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Cost impactful borehole thermal energy storage for multifamily buildings

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Borehole thermal energy storage (BTES) has slowly emerged in heating dominated regions as a cost effective means to utilize solar energy. A handful of applications worldwide have been reported. In this study, a large-scale BTES system is uniquely designed and developed as a retrofit solution for an apartment complex in the Midwest US Historical interval electrical and water demand data for this site was used to estimate real time heating and hot water demand needed to develop an optimal BTES system. In analyzing the BTES system, normal design considerations associated with the optimal spacing of the boreholes was relaxed in order to potentially develop a more compact BTES that would be needed for retrofit applications. Ultimately, a typically-recommended borehole spacing of 20 feet was not shown to be optimal. In addition, the impact of BTES use on real-time grid demand was considered, in order to quantify the impact of BTES use on grid power cost. The results emerging are striking. The cost-optimal BTES system designed offers an internal rate of return (IRR) of 29.3%, while reducing apartment-wide carbon by 46%. Moreover, were the apartment complex owner to implement this project, they would be able to advertise the apartment as "green". A higher rental fee would be likely.

Biography

Rodwan Elhashmi is a PhD candidate in Mechanical Engineering. His research has focused on developing economically feasible deep energy reduction in multifamily residences. His research has involved leveraging unit level real-time or interval metering of power and water consumption; optimization of stored solar energy systems to meet all heating and water heating needs in multifamily residences; and application of machine learning approaches to both estimate and actualize occupancy-driven energy reduction.

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