SOLAR ENERGETIC POTENTIAL ANALYSIS FOR THE BUILDING OWNED BY SC. SUNMED CLINICS S.R.L.

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***Abstract**: The problem of sustainable energy sources is one of the main discussion themes around the globe at this moment. The energy production of traditional methods have a big negative impact on the planet. This analysis will offer valuable information about electrical energy production potential, and even an estimation of the time required for the investment to pay for itself.*

***Keywords:** solar energy, GIS, AutoCAD Civil 3D, Autodesk Revit*

1. Introduction

The problem of sustainable energy sources is one of the main discussion themes around the globe at this moment. The energy production of traditional methods have a big negative impact on the planet. The undisputed importance of the subject comes mainly from the fact that the pollution level of the atmosphere overcomes the pollution levels from 1000 years ago by 100 times (figure 1). The increasing levels of CO2 in the atmosphere causes the „greenhouse effect" which increases the overall climate temperature. These changes in temperature cause ecologic imbalances and, in the same time, severe economic imbalances. According to IPCC (Intergovernmental Panel on Climate Change) study, one of the main causes of global warming is the atmospheric pollution with "greenhouse effect gasses". If this process isn't stopped, by the end of 21'th century, the overall temperature will rise by 5.8 degrees Celsius.

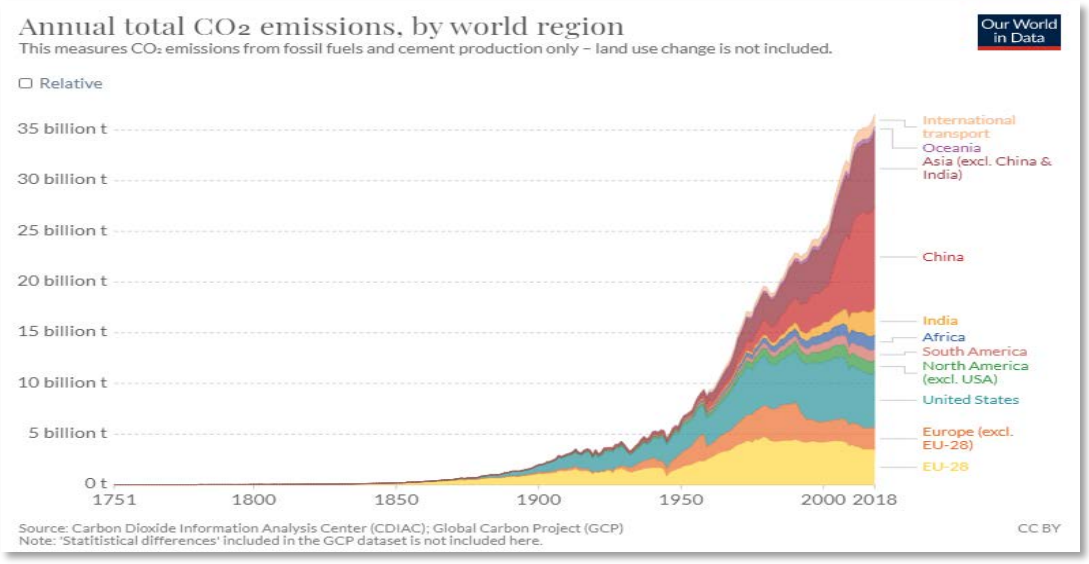

Fig. 1. CO2 atmospheric concentration variation, period 1951-2018

An accessible energy source is solar energy. The Sun is a permanent and non-polluting energy source. One good method for making use of this energy source is by conversing solar energy into electrical energy using solar panels. The main objective of this case study is to provide a set of useful information concerning the best option for mounting solar panels, according to the construction positioning, for obtaining the best efficiency.

2. Materials and Methods

The 3D model of the subject building for the study was made by using a technique which has as central point the extrusion of 2D polygons, combined with moving the UCS (User Coordinate System).
The 3D model was created using the AutoCAD Civil 3D software, for the building owned by SC. SUNMED CLINICS SRL From Gârbesti village of Țibana, county of Iași. (figure 2)

The data necessary for making the 3D model of the building was obtained from topographic plans and scale plans for every level of the building. This data was concerning the footprint dimensions of the building, topographic positioning coordinates of the footprint contour, different construction parameters like wall thickness, overall height of each building level, the positioning of windows and doors, etc.

