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USE OF SOLAR ENERGY IN THE FIELD OF IMPROVED LAND, DRAINING AND IRRIGATION SYSTEMS

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Abstract: The purpose of this paper is to draw attention to ways of using solar energy in drainage and irrigation systems. The following study presents pictures and arguments for the possible use of solar energy on the territory of Romania, especially in the western part of the country, in Crisana, an area where such a project is proposed.

Keywords: solar energy, drainage, irrigation

INTRODUCTION AND GENERAL TECHNICAL DATA

The notion of sustainable development is a relatively new concept meaning a development which meets the capacities of the present without compromising the capacities of future generations to in order to satisfy the own needs. In other words, sustainable development means a process of economic accumulation having as a result the improvement of mankind ‘s standard of living without damaging the ecosystem of the planet.

For each of us, electricity won a privileged place among the energy options. Even if some renewable sources of energy may be directly useful in thermal or mechanical equipments, the concern to obtain electricity on their account remains on the first plan. Definitely, in the near future, the conversion of solar energy into electric power will be a decisive factor in determining the strategy related to the production of electricity. Photovoltaic cells are semiconductor devices designed to efficiently transform sunlight into electricity.

Photovoltaic technology allows direct conversion of solar incident energy which falls on the surface of the Earth in the electric power, exploiting the properties of Silicon on a semiconductor circuit, used widespread in all electronic devices. Considering that the Sun's energy is distributed uniformly over the surface of our planet, the conversion of the cells based on crystalline materials is closely to the theoretical limit (laboratory) of about 35%, in reality on industrial plan the cells are produced with a yield of about 10-12%.

Solar energy is at the Earth’s level about 15,000 times higher than world ‘s energy consumption. Solar energy that is stored in a year on an area of 2 square meters of land (In the Centre of Italy as well as

Crisana, Arad, Timis regions) is equivalent to the annual electricity consumption of an average households (approximately-3,0 kwh).

Based on this assumption, and on the basis of a project for the rehabilitation and development of systems of irrigation-drainage in Crisana’s basin, Bihor county, one can implement such a solar energy system at all the stations of pumping water from the boundary area.

In principle, a large part of the pumping stations, operates almost throughout the year, both in winter and in summer.

2. NECESSARY CONDITIONS FOR THE USE OF PHOTOVOLTAIC (PV) SYSTEMS

Conditions of usage, at a maximum capacity of these systems, does not require something very strict in connection with climatic factors in the area, according to the database of the European Institute of the environment a big part of Romania’s territory has very favorable conditions for building solar fields. And this thing will be noticed in the following comparison between of Italy’s territory, the country which has invested the most in such projects lately, and the territory of our country.

The annual production of a photovoltaic system can be estimated through a calculation taking into account:

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The Annual Solar Radiation

The Benefits of the technical photovoltaic modules, of the inverter and of the other components of the system .The Conditions of modules-operative by increasing the temperature leads to dropping energy products schedule

The power of a photovoltaic system is expressed in kWp

One (1) kWp produces in Italy;

In the North around 1200 kWh/year

In the Center around 1400 kWh/year

In Southern around 1600 kWh/year

Romania benefits from more solar energy in comparison with Italy as follows:

In the North around 1350 kWh/year

In the center around 1550 kWh/year

In the South-East around 1,700 kWh/year

In the image, on the map is shown the level of solar heat over the territory of Romania, from May-September. Comparing the two images: foto1, which represents the annual average of solar radiations during the summer months one can notice that the level of solar radiations is preserved in the western part of the country at the same level throughout the year.

So one can immediately draw a positive conclusion over the implementation of a photovoltaic system, both for the systems of irrigation and draining.

