

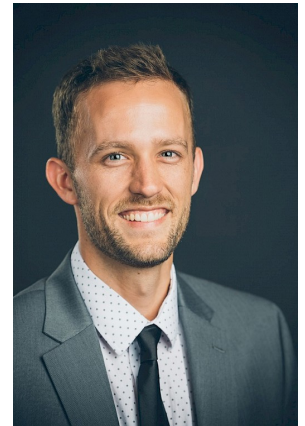
CASE STUDY

BUILDING MODELING

SUMMARY

Building modeling is an essential tool in building design, especially when aiming for a Net Zero Energy building, like the building pictured above that houses a corporate client. Entegrity was employed for building modeling services to ensure their building would be able to obtain their goal of reaching Net Zero Energy.

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CHALLENGES

The structure is a renovated building that was modified with energy efficiency in mind, aiming to offset all energy use through onsite renewable energy production. Due to the project being an existing building, several Energy Conservation Measures (ECMs) were limited. Challenges arose from some of the building's features: its location in a climate zone not conducive to certain passive energy strategies typically used in Net Zero buildings, building operations that run 24/7, and the large data center operating within the building.

CALCULATIONS AND CONCLUSION

A maximum building Energy Use Intensity (EUI) goal was calculated based on the amount of space available for solar panels. Historical utility bills and energy modeling were used to determine the finished building's current EUI score, the initial building design's EUI score, and the ECMs needed to reach the EUI goal.

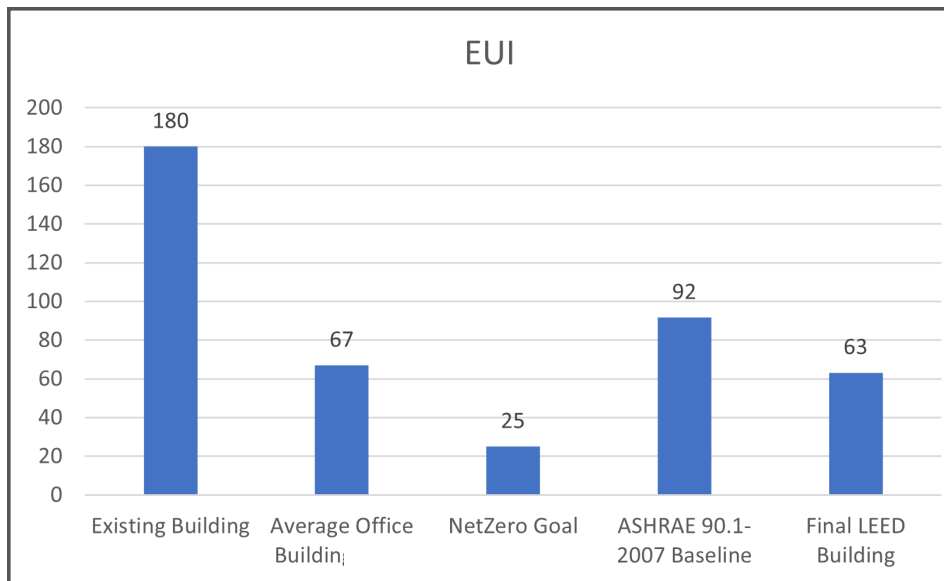


Figure 1 - This chart shows the EUIs for various building designs and targets throughout the project design phase. The existing building shows the EUI based on the last 12 months of utility consumption is at 180 kBTu/SF, and was compared to the average office building EUI of 67 kBTu/SF to show how much the building could be improved. The Net Zero Goal was made based on the maximum amount of rooftop solar the building could hold without the use of ground-mount solar. Once the project decided not to pursue Net Zero, LEED certification was pursued. The final building design achieved a model EUI of 63 kBTu/SF, compared to the ASHRAE 90.1-2007 Baseline model of 92 kBTu/SF, achieving a LEED certification rating of Gold.

ECM STRATEGIES EVALUATED

- Insulation to the existing walls and roof structure.
- Floor to ceiling existing windows with smaller, electro-chromatic glazing windows.
- Various HVAC strategies for best energy efficiency, including air-source heat pumps, water-source heat pumps, existing DX system replacement for higher efficiency equipment.
- Lighting to ensure spaces were not using excessive lighting power.
- Building envelope tightening via Infiltration analysis.
- Combined HVAC control strategies with occupant placement so only building portions in use would be conditioned for the day and night occupant shifts.
- Plug load strategies to minimize miscellaneous energy use in the building.
- Window area reduction impact via daylight modeling to make sure the amount of daylight entering the building would not be negatively impacted, as well as whether
- Light shelves impact on window area reduction.

Ultimately, the decision was made during the design process to not pursue Net Zero Energy. However, most of the ECMs that were recommended by Entegritiy were still implemented, including the installation of a rooftop solar array. The building went on to receive LEED Gold from the USGBC.

The Entegritiy team gained valuable experience working on this Net Zero Energy project and this helped steer several difficult decisions while designing the Entegritiy Headquarters located in East Village in Little Rock, AR. The Entegritiy Headquarters was able to receive Net Zero Certification through LEED, becoming the first Net Zero LEED Building in North America and the second Net Zero LEED Building in the world.