The main method for the 3D model making was 2D polygon extrusion. The 2D polygons were representing various constructive elements like walls, staircases and other construction elements. The 2D polygons were obtained by georeferencing of the scale plans and filtering of the needed elements by manually removing the other elements of the plan. (figure 3).

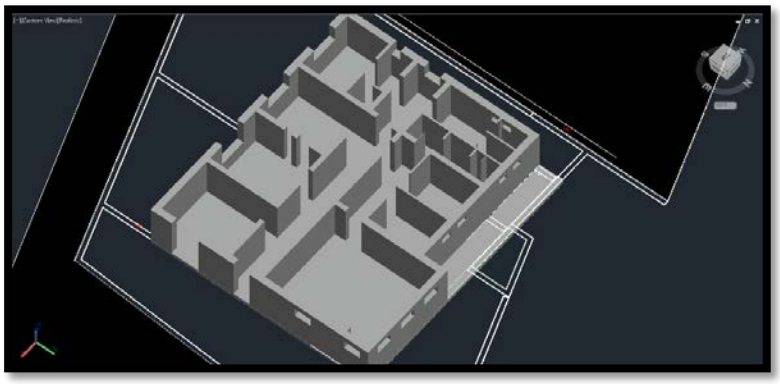

Fig. 2. Incipient stage of the 3D model showing the first floor walls

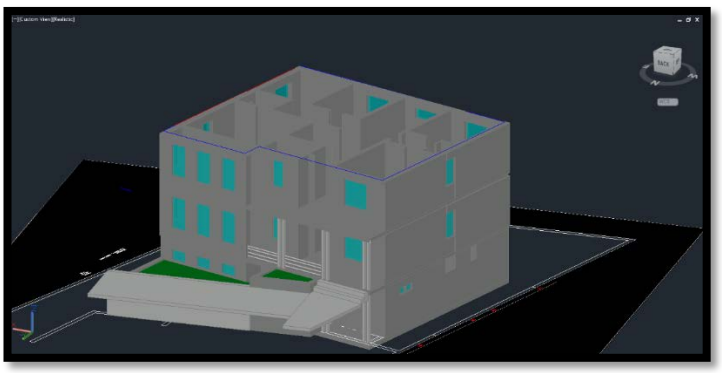

Fig. 3. Building 3D model last stage

The solar analysis was made using the Revit software and the first main objective in preparing the data for analysis was to import it from Civil 3D without modifying any parameters like form, dimension and positioning.

For the first step of the analysis was a point on the world map the building position in Revit for the software to be able to calculate the Sun's trajectory for the timeframe selected for the study.

Although the 3D model has attached geographical coordinates, the software needs the user to select on the map the position of the building. The accuracy of this selection of the interest zone is much lower than the accuracy given by the geographical data attached from the model, but for this case it doesn't play such great importance, given the fact that it cannot influence the Sun's trajectory enough to create any notable differences. (figure 4)