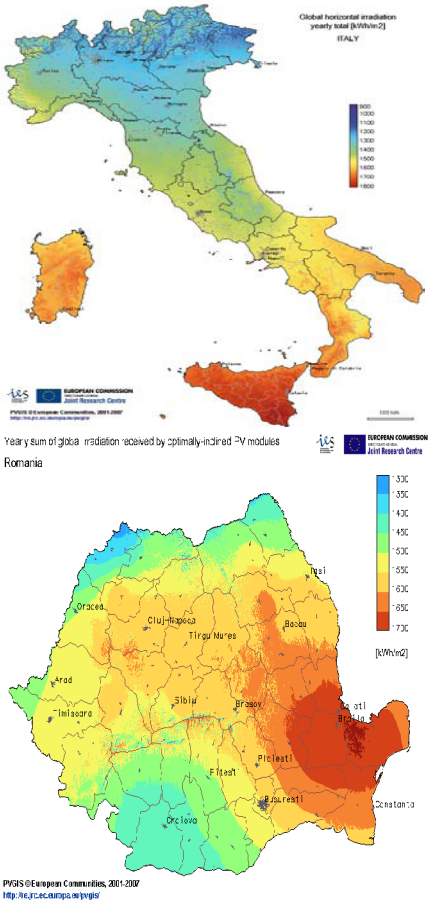

Photo 1. Map comparison between Italy and Romania Solar Energy System (European Institute of the Environment data) [6]

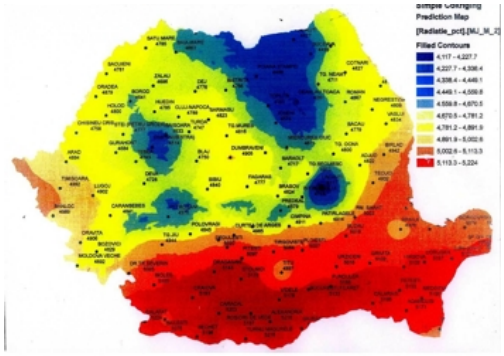

Photo 2. Regional Map of solar heat to over the territory of Romania during the summers (Meteorolgic) [6]

3. THE USE OF PHOTOVOLTAIC SYSTEMS IN THE CONTEXT OF IRRIGATION AND DRAINING SYSTEMS

The solutions of pumping water using solar panels or wind turbines have always been a very efficient solution. Individual irrigation systems that use this technology, have proved to be the ideal solution and are becoming more and more extensively used in agriculture. These systems use pumps or submersible surface. Essential in these applications are current pumps that have a continuing very high efficiency for pumping water, using a very small quantity of electricity. Block diagram of a system of this type is presented below.

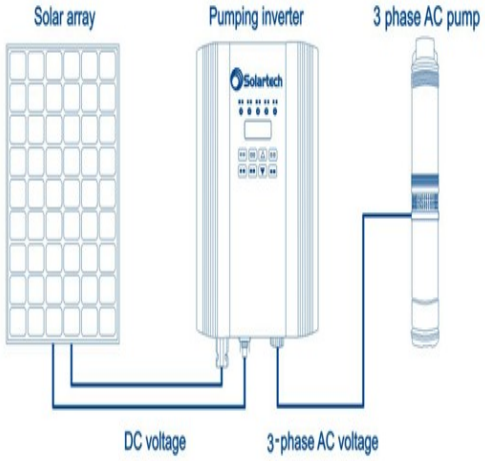

Photo 3. Block Diagramme of a solar pumping system [3]

For irrigations it is used a LORENTZ type system, due to pumping solutions using continuous DC current, and is the most important producer of systems for water pumping with solar technology.

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Photo 4. Example of pump fuctionala with the system. P.V. [3]

In order to achieve a pumping system one should establish from the beginning:

- the Water-use (field of use-irrigation, drainage, drinking, domestic)
- The source of the water (drilling, bad Dam)
- Water storage will be in (reservoir, dam)
- The volume of water needed daily.
- The difference between ground level and removal of tube (dimension A)
- Maximum pumping depth (A + C)
- The total length of the tube between pump and reservoir (B)
- Maximum depth from the ground (C)

These features make it very easy to be used in areas without electricity for irrigation use. The benefits of the system are exceptional. Besides the fact that these systems provide organic energy, these systems offer total energy independence and are very reliable.

In what draining systems are concerned things become a little more complicated. Besides the fact that it is needed a greater number of pumps connected in parallel, and a system of photovoltaic panels, it appears the need to use baterries for storing the electricity and in the cases it is required the connection to the national network of electrification as can be seen in the image.

