Urban Microclimate Analysis

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ABSTRACT:
This project is an exploration on building environmental performance. On it we will use different advanced simulation tools like DesignBuilder and Climate Consultant to analyze a recommended building. We are focusing on the Mamakating Visitor Center in Sullivan County, New York as our case study. Our first studies included analyzing the site conditions and elements such as wind, sun, climate, and weather. We studied the environment surrounding the building and its climate using the two software mentioned above. We found that during the winter, we should block the wind and get more sun in. However, in the summer, we should increase the wind and provide shadows to make it a comfortable place. From the site analysis we moved on to explore various materials that can be used in the walls and windows to simulate energy in order to reduce the amount of energy consumed by the building and make it more sustainable.

INTRODUCTION:
Climate Analysis is the most significant environmental factor architects and engineers need to take in consideration when designing a building. The study of the climate determines the most effective strategies for a building site. The climate of a site impacts the building design and many other aspects like the indoor temperature, human thermal comfort, and the calculation of the energy loads of a building.

URBAN MICROCLIMATE ANALYSIS
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CLIMATE ANALYSIS:

HEAT TRANSFER:
The exterior walls of the building will experience heat transfer due to the exposure to the weather. On the other hand, the adiabatic walls towards the back of the building don’t experience any heat transfer due to their adjacency to the existing building.

EUI for entire year = 175.77 Kbtu/ft² ; Net site energy = 63.19 Kbtu/ft²

SHADOWS STUDY:
The effect of shadows in a building can significantly impact its thermal performance. Shade is usually required in the summer while in the winter sun is desirable.

The images below show the shadows for a typical week during the winter and summer:

RELEVANT STRATEGIES SUGGESTIONS:
• Good Natural Ventilation can reduce AC usage in warm weather.
• Provide double pane high performance glazing (Low-E).
• For passive solar heat gain face most of the glass area south to maximize winter sun exposure.

CONCLUSION:
Our findings show that for the winter months the building is really cold due to the prevalent wind conditions that are present during those months. The range temperatures are found to be way below the comfortable zone during the winter and above the comfort zone during the summer. In addition, the building is in shadows most of the winter which contributes to the coldness of the building during those months and more usage of heating systems. Our graphs of the fuel breakdown reflects the high amount of heating usage in the winter and high values for the cooling during the summer months. In order to increase the performance of the building we suggested a series of strategies that were mentioned above. Some of these strategies were implemented during our analysis by testing different materials for both windows and walls which returned a EUI value of 175.77 Kbtu/ft² for the year.

REFERENCES:

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