

Accepted Manuscript

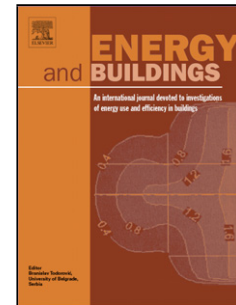
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PII: S0378-7788(17)31496-2
DOI: <https://doi.org/10.1016/j.enbuild.2017.10.027>
Reference: ENB 8046

To appear in: *ENB*

Received date: 2-5-2017
Revised date: 7-9-2017
Accepted date: 5-10-2017



Please cite this article as: Stefano Pili, Giuseppe Desogus, Davide Melis, A GIS tool for the calculation of solar irradiation on buildings at the urban scale, based on Italian standards, *Energy and Buildings* <https://doi.org/10.1016/j.enbuild.2017.10.027>

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A GIS tool for the calculation of solar irradiation on buildings at the urban scale, based on Italian standards.

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Highlights

- The Italian EBP calculation is based on a tabular methodology to assess solar irradiation on urban buildings
- The evaluation of the necessary input obstruction angle relies completely on the energy certifiers
- A questionnaire survey is carried out to assess the most adopted assumptions on its calculation
- A GIS tool is proposed to make an objective calculation that complies with legislation procedures
- The results are tested with a solar simulator

Abstract

The development of tools for urban environment analysis and representation, as a support for energy retrofitting and urban renewal designing strategies, is a prominent issue for the transition to more sustainable and resilient settlement patterns. This paper aims to develop and test a GIS-based tool for the calculation of solar irradiation, as a factor of the building energy performance, by applying, at the urban scale, the simplified method of the international standard (ISO 13790:2008) proposed by Italian specifications (UNI TS 11300: 2008-2014). This standard is a common cultural reference for technicians, practitioners, decision makers and ordinary citizens because it is the basis for the calculation of Energy Performance Certificates (EPC) for buildings. The standard physical model is simplified, but requires some base data that practitioners have to define from their expertise by an in-situ survey. So the adaptation of the calculation of solar irradiation according to the standard at the urban scale needs some simplifications and typological approaches related to the availability of base data. A simple and repeatable standard consistent methodology for the calculation of the solar irradiation on building surfaces has been developed, adopting commonly available base data on urban morphology such as topographic maps or Digital Terrain Models.

A summary on the state of the art of GIS tools for urban solar analysis and the standard algorithms for the calculation of the solar irradiation is also provided. For the study of the practitioner's approach in the use of the standard calculation a questionnaire is set up. The work then illustrates the methodology approach adopted for the tool developing and testing. The discussion focuses on the compliance of the results with standard calculation and on solar irradiation values reliability. Such consistency has been assessed via a sensitivity analysis based on different ideal cases. In order to assess the reliability of the results of the GIS tool, a comparison with the values obtained from a dynamic solar simulation environment (Daysim) is performed.

1 Purpose and theoretical context

Among the EU strategies and actions for achieving the 20-20-20 target (EU 2010)[1], the research for the improvement of the sustainability of urban settlements has a leading role. The process for energy efficiency or, more broadly, for the sustainability improvement of the built stock is not just a technological optimisation process, but involves decision-makers, investors and individual citizens. In order to promote and regulate such wide and complex renovation process, local authorities, i.e. decision-makers, must have the knowledge and tools to design plans or programmes able to integrate the energy paradigm in more holistic urban regeneration approaches [2, 3, 4, 5]. Tools must represent a physical phenomenon using a language that

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