Solar cadaster of Nantes metropole based on high resolution solar mapping at urban scale from 10 cm digital surface model for rooftop PV development

D Callegari, N. Bodereau, M Bourgeon, A. Ebel, E Dion, M Force, E Séguin, Etienne Wey, Laurent Saboret, Benoît Gschwind, et al.

Solar cadaster of Nantes Metropole based on high resolution solar mapping at urban scale from 10 cm Digital Surface Model for rooftop PV development

Callegari D.[1], Bodereau N. [1], Bourgeon M. [1], Ebel A. [1], Dion E[2], Force M [2], E. Séguin[3], E. Wey[4], L. Saboret[4], B. Gschwind[5], P. Blanc[5]
[1]ISWT 2.0, 42 avenue Alexandre 92000 Nanterre
[2]Nantes Metropole, 2, Cours du champ de Mars 44923 Nantes Cedex 9
[3]Institut National de l'Information Géographique et Forestière, 73 avenue de paris, 94165 Saint-Mande[4]TRANSVALOR, Parc de Haute Technologie, 694 Av. du Doc. Maurice Donat, 06255 Mougins
[5]MINES ParisTech, PSL Research University, Centre for Observation, Impacts, Energy, CS 10207 - 06904 Sophia Antipolis, France

Objective & Background

Rooftop PV systems in urban areas are very interesting because (1) they do not emit pollutants nor GHGs during their exploitation, (2) they produce electricity where this electricity is consumed and (3) they add value to unused urban roofs. Solar resource assessment and mapping at the urban scale will thus be crucial to develop solar cadasters – which are meant to analyze the solar potential on roofs, help public or private decision-makers and investors, as well as promote the development of rooftop PV systems in these urban areas.

This communication presents the high-quality and innovative solar cadaster for Nantes Metropole, developed by the French startup In Sun We Trust. This solar cadaster provides a free, accurate and easy-to-use tool for the general public to assess solar potential of rooftop PV systems in the 30 km x 30 km region of Nantes Metropole, in the North-West part of France.

Method

The development of this solar cadaster has required:

- a high-quality long-term solar resource dataset. We chose the database Helioclim-3, which provides solar irradiation data from satellite observations (www.soda-is.com). To improve the accuracy of our cadaster, we calibrated this dataset with local *in-situ* pyranometric measurements from Météo France;
- a decametric digital terrain model (DTM) to describe the orography (SRTM, srtm.csi.cgiar.org);
- a high-accuracy 10 cm digital surface model (DSM) to provide 3D description of buildings, vegetation and superstructures. This DSM has been provided by the IGN French national mapping agency, using aerial images correlation;
- a high-accuracy map of buildings to provide location and contours of corresponding roofs. We chose to use BDTOPO provided by IGN.

We developed a specific algorithm to detect on roofs 1 m^2 planar patches without local superstructures, from the DSM. This algorithm also estimates the angular orientations of each patch. Additionally, we created an optimized algorithm to compute the local shadow mask for each detected patch. This algorithm uses several levels of details from the DSM and the DTM. With the local shadow mask, the angular orientation and the calibrated Helioclim-3 datasets we computed the long-term average of monthly sums of solar global irradiation. Finally, from these solar irradiations we infer energy production, environmental metrics and finance metrics to assess the potential of rooftop PV systems using simulation models.

Conclusion

The solar cadaster developed by In Sun We Trust for Nantes Metropole with the support of TRANSVALOR, IGN and MINES ParisTech is now operational and is available at nantes-metropole.insunwetrust.solar for free. In addition to the innovative methodology used to produce this solar

cadaster, the funding method is also innovative. It is not solely based on public funds, but also partly supported by a business model with local selected PV installers, who are connected with potential clients thanks to the solar cadaster. It is believed that this first innovative solar cadaster will be used as a basis for future solar cadasters, to help every citizen and to promote rooftop PV systems in urban areas.