

Importance of the ground-albedo inside an urban canyon and potential increase of irradiation on building walls

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Energy demand in cities is continuously increasing. For the demand of electricity this will also result in an increased number of photovoltaic installations inside the cities. The yield is mainly depending on the available solar resource. Especially inside the urban environment, one way of artificially increasing the irradiation onto building facades is by increasing the surface albedo of either pavements or walls. That, however, also has an impact on the urban climate.

For the assessment of the solar resource multiple tools are already available. Though, those tools are still quite simplified. One very important issue, especially inside the urban environment, is the estimation of radiation reflected from ground and wall surfaces.

The relevance of reflected irradiation inside a street canyon was estimated and the impact of increasing the ground's albedo was assessed during a study. Measurements were taken inside an approximately 15 m wide urban canyon in Vienna. Also, the ground's albedo was increased temporary to 0.77 on a limited area of about 30 m². The irradiance onto a south-facing wall was measured in 3.5 m above ground. In addition, the irradiation was estimated using the view-factors onto the ground, walls and the sky and considering multiple reflections up to two times.

The measurements during the end of August 2016 show that the increase of the ground's albedo results in about 13.8 % higher irradiation on the wall point. The estimations using view-factors show agreement with the measurements. Further, the estimation was done for an increase of the ground's albedo from 0.13 to 0.5, corresponding to bright concrete, and at a wall point in 12 m above ground. In that case, the irradiation was increased by 7.4 % compared to the situation with asphalt.

This shows that radiation reflected from the ground inside an urban canyon is a relevant portion of the total irradiation. In addition, increasing the ground's albedo has a significant impact on the yield of photovoltaic installations on facades, but also on the climate. Finally, it is concluded that the reflected irradiation should not be estimated in the simplified way as it is state of the art. Inside an urban canyon this causes an overestimation of the reflected irradiation component. Therefore, improved algorithms for the estimation of the solar resource inside the urban environment are required.