One can achieve systems that can divert the produced energy (excess energy) in network.

Such a system is composed of:

• photovoltaic panels for connection to network
• Inverter for divert network
• electric meter to measure the amount of energy produced and delivered in the network.

Considering that Pumping Stations within systems draining have as components more than two electro-pumps the system of solar panels will be one of the larger sizes of 20 Kw. So, most of the time it is needed the reserve of baterries, in particular the one based on gel.

The irrigation systems in general are used to maximum capacity during autumn, winter and spring. But in some lower areas of the country, such as Crisana' s basin, these systems function during the summer making possible the implementation of a photovoltaic for water pumping stations.

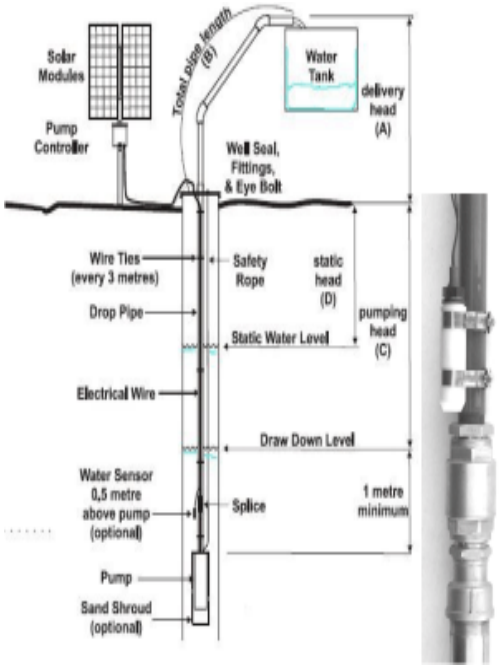

Photo 5. LORENTZ system [3]

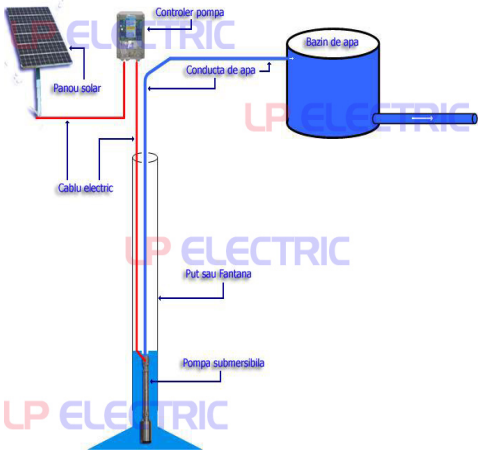

Photo 6. System-controller + pump + solar panel [5]

Generally in the systems of power supply energy from a photovoltaic system employ submersible pumps, which are easily automated, and are more reliable in time. The next picture is this schema of connection of a submersible pump at a system of solar panels.

4. ADVANTAGES AND DISADVANTAGES

The most significant advantage represents the fact that, at least theoretically, they have unlimited lifespan, but we can take into account the fact that they have a very low cost of maintenance. Initial investment is the great disadvantage of all alternative energy systems, and thus included those based on photovoltaic panels. But this it is amortized in time and the installation of such a system is recommended.

There are of course other drawbacks, among which we can enumerate the yield low of photovoltaic cells regarded through the produced energy first reported from the surface of idleness and dependence on solar radiation (RADIUS, angle, intensity, temperature, etc).

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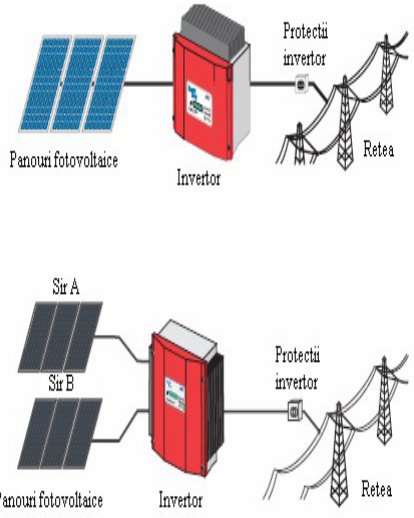