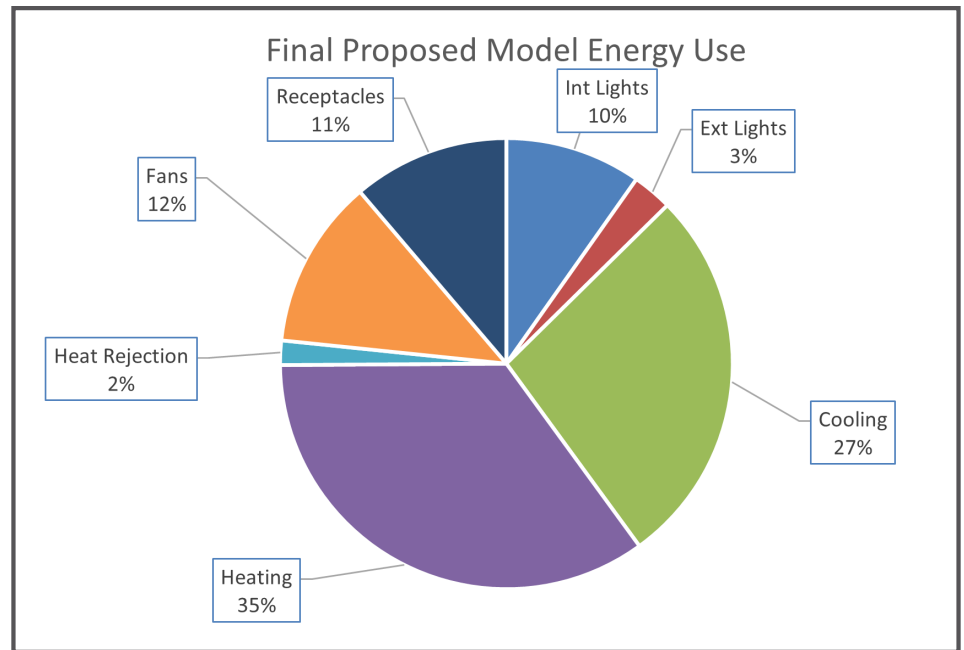


Figure 2 – After implementing all ECMs, the energy breakdown determines the highest end-use throughout the facility. In this case, 76% of the total facility energy was used for heating and cooling the building. The remainder was used for lighting and miscellaneous plug loads.

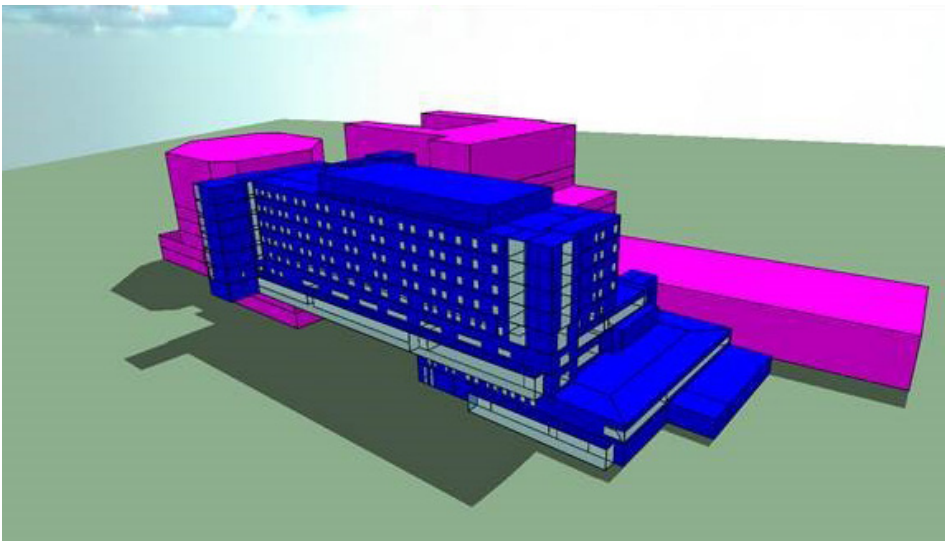


Figure 3 – The building energy model was built using the IES energy modeling software that allows complex building geometries to be built 3-dimensionally within the software. IES utilizes a plug-in with SketchUp to build the exact geometry, orientation, and HVAC zoning of the actual facility. Additionally, the model can determine the exact location of the sun throughout the year to help determine potential daylighting opportunities or even excess glare or shading issues.



Entegritiy is a sustainability and energy services company specializing in the implementation of energy conservation and renewable energy projects. Entegritiy is uniquely qualified to deliver innovative and sustainable solutions to Optimize Building Performance. We help our clients realize long-term energy savings by focusing on their needs: selecting the most cost-effective scope, contract structure, and financing strategy available to them. Our comprehensive service package includes energy savings performance contracting, commissioning, energy modeling, building testing, lighting solutions, renewable energy, water conservation, and sustainability consulting.