

Massive deployment of photovoltaic systems in urban environment: From solar resource modeling to the multicriteria evaluation of the PV-suitability.

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Task 63³

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A massive deployment of solar systems in the urban environment is expected in coming years. To that aim it is necessary to provide reliable models and tools to sustain this deployment. In this presentation, two work will be presented, a comparative study of the tools for urban modelling of the solar resource, and a multicriteria decision aiding approach to assess the PV-suitability in urban context.

First a comparative analysis of ten tools used to evaluate the solar irradiation in urban environments will be presented This study is conducted in the framework of the International Energy Agency task 63. The focus here is on the vertical surfaces (i.e., façades). The analyzed tools have a large range of applications, from detailed microclimate studies to large-scale irradiation modelling. The benchmark tests consist in simulations using two conceptual urban designs. Two representative winter and summer days are defined. The results, obtained for the modelling of the shortwave irradiance received on the facades, are discussed and the observed differences discussed. In addition, the tools are compared based on their performances (calculation time), and their workflows. This work is conducted in the framework of the International Energy Agency task 63 and gather the contributions of numerous experts from four countries, seven universities, one companies and one research institute.

The modelling of the solar resource is necessary to asses the viability of urban PV systems. However this information is insufficient to have a comprehensive overview of the feasibility of a urban PV project. He re we propose a multicriteria approach in order to evaluate the suitability of a building to be equipped with Photovoltaic (PV) systems (sometime called the PV-suitability (or PV-feasibility)). In the present case, technical (roof complexity), economic (levelized cost of energy), environmental (CO2 reduction), energetic (self-consumption) as well as social (heritage constraint) are considered. These criteria are evaluated for each building of the Greater Geneva Agglomeration (GGA), a cross-border French-Switzerland territory of nearly 270 000 buildings. Then a multicriteria methods, ELECTRE TRI, allows to sort these buildings in three categories, A,B and C, that respectively corresponds to “Very High”, “High”, “Moderate” PV-suitability. Large differences are observed within the 210 municipalities of the GGA as some of them have almost no A-ranked buildings whereas others have more than 30% of them. Finally it is showed that by prioritizing the A-ranked buildings, 50% of the annual electricity consumption of the GGA could be produced by PV systems.