ANALYSIS AND COMPARISON OF THE TRACKING SYSTEMS OF SOLAR INSTALLATIONS

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Abstract - This article discusses the tracking systems of solar plants. Overviews of existing monitoring systems, a comparative analysis of the tracking systems of solar plants through solar tracking on schedule and on the basis of the counter are presented.

Index Terms- System Of Tracking The Sun, The Solar Thermal System, Solar Cells (Sc), Solar Power, Solar Photovoltaic Power Plant (SPPP)

I. INTRODUCTION

Solar power is increasingly developing in the modern world; it is characterized by maximum ease of use, the largest resources, and environmental friendliness and widespread. These circumstances determine the solar energy as one of the most promising directions of development of renewable energy.

As known, the maximum efficiency of solar panels is in contact with it to direct sunlight. But as the sun moves continuously along the horizon, solar rays fall on the panel at an angle that reduces the efficiency of solar cells. To increase the efficiency of solar panels, following the sun systems are used, automatically rotating the solar panel to get the direct rays (Figure 1). [1]



Figure 1 - Solar heating systems with solar tracking system

Many consumers still use fixed south orientated system. Such systems are used mainly in private houses, when to the roof of an existing building, where there is no possibility to establish a tracking system, the fixed solar photovoltaic plant (SPPP) is mounted. Also, this type of installations is used in exposed to strong wind effects areas.

Figure 2 shows the experimentally obtained dependence of the photocurrent Iph on the angle of radiation incidence αi, calculated by graphical integration. The average value of the photocurrent when changing the angle of incidence from 0° to 180° can be defined as Iph. Aver. = 110 mA.

$$\varepsilon = \frac{I_{ф.max} - I_{ф.ср}}{I_{ф.max}} * 100\% = \frac{196-110}{196} * 100\% = 44\% \quad (1)$$

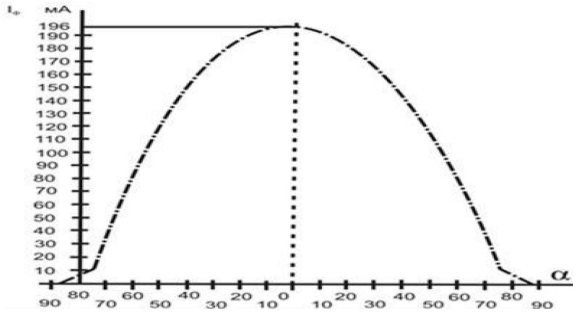

Figure 2 - The dependence of the photo transducer current on the angle of radiation incidence

Thus, if the solar power plant is stationary and oriented in the direction of the midday sun, it loses about 40% as compared with a movable solar thermal system. On the condition that the hour angle of sunrise and sunset is suitably ranging from 0° to 180°, and along the whole shining day the direct solar radiation is available. [2]

This implies that the decisive factor of SPPP efficiency is the orientation of SFPP at the light source, i.e., at the sun.

There are several ways to track the sun:

- Manual aiming at the sun;
- Passive systems (based on the programming of the algorithm of solar cell operating);
- Active systems, which have a number of different solutions.

The first method is simple, less effective, although the lack of instrumentation and a minimum of moving parts makes it the most reliable. Problems in the mechanical parts are rare. This method of orientation solar panels is rarely used, as it has the lowest accuracy, depends on the operator, and requires constant maintenance.

The passive method involves tracking the sun in azimuth and angle, based on the permanent characteristics, which correspond to the geographical place of installation of solar cells (SC). To implement this method, you must define the constant reference values to be used as a basis for calculating the actuators working in the sun tracking. The disadvantages of this device are the need of adjusting

respectively for the seasonal height declination of the sun, the complexity of the programming; the program is acceptable for only one geographical location of SC.

The greatest progress have achieved the active sun tracking systems. They are easy to use, these solutions offer complete schedule, which is adjusted by the solar tracking system. It can be assumed that an active tracking system is an autonomous solar panels control system, which can be programmed according to the cycles of the sun. The system is the most reliable among those using the electric drives, as almost never requires operator intervention. Changes to the program are made quickly, if necessary, remotely. Such systems are typically used in commercial and industrial solar power plants. [3,4]

Currently, it is understood that the computer control will be displaced, giving way to control by misalignment sensors for all types of energy solar power plants that provide high accuracy, wide capturing angle and high reliability. Driving tracking sensor without external control is able to orient the solar panel on the best light. [5]

To maintain optimum irradiance for solar tracking system, a variety of sun-tracking systems, from simple analog to analog and digital have been developed. These systems are mainly designed for changes in solar irradiance and actuated by changing the angle of illumination.

Based on the analysis and comparison, it is can be marked out that:

- The use of sun-tracking systems increases the efficiency of solar panels of solar thermal system;
- The most profitable and reliable are the active tracking systems, tracking the sun on the schedule.

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