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PREDICTION OF ENERGY EFFICIENCY OF PHOTOVOLTAIC PANELS IN LVIV

Along with other devices generating electrical energy (EE) from renewable energy sources, photovoltaic (PV) panels have several advantages, including: simplicity in design, construction, low weight and size, long life. The main disadvantages of using solar cells are their low efficiency, instability of receiving of EE due to weather conditions and the dependence of output power from the angle of incidence of sunlight on a panel. The value of the output power of solar cells depends on the locations and orientation of the panel, the angle of inclination of the panel, weather conditions, environment, season, time of day and other factors.

To get a clear picture of the work of PV panels and predict the amount of EE generation by it, it is necessary to have weather data for the region, where this panel is set, such as insolation and environment temperature at least for a period of one year. For this purpose, an electronic database of hourly meteorological data for 2013 year for the city of Lviv was formed, which includes hourly values of dispersed, direct and total insolation and hourly values of environmental temperature. Using this framework, it is possible to solve a number of useful tasks, such as: obtaining of the optimum parameters of solar cells location at which the largest value of EE will be generated during the year, finding the optimal value of tilt angle of PV panels at a given orientation (ie the azimuth of panel orientation are known in advance).

The algorithm of calculating of solar radiation arrival on arbitrary oriented in space plane was created based on the established database. It is shown how to estimate the annual amount of EE generated by particular PV panel, set in some specific location in Lviv, considering the total annual inflow of solar radiation and having that PV panel nominal parameters.

Our calculation shows that the optimal placement of PV panels for the city of Lviv is their orientation to the south with a deviation to west which equals 3°, and the optimal value of tilt angle of the solar cells in relation to horizon is 49°.