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THE OPERATION OF A HOME SOLAR POWER PLANT SIMULATION TO THE OUTPUT INCREASE

Veriahin V. V.
Scientific director – D. Sc., prof. Antipov I. E.
Kharkov National University of Radio Electronics,. CRETISSdep.,
Kharkov, Ukraine
vladyslav.veriahin@nure.ua

Theses are about increasing electricity output from a small solar power plant, which is installed in non-optimal conditions. For part of the day, solar panels may be in the shadow of surrounding objects. The question arises: where to place and how to orient solar panels? To answer this question, a model is proposed that performs all the necessary calculations and gives appropriate recommendations. Numerical results were also obtained for a specific situation of placing solar panels.

The operation of home solar power plants has a number of features that are usually not taken into account when a high-power solar power plants designing. The first features are the energy loss in control devices, which is discussed in [1], and the second one is the non-optimal location. When designing powerful solar power plants, a suitable site is initially selected that is not obscured by extraneous obstacles. But when installing a solar panel (SP) in the courtyard of a private house, or on the balcony of an apartment, part of the sky may be blocked by neighboring houses, trees, etc., as shown in Fig. 1. The choice of direction (orientation) of SP in such cases is not obvious.

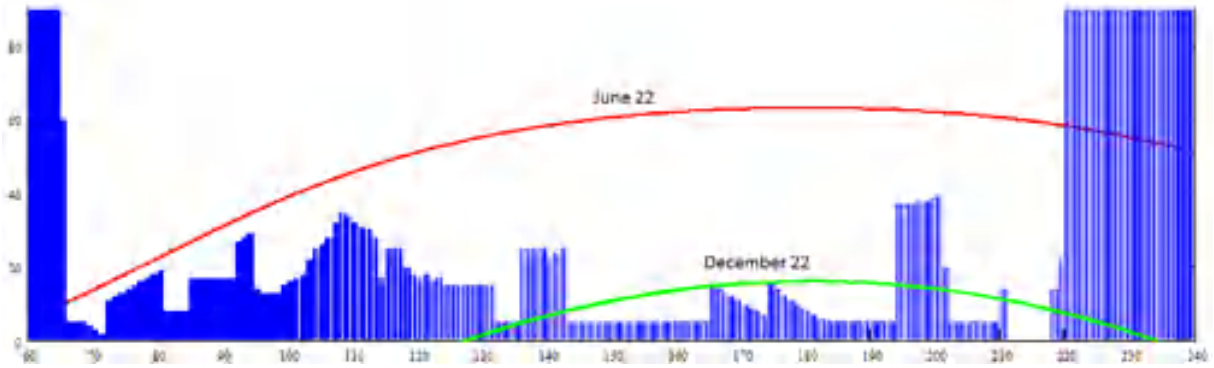

Fig. 1

A mathematical model was developed to solve the problem. The model takes into account: the latitude of the area, the daily and annual Sun movement, the solar radiation attenuation in the atmosphere depends of the Sun angle elevation, the angle between of sunlight and solar panels, the angles of closure of the sky, as well as the probability of cloudy and sunny day.

The model provides for the electricity generation calculation for each minute of a given year part for each of the given angles and each inclination and rotation of the solar panel. Its structure and required external data are

shown in Fig. 2.

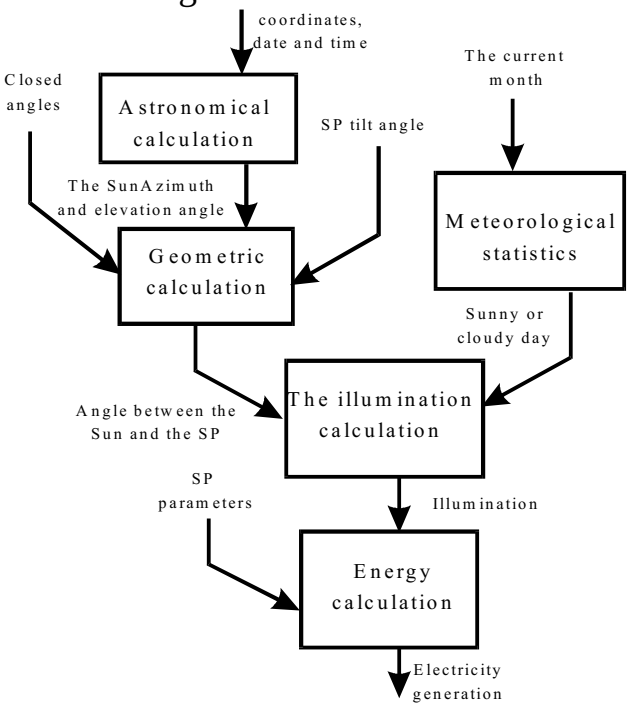

Fig. 2

On average, over a year, the monthly rotation of the joint venture gives an “increase” in production of 6%. In some months (June, November, December, January) the winnings are more than 19%.

Thus, using the developed model, data on the solar panel installation angles were obtained, providing maximum output both on average for the year and for individual months. Here are calculations for just one option for placing a solar panel on a balcony in an apartment building.But the capabilities built into the model will allow, if necessary, to perform such a calculation for any location where the solar panel will be installed. To do this, you only need to change the closing angle file and the panel orientation angles.

Data on closed sky angles is loaded into the model as a separate file. Data on sunny and cloudy days are modeled based on long-term meteorological statistics.

According to the simulation results, the optimal angles are different for each month, as shown in Fig.3. It is also clear that they differ significantly from the average for the entire year.

The electricity generation calculations were made for the conditions shown in Fig. 1. The results showed that the difference is quite significant.

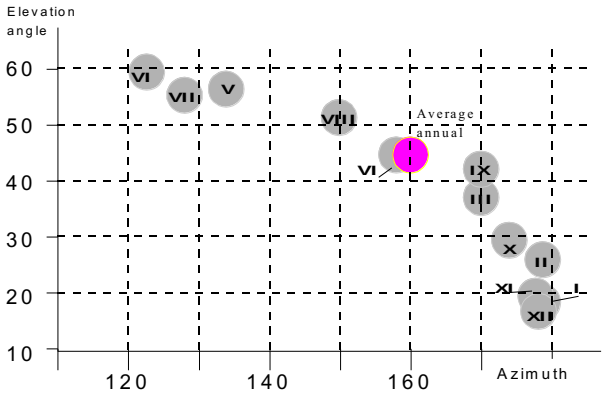

Fig. 3

Reference:

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