

A Study on The Relationship between Building Façade and Solar Energy Utilization Potential in Urban Residential Area in West China

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Abstract : Along with the increasing density of urban population, solar energy potential of building facade in high-density residential areas become a question that needs to be addressed. This paper studies how the solar energy utilization potential of building facades in different locations of a residential areas changes with different building layouts and orientations in Xining, a typical city in west China which possesses large solar radiation resource. Solar energy potential of three typical building layouts of residential areas, which are parallel determinant, gable misalignment, transverse misalignment, are discussed in detail. First of all, through the data collection and statistics of Xining new residential area, the most representative building parameters are extracted, including building layout, building height, building layers, and building shape. Secondly, according to the results of building parameters extraction, a general model is established and analyzed with rhinoceros 6.0 and its own plug-in grasshopper. Finally, results of the various simulations and data analyses are presented in a visualized way. The results show that there are great differences in the solar energy potential of building facades in different locations of residential areas under three typical building layouts. Generally speaking, the solar energy potential of the west peripheral location is the largest, followed by the East peripheral location, and the middle location is the smallest. When the deflection angle is the same, the solar energy potential shows the result that the West deflection is greater than the East deflection. In addition, the optimal building azimuth range under these three typical building layouts is obtained. Within this range, the solar energy potential of the residential area can always maintain a high level. Beyond this range, the solar energy potential drops sharply. Finally, it is found that when the solar energy potential is maximum, the deflection angle is not positive south, but 5 °or 15°south by west. The results of this study can provide decision analysis basis for residential design of Xining city to improve solar energy utilization potential and provide a reference for solar energy utilization design of urban residential buildings in other similar areas.

Keywords : building facade, solar energy potential, solar radiation, urban residential area, visualization, Xining city

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020