Achieving NetZero Energy with Thermal Mass and Insulation

NetZeroEnergy (NZE) is an important issue today in the building construction industry. It is not a lofty goal, but rather, is a real and achievable solution that can greatly reduce, or in some cases, eliminate energy consumption in new and retrofitted structures. NetZeroEnergy is the result of careful planning, so that the total energy consumed is offset by renewable energy onsite. Architects and designers on new or modified construction projects should consider energy management and energy conservation options as the foundation to planning a construction project. Architects, engineers, designers, and builders can all contribute and influence the way NetZeroEnergy can be achieved in any given scenario. Whether temperature controls are required for comfort, or as part of an air flow process, there are many ways to use thermal mass and insulation to generate energy saving benefits.

First we must know how it works

Energy Optimization can be achieved by using concrete masonry walls and barrier sections. Finding the right balance of thermal mass, area mass and insulation is required to get as close as possible to NetZeroEnergy. First, mass must exist in the structure to provide thermal insulation and to create an effective barrier to air flow. Energy optimization is controlled by interior or exterior concrete masonry construction, with sufficient insulation, and incorporates renewable energy sources that can make conditions comfortable while minimizing the use of energy systems.

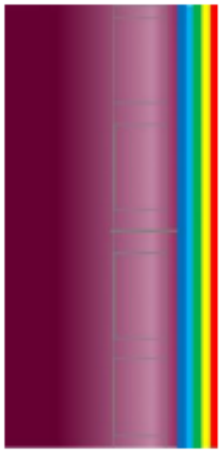
Frame structures rely on energy systems

Since Frame structures lack mass, energy use is reliant on insulation and air handling systems that consume energy and contributes to the high cost of heating and cooling a structure. Without thermal mass, achieving NetZeroEnergy in these situations is difficult to manage and maintain. There is a trend to add concrete masonry internally or externally to provide thermal mass and insulation in order to help reduce energy costs in frame structures. Concrete masonry is a great thermal mass barrier. Integrating thermal mass and insulation with other structural elements works to control energy consumption and can make NetZeroEnergy possible in specific areas or in the overall project.

Thermal Mass and Insulation control temperature zones

With the rising cost of utilities and uncharacteristic weather patterns becoming more common, alternative methods are explored to reduce energy consumption. In some cases, thermal mass and insulation alone are adequate to maintain a level of acceptable temperature zones. Concrete masonry provides thermal mass that can work to restrict or reduce variable temperature spots, and adding insulation can work to further control specific temperatures in areas of a structure. A structural engineer
and a mechanical engineer can help you to determine the correct volume of masonry, the right amount of surface area, and the placement of these barriers that you should use. How you implement these strategies can greatly impact how air patterns are controlled and modified to create the specific temperature conditions you require.

These charts represent temperature distribution in a brick veneer (CMU) backup wall using exterior insulation (left) and interior wall insulation. The light colors represent warmer temperatures, the dark colors represent cooler temperatures. This demonstrates that in a steady state condition the walls with interior insulation have a large cold thermal mass on the outboard side, whereas with the exterior insulation (right) the mass stays warm due to exposure to the interior mass.



Exterior Insulation

Interior Insulation

Plan where to use Thermal Mass

The placement of thermal mass, the weight of mass, air flow patterns, and incorporating a combination of other structural and design elements are important to consider early on in a project. Since many times a combination of similar and dissimilar materials are used to create form and function in a structure, it is critical that thermal mass and insulation properties are addressed in the planning stages. Effective and efficient controls can be achieved through carefully planned energy management strategies to further reduce energy consumption. The more concrete masonry is used throughout the structure, an opportunity exists to reduce the use of mechanical systems through the proper balance of insulation and thermal mass applications.

Energy Conservation is the new future

Thermal mass solutions will allow structural engineers to integrate NetZeroEnergy tactics effectively for new and retrofit construction. The process of conserving energy is not only necessary for cost control, but integrating these strategies with renewable energy sources is beneficial to the planet as well.

**This article is presented (not written) by Masonry Advisory Council*