The impact of the solar energy collecting systems on an individual agricultural household

Turek Rahoveanu, Petruta

Research Institute for Agricultural Economics and Rural Development

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THE IMPACT OF THE SOLAR ENERGY COLLECTING SYSTEMS ON AN INDIVIDUAL AGRICULTURAL HOUSEHOLD

TUREK-RAHOVEANU PETRUŢA[1]

Summary

Using solar energy through photovoltaic systems implementation in an agricultural household leads to the increasing of it's efficiency, to optimizing energy balance thus implying the decreasing of the primary energy costs.

The solar energy refers to a renewable energy source that is produced directly by light and solar radiation. It can be used to generate electricity through solar cells (photovoltaic); to generate electricity through thermal power plants; to generate electricity through solar towers,etc.

The introduction and development of new technologies and processes through the use of energy from renewable sources leads to production costs reduction and implicitly to the increase of ecomonic profitability of the agricultultural holding.

Key words: *renewable energy, solar energy, photovoltaic panels*

INTRODUCTION

The implementation of an energy strategy for harnessing the renewable energy sources potential (RES) falls within Romania's coordinates of energy development in the medium and long term, offers the adequate framework in adopting decisions regarding energy alternatives and registering in the Community acquis in the field.

Renewable energy types

In the specific conditions in Romania, the following types of renewable energy sources are taken under consideration regarding the energy balance:

- solar energy – used in the production of heating through methods of passive and active conversion or in the electrical energy supply through photovoltaic systems;
- wind power - used in the production of electrical energy with wind generators;
- hydropower – hydroelectric power plants with an installed power that is less or equal to 10 MW ("small hydropower"), or hydro power plants with an installed power that is bigger than 10 MW ("big hydropower");
- biomass – comes from the residues from forestry and agricultural holdings, wood processing wastes and other products; the biogas is the result of animal manure fermentation under anaerobic or from the city treatment plants;
- geothermal energy – the energy that is stored in underground hydrogeothermal blankets and deposits, operated with special drilling and extraction technologies.

The renewable energy resources that are at Romania's disposal

Romania can develop production systems for all the types of renewable sources, depending on the specifics of each geographical region in the country. Following the studies that were made in our country, the green energy production potential is of 65% biomass, 17% wind power, 12 % solar energy, 4% micro hydro power plants şi 2% voltaic and geothermal.

Far more important, in terms of solar energy collecting capacity, is the technology that is used for the solar collectors's building (photovoltaic systems).

The main applications of the solar energy in Romania are:

[1] Cercetator Stiintific, Turek-Rahoveanu Petruta, ICEADR, turek.petruta@iceadr.ro

- Wastewater heating systems in public and residential institutions
- In agriculture for drying agricultural products;
- In greenhouses heating
- In drying of medicinal plants
- In agricultural and holding households irrigation

OUTCOME AND DISCUSSIONS

The solar energy conversion into electrical energy technology is made with the help of the photovoltaic systems by photovoltaic effect. The photovoltaic effect is the effect of an electromotive tension under solar energy.

The use of renewable energy sources and the improvement of eficiency in using them by installing photovoltaic panels that will generate the necessary energy for the irigation and fertirigation in the agricultural household.

The dropwise irrigation and fertirigation system has a main water delivery pipe, 10 lines of hoses with dropper (tube) with a 16 mm diameter, the droppers are placed at a 30 cm distance / flow of 2,0 l/hour/dropper and a dosing pump (dosatron type) fitted on the main water column that is connected to the water source and to a fertilizer container.

The irrigation water pumping system is made up of: 280 W photovoltaic panels, controller, PS1200 submersible pump, insures a water flow between 5,2 and 8,5 cbm/day, 4 cbm water collecting tank, drilling shaft.

Given the rigging with these appliances we estimated a calculation of the water intake that is necessary for the irrigation of a 1000 sqm agricultural individual household (table nr.1).