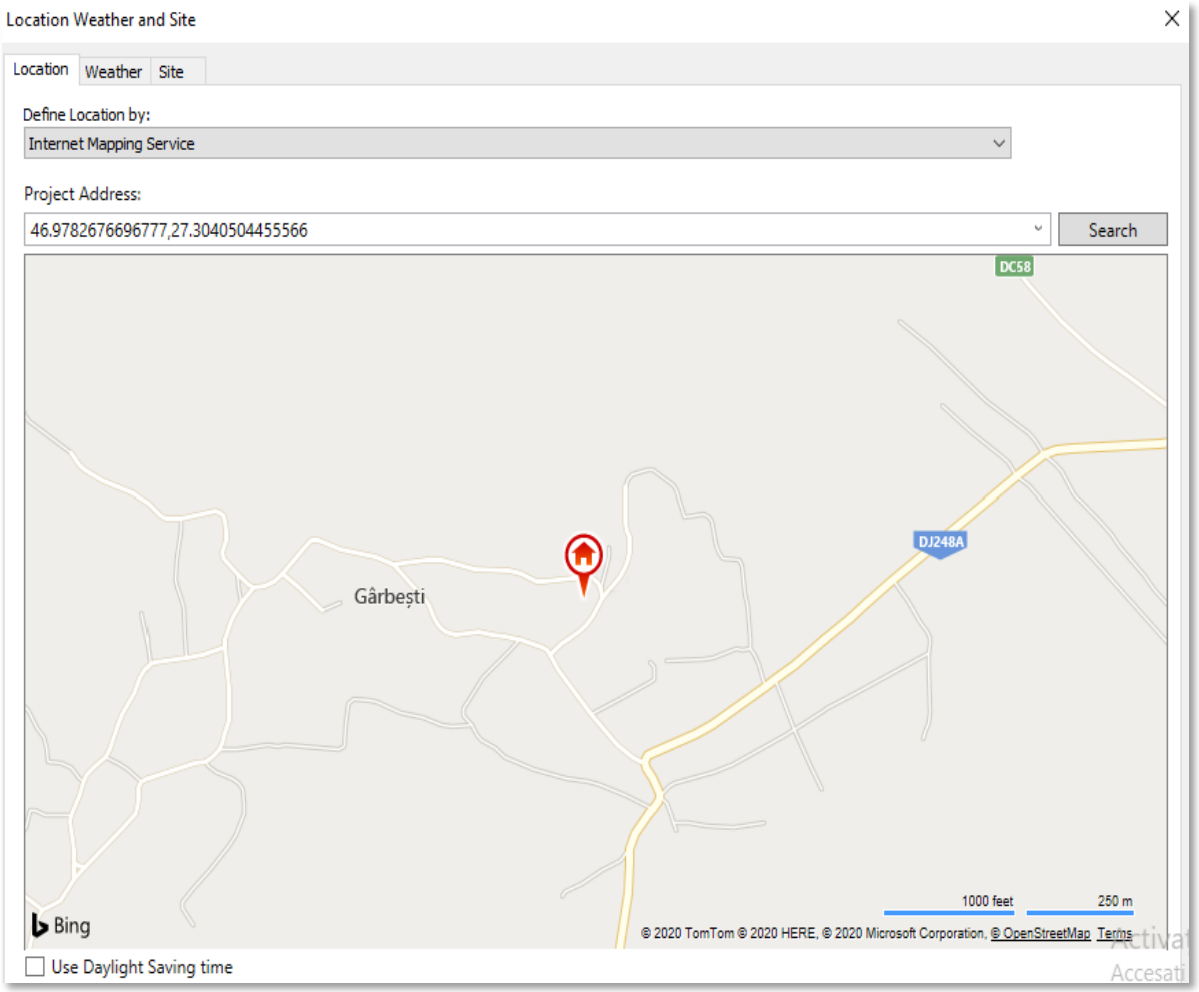

Fig. 4 – World map selection window in Revit

For the Revit analysis it was selected as study type „Solar Energy-Annual PV", this type being the most adequate for the project. (figure 5)

For the "Surfaces" option it was selected the "user selection" option which permitted manual selection for the surfaces of interest for our study.

