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POSSIBILITY OF APPLICATION OF SOLAR PUMPS IN IRRIGATION

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Abstract: Today, is very often, especially where there is no indented city water supply network, on smaller agricultural areas, farms and the like. for irrigation use solar pumps. The paper deals with the problem of dimensioning of solar pumps in irrigation. For irrigation needs, the paper analyzed the solar pump of smaller capacity which are intended for watering of small agricultural areas, such as those in greenhouses, etc.
Keywords: The solar panel, the sun, irrigation, agriculture

INTRODUCTION

In the Republic of Serbia today is about 40% of arable land, while the region of Vojvodina has 1.78 million ha of fertile arable land, of which only 28% is irrigated. [1] In stated problem lies an enormous research task, which consists of increasing the surface area that could be irrigate, and that energy that would have initiated such systems is renewable. Demand for water is greater the very sandy, particularly windy and southern positions than on the structural soils of the northern exposition [2]. Schedule of moisture on the surface of the earth is far more complex than the layout of heat and light.

Moisture, particularly in the form of water, plays an important role in the life of plant species, because it is a requirement for many the life processes who can not imagined without the participation of water. It is considered that moisture is one of the most important herbal ecological factors, far more influential than light and heat, because the diversity of flora and its a geographical layout usually depends on the just from the schedule moisture.

While the sun's rays directly receive to biomass, moisture (rain, snow) receiving himself through the land. It occurs in the form of air humidity and of atmospheric deposition [3].

Plants in themselves contain up to 95% water, but by far is higher amount of water which pass through herbal organism. The evaporation of water from plants is called transpiration, and it is of unusual importance, because it is conveyed by way of water. The relationship between taking water from the soil and allocations via the leaves called water balance of plants. It is normal that the water balance is in equilibrium, but often occur under the influence of heat, to violate this occurs and the water deficit which may be from 5 to 10 and up to 30% without any damage to the herbal organism. When this lack of exceeds a certain limit, then the plants are showing the first signs of wilting, ie. loses turgor and leaves were due to wilt wither, which can be permanently or temporary.

POSSIBILITY OF PRODUCTION ENERGY ON AGRICULTURAL OF LAND

For centuries, the sunlight is applied to produce food for humans. However, in 1970 - in those years they began to applied by solar photovoltaic panels, very often i on arable the agricultural land. This was one of the disadvantages of this form of renewable energy source, because he disturbed yields in agriculture.

Architecture and technologies of solar panels over time in sophistication, so that they used today and lands that are used agricultural production. The goal of contemporary of agricultural production is that the produce food and electricity at the same time. Such plants could provide additional sources of income for agricultural producers. By selecting of adequate of agricultural crops submitted by the of, seed, the same would be protected obscuring of: sun and high temperatures (which last year recorded an increase) heavy rainfalls, of the winds, hail and the like.

SOLAR PLANT IN IRRIGATION

In recent years, about 30% of users of solar energy in agriculture uses the sun to drive irrigation pumps, but this trend is changing rapidly in favor of those farmers who of their installation linked to the power

grid in order to sell the excess electricity produced. Some of the construction of solar panels I can change their slope as the sun changes its position. This makes it possible to provide a an increase in daily gain energy by as much as 55% [4]. When designing the solar plant for irrigation of agricultural cultures, the most important task is to choose the solution which is the largest efficiency, and the investment minimum. Selection of appropriate methods of irrigation, is conditioned by a number of factors: the land, biological, climatic, relief, economic, hydrogeological technical and technological. When designing such plants, and making a decision for selection of equipment important role is played lot size to be irrigated and its need for with water. [4]

a)

b)

c)

Figure 1. a) Fixed solar systems for solar drive pumps and irrigation, b) Semi mobile solar system for irrigation "pivot, center pivot", c) Mobile solar irrigation system

How solar photovoltaic panels produce the most energy during the summer when there is the most the sun then, in agricultural production and the greatest need for with water. The applicability of these solutions for irrigation can meet the needs of all types of agriculture production: farming, pomology and viticulture. This solar water pumps any submersible or floating, provides the water needed for the [5]:

= irrigation of agricultural cultures,
= dewatering (removal of excess water) and
= servicing households.