Estimation of the irrigation use by furrow compared to the dropwise irrigation

Table nr.1

Crop	Surface (m^2)	Irrigation water use (m^3)	Dropwise system water use (m^3)	Difference between Irrigation by furrow/dropwise system use	
				mc	%
Spring crop from which:	**1000**	**45**	**18,5**	**26,5**	**58**
Spinach	600	18	9,5	8,5	47
Salad	200	12	4	8	66
Green onion	200	15	5	10	66
Summer-autumn crop from which:	**1000**	**192,5**	**24,83**	**167,67**	**87,1**
Tomatoes	300	45	20,28	24,72	55
Cucumbers	200	60	12,5	47,5	79
Peppers	250	87,5	17	70,5	80,5
Eggplant	250	75	16	59	78
Autumn crop	**1000**	**300**	**62**	**238**	**79**
Cabbage	1000	300	62	238	79

Source: Own calculations

By analysing the data from the table above for the spring crops on a 1000 sqm surface, in the irrigation by furrows system it's estimated a total water use of 45 cbm and in the dropwise irrigation the total water use is 18,5 cbm, the difference being of 26,5 cbm. The reduction of use is of 58% due to the use of the dropwise system.

Given the compliance with the technological estimates for the vegetable crops, the percentage is reduced to 87,1%, by determining the water rate for each plot at the summer – autumn crops. For the autumn cabbage crop the water use difference is of 238 cbm, representing 79%.

SWOT Analysis

Advantages:

- The solar energy is available in huge quantities and it's ecological;
- The photovoltaic panels are not polluting and don't have harmfull effects on the environment;
- The pay off will happen in a short time, because the systems are very reliable and can function 10-25 years without big maintaining costs;
- In the hot periods when the water need is high, the photovoltaic panels are at maximum yield.

***The advantages of a dropwise system**:*

- Big watering power in a relatively short time
- Water economy
- Watering reduced time
- Minimum effort in watering plants
- Avoids the presence of water on the leaves, reducing disease attacks that way
- Together with the water can be administered: fertilizers, insecticides and fungicides.

Disadvantages:

- The very limited spread of the use of solar energy collecting technology.
- The solar energy is dependent on sunlight, in other words, on the quantity of solar radiations that reach the Earth
- The price for the production of electricity through photovoltaic systems is bigger than it's production in the steam power plants
- Variation depending on atmospheric conditions.

Opportunities

- An economic analysis using different orientations for the photovoltaic panels
- An analysis of the impact upon the net of the different combinations of renewable sources of energy using optimizing techniques and comparing to classical solutions.
- The existance of some surfaces of degraded land on which energetic plants can be grown, suitable for polluted soil conditions;
- Using renewable energies can reduce atmosphere pollution significantly and it can contribute in time to reducing greenhouse gas emissions (especially by using biofuels);
- The existence of mountain areas that are isolated, without electricity as well as touristical mountain areas of interest for the development of some applications in renewable energy systems;
- The usage of degraded or uncultivated surfaces for energetical plants and oleaginous crops;

Threats

- The lack of strategies or plans for the placing of installations/equipments can harm the landscape;
- The lack of some integrated strategies can lead to the growth of the surfaces that are cultivated with energetical plants at the expence of those cultivated with food crops.

CONCLUSIONS

Using a dropwise irrigation and fertirigation system, the water pumping system that is powered with renewable sourced energy will ensure the optimum unfolding of the technological flow, an increased work productivity and obtaining quality products.
The quality and quantity of water is very important for an agricultural household , which becomes a key factor in the development of this activity through thev use of photovoltaic systems.
The crop irrigation represents a domain in which the new practices can semnificantly facilitate the more efficient water use.
The setup for the agricultural lands is very expensive, which leads to a very high price for the water that is used for watering, price to which, of course, adds up the farmer's direct expenses for the water.

Dripwise irrigation

The irrigation systems execution solutions have to keep in mind that the demand is not constant over the year. The maximum demand in the irrigation period is in general two times higher than the annual average and during this period the groundwater level is lower which makes the system oversized over the year.

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