Doctoral Thesis Title: Development of a tool for the optimization of earthworks in large photovoltaic plants, and evaluation of losses associated with topography.

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Abstract

In the context of large-scale ground-mounted photovoltaic projects, earthworks are becoming increasingly important, mainly due to the use of trackers and soils with more complicated topographies. Not only are they an important item in the budget, but their correct execution depends on the optimal positioning of the structure, and has an influence on the shadows that affect the panels and their energy production, as well as on the hydrological behavior of the plant.

Generally, flat lands are sought, where the orography is not problematic, but due to the increase in the size of the parks and the occupation of the best lands, there are more and more projects that present complex topographies. There are few tools on the market that provide an optimal solution to the problem and even fewer that are specifically designed with this problem in mind.

The aim is to explore the potential of different algorithms to generate optimal solutions from a constructive point of view and with a positive impact both economically and in terms of project time.

The main objective will be to identify which algorithms produce valid solutions and what degree of quality they provide. To meet this objective, first of all, the problem must be adequately characterized and appropriate tools must be developed for the implementation and analysis of the different algorithms.

In addition, and given the industrial nature of this proposal, it is intended to generate a tool for the implementation of this know-how that can be used by personnel from engineering companies.

This tool should meet the following requirements:

- Allow both the manipulation of solar structures in a comfortable and manual way and the application of optimization algorithms that generate valid solutions for the set of them within a plot in an automatic way.
- Precise calculation of the required volumes of cut and fill.
- Generate the output files necessary for the creation of the planimetry.
- Calculate certain parameters typical of solar structures (e.g. pile-driving length).
- Using ray-tracing algorithms, identify shading zones and their approximate impact on production.
- Identify low points that may cause problems in topography.

Available Means: All means of Grupotec Servicios Avanzados (specialized software, internal know-how...) and of the Departamento de Ingeniería Cartográfica, Geodésia y Fotogrametría (laboratory equipment, software licenses etc...) from the UPV.

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