Depending on the types of agricultural cultures and their water needs, the size of the plot and the weather conditions, solar systems for irrigation may be:

= the fixed (Figure 1a),
= semi-mobile (Figure 1b) and
= mobile (Figure 1c).

When in dimensioning and the choice of abstraction, with regard to water availability and choices of solar pumps, to be distinguished:

= underground waters,
= surface water (rivers, lakes, reservoirs etc.).

Choice of water intake is the most important problem in defining a solar plant for irrigation. Here is certainly worth a take account of physical and chemical properties of water, its temperature etc. Water intakes of surface water courses are not limited to capacity, unlike underground of water courses.

For the purposes of extraction of groundwater the necessary the investments in drilling of wells [6].

In dimensioning of and selection of the device for irrigation, should consider the following:

= species of plant and its need for water,
= watering the duration (h).
= Tornus irrigations (number of days).
= firth norm (m^3/ha),
= the required amount of water during growing season (m^3),
= pedological content of the soil,
= parcel size (ha),
= configuration of plot,
= capacity solar pump (l/s),
= available pressure in the system (bar), etc.

The choice of solar pump is based primarily on the availability of the most affordable multimedia water intakes. It further pump selection is performed in accordance with the required quantity of water and the necessary efforts pumps.

MATERIALS AND METHODS

Irrigation systems in Republic of Serbia are usually driven by diesel or electric motors. The goal of of this paper is the presentation of the possibilities of small for irrigation of agricultural areas with solar pumps of small capacities, although solar pumps can be used for irrigation of agricultural areas with larger capacities than 1,500 l / h. Justification of this study lies in the fact is very fragmented holdings in the Republic of Serbia.

The paper presents justification of of solar pumps in irrigation, depending on their capacity. Were analyzed water demands to be used for watering of small of agricultural areas, that the application can be found in greenhouses, etc. The advantage of these of watering, the method especially dropwise, the small amount of water that are given plants. For this reasonthis paper analyzes three types of pumps: A to 2 l/h, B 4 l/h and C to 8 l/h, table 1. Average work time for which the observed justification of use of these pumps amounted to 10 h / day. Capacities the said solar pump on a monthly and annual basis are shown in table 1.

Table 1. Capacity of solar pumps on a monthly and annual basis

Size of the solar pump	Capacity (l/h)	The capacity on a monthly basis (m^3/mes)	The capacity on an annual basis (m^3/god)
A	2	0,6	10,80
B	4	1,2	14,40
C	8	2,4	28,80

RESULTS AND DISCUSSION

Using solar energy in agricultural production most appropriate is, since the highest energy is produced at those moments when it is most required for the growth of of agricultural cultures. For example. irrigating is carried out in the period when he has the most solar energy and when needs were for with water for agricultural culture is greatest. How would liberate the need the use of conventional energy sources in the irrigation of smaller of agricultural areas (eg. under the the greenhouses and glasshouses) can be used all year round solar pump with a capacity of 0.6 to 2.4 m^3/mes. Problems for wider application of these solar pumps in agriculture are:

- financial and economic aspects,
- a continuous supply of energy during the whole year [7],
- no informing of agricultural producers and others.

CONCLUSIONS

From year to year reduces the required investment for solar systems (solar pump) in irrigation and the time required for the repayment of the total investment in such systems. Due to its small investment and is very of simple of equipment today is is very economical payable application of solar pumps of small capacity of from 2 to 8 l / h. In the world investments in this equipment cost effective for a few years (2-3 years).

Because of the low price of electricity in Serbia, which is still below the average in the each region, the use of these solar plant is on the verge of profitability. But harmonization electricity prices with the prices in the region, and how there would be justification of the use of solar plants for irrigation. But by adjusting electricity prices with the prices in the region, will exist justification of use of solar plants for irrigating.

Note

This paper is based on the paper presented at The Vth International Conference Industrial Engineering and Environmental Protection 2015 – IIZS 2015, University of Novi Sad, Technical Faculty „Mihajlo Pupin”, Zrenjanin, SERBIA, October 15-16th, 2015, referred here as[8].

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