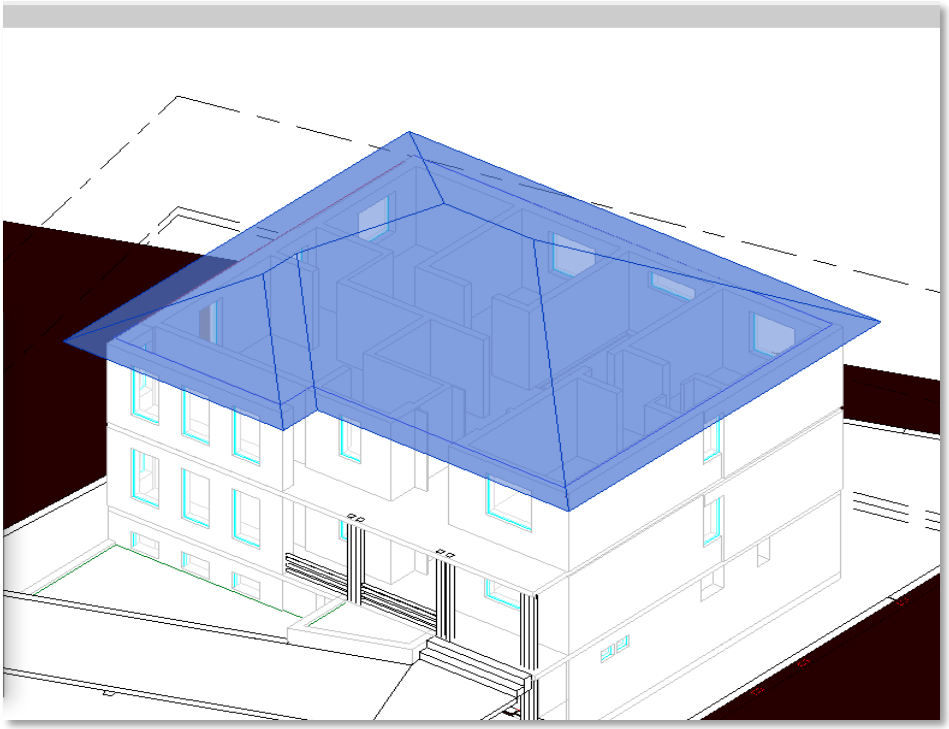

Fig. 5 – Selected surfaces for the analysis

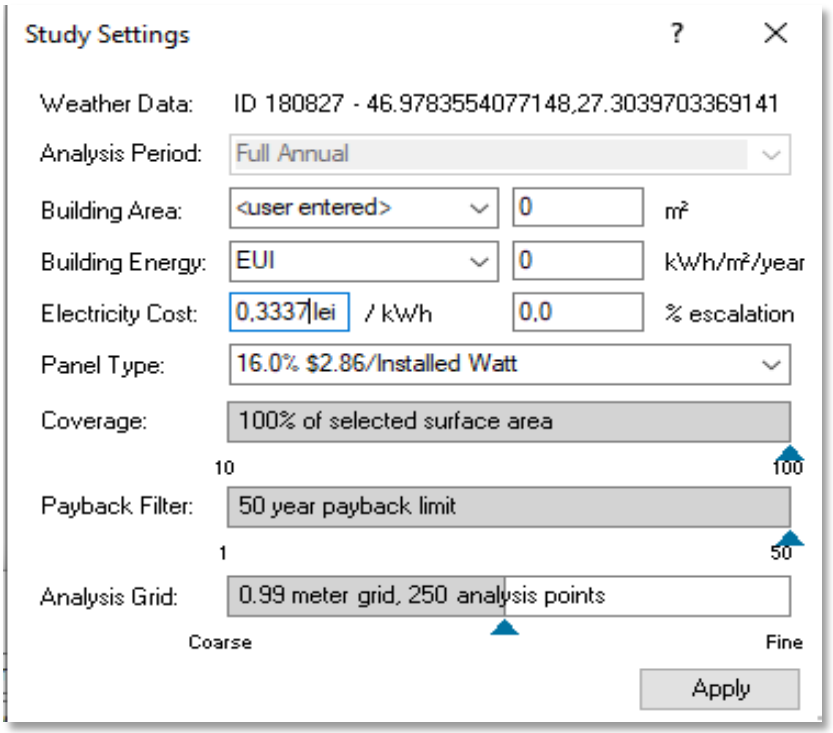

Fig. 6 - „Study Settings” window

As an additional setting for this study, in the "Study Settings" window the user can also set parameters like the Kw/h price in the designated area, which in our case was set at 0.3337 RON. This is one key parameter that is needed for the program to calculate the money savings generated by switching to solar panel energy. (figure 6)

3. Results and discussion

After running the Revit analysis, the results were shown visually by coloring the various surfaces of the roof in suggestive colors according with the intensity of the solar radiation potential for each one of them. (figure 7) The coloring of the surfaces was made incrementally starting with blue for the surfaces with lower energy potential, continuing to yellow and finishing to red for the surfaces with the most solar energy potential. (figure 8)

