Sustainable, Design, and Construction of a Residential High-Rise Building in San Francisco
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The Project

Buildings in the United States account for 40% of our primary energy use, 72% of electricity use, 13% of potable water consumption, and 39% of carbon dioxide emissions. In response to the impact of the built environment, the city of San Francisco has instituted stringent green building codes, requiring all new construction high-rise buildings to achieve LEED Gold certification.

Energy Modeling

Energy modeling is a process of simulating how energy will flow through a building, whether that process is on-site electrical energy or the results of heat. We obtained energy models on-site.

1. Using hourly weather data for the site and a high-fidelity model, we evaluated the potential of solar energy that would occur for each floor of the proposed building throughout the year. This will reduce carbon emissions of the building's operation by a factor of three.

2. A high-fidelity software package is used to perform energy consumption of the building to respond to changes in the environment.

Recommendations

1. Continue to invest in design measures to identify opportunities for reducing the building's environmental impact and increasing its success in a high-performance system of functioning parts.

2. Invest in a high-performance building envelope that contains superior insulation (including energy-coated walls, doors, and windows) and reduced thermal mass.

3. Integrate an effective building energy management system that will allow for continuous monitoring of the building's energy consumption.

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5. Use San Francisco's building code 47B for the building's exterior, as it is the one that is most suitable.

6. Integrate an efficient building energy management system that allows for continuous monitoring of the building's energy consumption.

Integrated Building Design

In ensuring new cases of existing green buildings and speaking with experts in the industry, we found strong correlation of the integrated building design (IBD) from the conventional building design (CBD) in the process of delivering better performance. IBD refers to collaborative process between the decision-makers and technical experts involved in a building's design, to reach performance goals within budget.

Linear Design Process: Conventional

Integrated Design Process: Iterative Process

Integrated Design Process: Greater Potential Savings

Conclusion

Our recommendations for increased energy and water efficiency, monitoring systems and the integrated building design process will help ABDO reduce the environmental impact of this building.

This project will be a useful learning tool for both our client and for other developers seeking to reduce the long-term environmental footprint of future building projects.

Project Goals

The goals of our project were to increase the energy and water performance of the building and to justify an integrated building design process. These goals will help our client with their overarching goal of achieving LEED Gold certification or better.

Within these goals, we had to respond to three significant drivers:

1) We needed to provide recommendations that fit within the financial feasibility of the client's budget.

2) Ensure that our recommendations would sustain the transfer of ownership from ABDO to individual condo owners, as ABDO will no longer have a stake in the building after all of the units are sold.

3) Assure the long-term performance of our recommendations.

Water

To reduce the water load in the building, we calculated the internal water usage using the Federal standard for fixture efficiency. We then adapted the adapted standard of fixture efficiency when installing fixtures with water-efficiency standards. We found that in reducing some water fixtures and minimizing internal water use, the building's overall water usage was a successful outcome.

To determine the water use and savings, we factored in actual annual water usage in terms of 17% and 10% reduction in building operations. We included all water sources.

With the exception that low-flow fixtures were installed, we reduced the water usage of building monographs into the units. Based on survey of the fact that 20% of the reduction is expected from water fixture, we modeled 6% of fixtures and 3.5% of fixtures to install low-flow fixtures and lower the water rate below to allow the building's overall water rate to match that of the building.

The 3.5% water reduction of inefficient fixtures is approximately equal to a 5% decrease in 3.5% of fixtures, thus adding the total of the five fixtures the building's overall water usage was reduced in a significant manner.

The model showed that the building's overall water usage was reduced by 12% to 17%.

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