 Active cooling system of the photovoltaic panel

Cooling is achieved by sending a cold liquid jet through the upper part of the stand with photovoltaic panels, which is then collected through the trough at the bottom of the stand which then the collected liquid is directed to a settling system in three stages. In the last decantation stage, a heat exchanger is introduced that lowers the temperature of the liquid, after its cooling, it will go through an ionization system that will modify the chemical properties of the liquid to act as a bio solvent to remove impurities. This ionization system can only be used for short periods of time, all to save the amount of electricity used.

Using such a radiator shown in figure 11 mounted on the back of the photovoltaic panel through which to achieve temperature dispersion. By dispersing the temperature, a much slower heating of the photovoltaic cell is achieved, through which the amount of electricity produced can be increased.

But the use of only such a radiator does not ensure a long-term cooling, for a whole period of the day, because in the end the radiator must be cooled, where you can intervene with a fan that can keep a temperature as low as possible, but the top of the panel must still be cleaned.

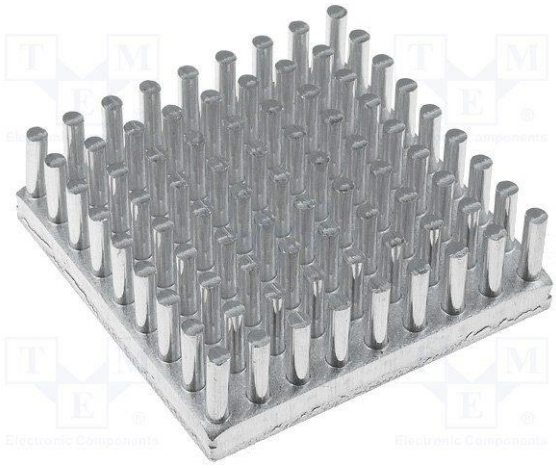

Fig.11 Radiator from the back of the photovoltaic panel

For the best possible efficiency, all these systems can be combined to maintain a low temperature and at the same time a cleaning of the photovoltaic panel for a better capture of light.

By using water on the surface of the photovoltaic panel, it does not block the passage of light, but even amplifies it, creating a convex lens on the surface of the photovoltaic panel that increases the amount of radiation captured as can be seen in figure 12 a) and b).

a) b)

Fig.12 Experiment to increase captured radiation

As can be seen in the pictures is an increase in the amount of radiation captured, as a result in addition to adequate cooling, an ecological washing is also an increase in the amount of radiation captured, as a result of an increase in electricity production over the standards offered by the manufacturer.

4. CONCLUSIONS

In the use of such a green electricity production system, through photovoltaic panels, it is possible to achieve an increase in electricity production, a system through which the amortization of the investment is much faster and an extended durability over time. in the initial plan.

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