Studying new solar tracking strategies to maximize electric production

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Solar tracking designed by the University of Cordoba. Credit: Universidad de Córdoba

From making a small calculator work to generating energy to produce the entire output of an important brewery, solar energy has been undergoing significant growth in recent years, taking the place of nonrenewable energy resources that negatively affect the environment.

In addition to producing clean energy, solar plants can be adapted to different sizes and allow for self-consumption. Over the last few years, their profitability as compared to other kinds of energy has become increasingly greater due to the lowering of prices of the materials used and the continued optimizations that have been applied stemming from research in the science and technology sector.

The University of Cordoba chose to continue improving upon the technical services at solar plants by focusing on some of the still existing disadvantages: the high variability of solar resources and the shadows that are cast among the collectors. Specifically, they focused on photovoltaic plants, those that convert solar light into electricity.

At photovoltaic plants, it is common to use two-axis solar trackers. "These trackers are inspired by sunflowers and they seek to maximize solar light collection by the movement of the photovoltaic modules. However, this movement can create partial shadows among the modules, which negatively affects energy production," explains Luis Manuel Fernández Ahumada, one of the researchers working on the study.

This research integrates two methodologies that were undertaken in previous studies. On the one hand, a mathematical model was created to optimize the collection of solar light, applicable to isolated trackers. On the other hand, using a simplified geometric model, they were able to characterize possible shadows among the trackers.

Having done this analysis, specific design recommendations were proposed that were studied at photovoltaic plants with two-axis tracking systems located in Cordoba. Using the backtracking technique, the panels followed sunlight as they are programmed to do and, when they detected that one could cast a shadow on others, they backtrack, and thus avoid casting shadows upon each other.

"It was proven that with this tracking strategy, these plants could produce at least 2% more energy annually," points out Luis Manuel Fernández Ahumada. Hence, this maximizes the performance of one plant compared to others that do not account for energy loss from shadows being cast among panels.

This study is framed in the Solar Energy Assessment and Planning Tool (SEAP) service within CLARA project that aims to create an ecosystem of services to use weather forecasting data in order to improve processes. Funded by the European Union in the area of the program Horizon 2020, the project is carried out by a European consortium made up of universities, regional governments and businesses. The SEAP service focuses on improving photovoltaic production and is coordinated by the University of Cordoba, participating via the TEP-215 Physics for Renewable Energy research group.

The group continues to work in the field of optimization of solar plants. Currently, they are working on making sensor devices that provide the optimal positioning for solar trackers in real time in order to maximize energy production without creating shadows. In another line of work, they are studying the use of weather forecasting in creating strategies to get optimal solar tracking that will produce the maximum amount of energy possible.

More information: L.M. Fernández-Ahumada et al, Influence of the design variables of photovoltaic plants with two-axis solar tracking on the optimization of the tracking and backtracking trajectory, *Solar Energy* (2020). DOI: 10.1016/j.solener.2020.07.063

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