5 WAYS TO LOWER ENERGY USE INTENSITY ON YOUR BUILDING PROJECT

HOW TO REDUCE EUI, REACH ARCHITECTURE 2030 TARGETS, & ACHIEVE NET-ZERO CARBON

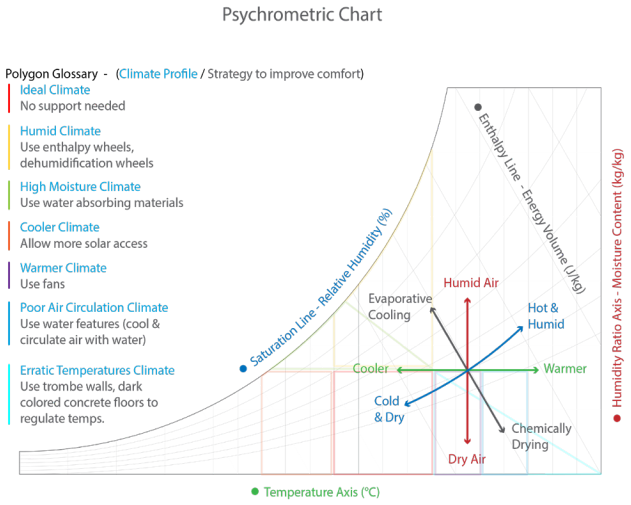
With buildings consuming 40% of the world's energy, producing a large amount of greenhouse gas emissions, it is critical that the construction industry make significant strides in reducing energy waste. More green and net-zero carbon buildings are being built to counter the adverse effects of climate change, and many designers are using building simulation to make data driven design decisions and significantly reduce the overall energy use intensity(EUI) on building projects.

Energy Use Intensity (EUI) is a building's annual energy consumption relative to its gross area. This metric is often used to compare the energy efficiency of two building designs; compare building designs to national benchmarks; or to showcase the measured (metered) energy use of an existing building. The broad categories of EUI breakdown fall into heating, cooling, lighting, equipment, fans, pumps, and hot water.

To meet the energy performance goals, including those laid out by Architecture 2030, one of the first steps is to establish an EUI baseline and targets to work toward. By calculating the EUI of a building, architects and engineers can better predict the project's yearly utility cost which helps them understand the impact of each design decision. If you're looking to reduce the EUI on your building projects and are unsure of where to start, this e-book provides five important strategies to help you reach your targets.

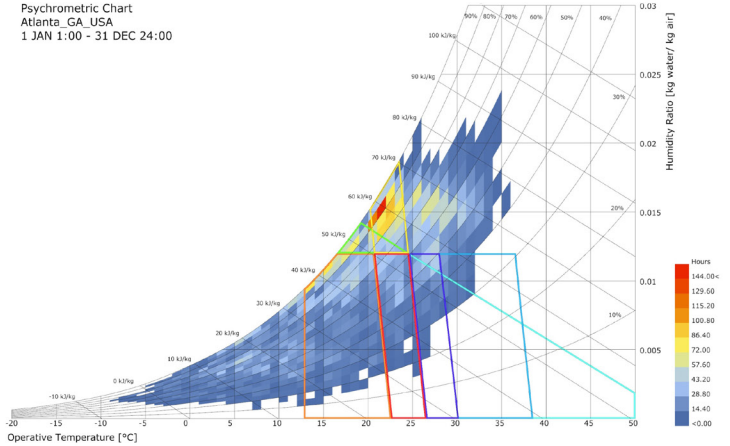
1. Conduct Climate Analysis

Building design that responds sensitively to the local climate conditions can improve occupant comfort and significantly reduce energy consumption. Architects and engineers who understand the passive impacts of climate will be better able to deliver cost-effective, energy-efficient, buildings. For example, solar heat radiation can work against or in favor of whole-building energy consumption depending on the building location. Therefore, choosing glass with the right SHGC value can save a considerable amount of energy by reducing the cooling load in hot climates and heating load in cold climates. Keep in mind that with this strategy, a less compact design can be more energy efficient with free heating and daylight sensors.