PV system Photo 7. Connecting to the network of electrification [5]

Such a system is revealed in the following picture:

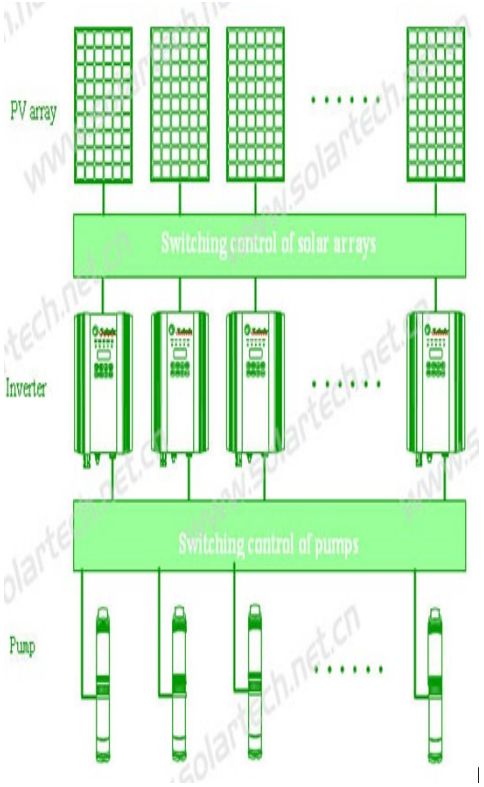

Photo 8. Diagram of a pumping stations with PV system laun [4]

5. CONCLUSIONS

Despite the price, and the dependence of external factors, solar panels are a solution for the future. This is proven by the increase of nearly 50% registered in the number of such systems used around the globe, every year since 2002. The percentage of usage the solar energy is still minuscule estimating that it will arrive at 0.40% in 2010. But in the future, along with the development of technology and reduction of the initial costs the photovoltaic panels will definitely become more and more used

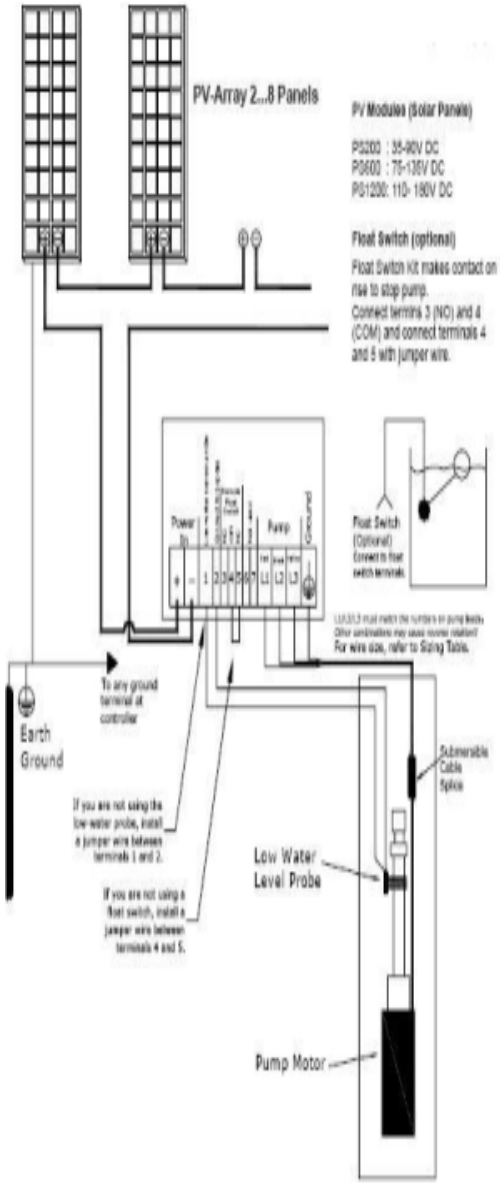

Photo 9. Scheme of a submersible pump connected to solar panels [4]

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[5] www.solar-valahia.ro

[6] www.wikipedia.com

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