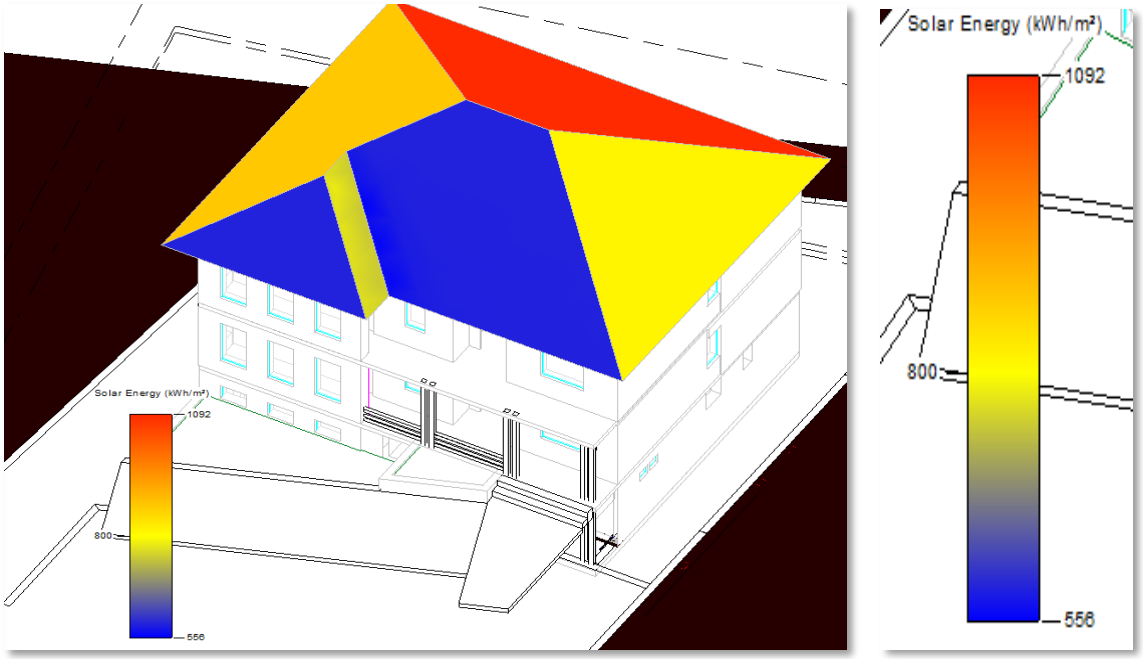

Fig. 7. The analysis result for the roof surface

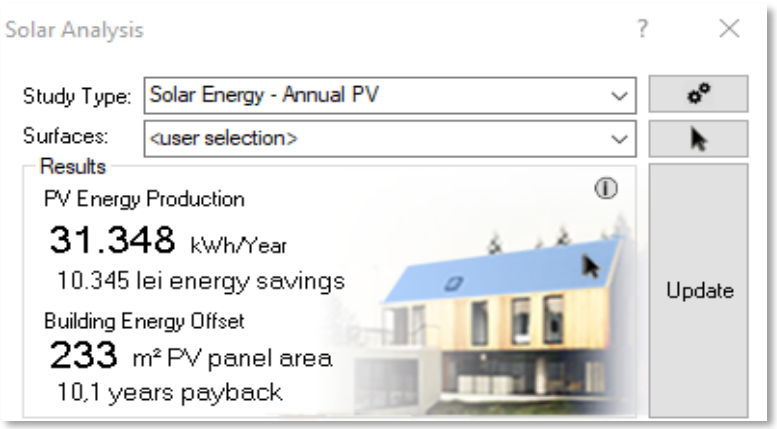

Fig. 8. The solar potential analysis result panel

Also, the analysis generates a panel report showing the overall energy production potential for the entire year, and the payback period of the investment, as well as the necessary solar panel surface for the selected areas of the roof.

4. Conclusion

The solar energy potential analysis makes possible the visualization of the best placement areas for the solar panels. This type of analysis comes in handy, as in this particular case, when the client wants to install solar panels on a building that is already built, and it also could be useful in incipient stages of the project, being capable to help determine the best position for an entire house in order to obtain the best energetic efficiency.

Given the fact that it can generate data in familiar units like Kw/h and even generate a conversion of this in money, we can consider this type of application as very easy to interpret by the client and oriented for wide scale use

5. References

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