Abstract

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Department/Program: Renewable Energy Program

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Title: Ground Source Ventilation and Solar PV towards Zero Carbon Houses in Riyadh

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Abstract:

While renewable energy technology is developing in the Kingdom of Saudi Arabia (KSA), and the ambitious 2030 vision encourages the shift towards more efficient and clean energy usage. The research on the application of geothermal resources in the residential use for Saudi Arabian context will contribute towards a more sustainable environment. This papers main goal was to investigate the possibility of achieving a zero-carbon house in the capital city of Riyadh, by applying a ground coupled system into a current sustainable house that uses a grid-tied solar system. The current house was built and designed by King Saud University for the 2018 Solar Decathlon Middle East competition. However, the house failed to reach zero-carbon operation due to the high cooling demand. This study redesigned and validated the house using Revit and Carriers Hourly Analysis (HAP) software. After that, a ground source ventilation system was designed using the GCV Tool to reduce cooling loads. After the application of the ground source system, the new electrical loads were compared with the current house. Finally, a simple economic analysis that includes the cost of applying the ground source system was reported. The findings of this study indicated that the current solar house with all its features is not capable of reaching zero-carbon using a ground-coupled ventilation system. Further findings showed that zero-carbon is only possible if current design changes were made, such as electrical appliance schedules. The same findings showed that there is no feasibility of building such a house, since the main purpose was to compete for a contest. However, the findings suggest that if the same GCV system designed in this study was applied to typical houses, there might be better

economic feasibility. While cooling in the residential sector is the dominant energy consumer in the Gulf region, this work will certainly help in moving towards using renewable sources to meet those demands. This paper was limited to the current built house and has not changed any design features except for the addition of the ground source ventilation system.