A Cost-Benefit Analysis of Innovative Energy Efficiency Techniques on Existing Structures

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Abstract

Most older buildings in New England are energy inefficient and lack the latest energy-saving innovations. WPI's Sanford Riley Hall certainly is one such building. A computer modeling software was used to analyze a variety of new technologies that could be used to retro-fit buildings like Sanford Riley Hall in order to make them more energy efficient. This project examined non-intrusive modifications such as aerogel windows and cool roof technology along with industry alternatives. Our results showed that significant savings can be made by replacing the current windows with Triple paned argon windows.

Background

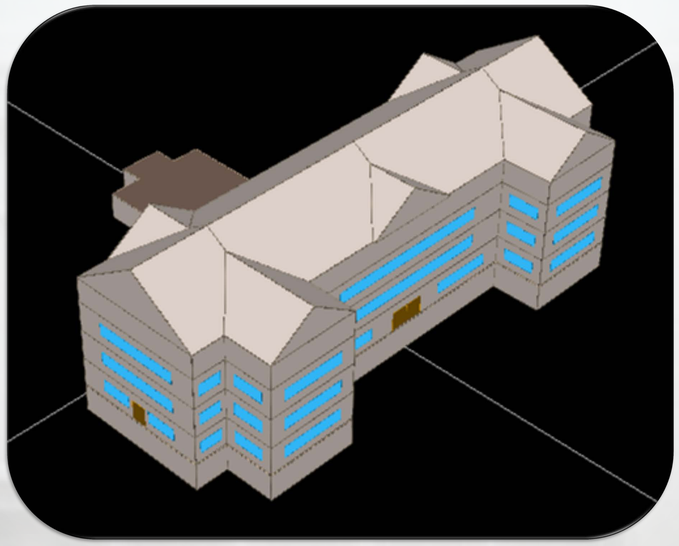
Buildings in older areas such as New England are vastly outdated in terms of their energy efficiency with regards to heat (heating in the winter and cooling in the summer). The majority of the lost heat escapes through the windows and the roof. The problem with optimizing heat efficiency is that most solutions aren't cost effect enough to offset the cost of the more efficient technology. Aerogel windows minimize heat transfer and maximize solar energy transmittance. Cool-roof technology optimizes the roof's color to suit the climate.

Project Goals/Objectives

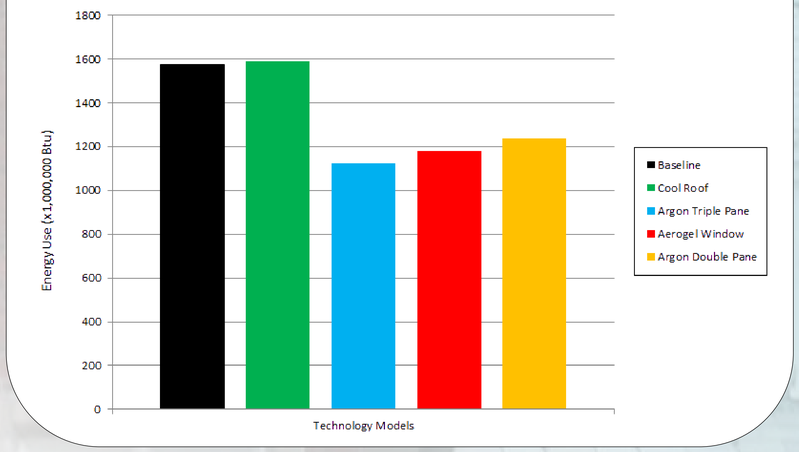
- To analyze two separate innovative technologies (Aerogel windows and cool-roof technology)
- To do a cost-benefit analysis of these technologies vs. existing alternatives.

Methods/Process

•Measured the Size of Riley hall, and using Google Earth to find a bird's eye view as a frame of reference, measured the lengths of all walls. Also used Google Earth to study the specific style that the roof of Riley hall was built with.
•Input the measured Data into eQuest, and created a model of the building.
•Ran multiple simulations on the model, each time altering the materials that the roof and windows were made out of.
•Generated enough data to account for each of our proposed solutions.
•Calculated the cost to heat the building in a year for each scenario.
•Found the cost of heating the building for each scenario, and compared the potential money each scenario would save with the amount of money it would take to implement each scenario.



Energy Usage in Each Model



Conclusions/Recommendations

•From a cost perspective, Aerogel windows are only a feasible investment if the cost of the multimillion dollar autoclave isn't included.
•The roof seems to not have any notable effect on the cost of heating .
•Our results concluded that Triple pane argon windows are the most efficient.
•We recommend using traditional roofing techniques and triple pane argon windows for maximum savings.

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