CLIMATE ANALYSIS

PSYCHROMETRIC CHART



5.19 % COMFORT - NO PASSIVE STRATEGIES

Impact of Passive Strategies
% of additional comfort - higher is better

2.15 % EVAPORATIVE COOLING

2.04 % THERMAL MASS + NIGHT VENTILATION

2.58 % OCCUPANT USE OF FANS

24.57 % INTERNAL HEAT GAIN

5.90 % DESICCANT DEHUMIDIFICATION

13.58 % DEHUMIDIFICATION

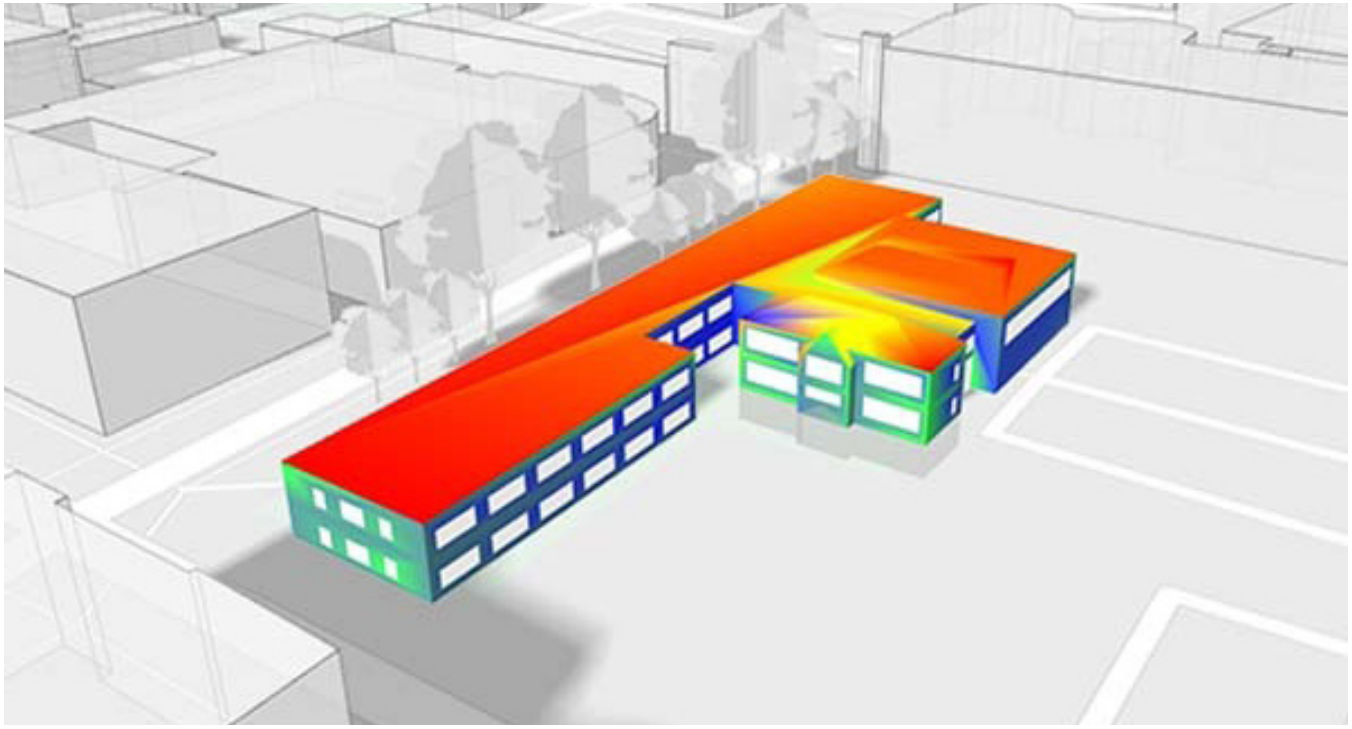
This chart shows the relationship between dry bulb, humidity ratio, and enthalpy. The polygons overlaid on the chart represent different strategies to increase comfort. Based on ASHRAE 55-2013 under standard conditions.

2. Select the Massing

For effective energy efficiency, compact designs are the most efficient configurations with less than 40% glazing. However, this would not be ideal for daylight and harvesting energy during the heating season by accepting sun. It is important to keep in mind that, in many cases, the envelope does not drive the load. For Hospital or Lab buildings, it is the internal load that drives the energy use. For example, in cold climates, you may pay a penalty for not having enough windows facing the south (northern hemisphere) or north (southern hemisphere) of your building.

Generally, it is best to choose the massing based on architecture and urban design concerns and then adapt your chosen massing based on analysis to make it high performance. For example, buildings in hot climates receive more sunlight in the east and west which requires more energy for cooling. To combat this, shading strategies will be needed.

Designers must pay attention to whether the building is heating or cooling dominated to aid in picking the correct strategy for the building envelope.



3. Implement Strategies For Envelope Design

Having efficient roofs, walls, and glazing insulation when your climate has seasonal temperature peaks can significantly help lower a project's EUI. It is also important to check your envelope heat capacity input since this property is related to thermal mass and, depending on your climate, can be an effective passive strategy to reduce energy use.

Additional strategies include:

1. Façade Upgrades

- High-performance window replacement
- Shading Strategies (Fins or Overhangs)

2. Air-tightness Improvements

- Replace weather stripping with new gaskets
- Passive stack effect mitigation
- Façade air tightness caulking for the entire building

3. Additional Insulation

- Super-insulated walls and roof with a continuous air barrier
- Additional insulation on the roof and below grade level

4. Optimize For Usage and Schedule

Daylight and occupancy sensors are a must for net zero designs. If you are unsure whether they will be in the final design, it might be worth running an optimization to illustrate the energy savings and payback period associated with partial/full sensors in your project. If both are included, it would also be safe to drop your unoccupied properties to 0.0 w/ft2 so both lighting) and Appliance Use can stop wasting energy when no one is occupying the space. This way, 35% of your energy could be going into schedules, set points, and lighting/ equipment loads. See how you can reduce lighting load for your project in this article.

5.Consider Options For Energy Generation

Photovoltaic Panels (PV) and Solar Hot Water (SHW) significantly reduces your EUI. The more you have, the less energy you need to purchase. It is always better to reduce the load first before adding this strategy. Since this can be a somewhat expensive strategy to implement, make sure to calculate the cost of your PV and optimize for a target array size before adding to your project.

Final Thoughts

When working to reduce EUI on your projects, be sure to evaluate whether these tips are realistic strategies for your design. The effectiveness of each item varies by project. As always, use simulation to check that the strategy is working. If you get unexpected results, it may point to incorrect assumptions. Optimizing for energy reduction and initial cost will help the whole team quickly reach an informed decision on the best route forward with the best performing options at the table.

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