

Executive Summary

In order, to estimate the loads of the building an energy simulation model was run in Trane Trace 700 to determine the cooling and heating loads, energy consumption, and annual cost to operate the Grunenwald Science and Technology Building. The input of the building into Trace was done as a block load simulation rather than a room by room analysis typically used to obtain a more accurate energy model. This was done since the block load will still supply a reasonable estimate while requiring less time to input the model to an energy simulation program.

The process for creating the zones for the block load analysis was done by combining all the similar room types into one large space where the ventilation requirements will be the same as one another. From this point exterior wall areas and directions were determined for each space type and placed into Trace, along with the roof areas associated with 3rd floor rooms. The energy analysis was run obtaining results that were reasonable when compared with the designer's energy analysis results. The results obtained by the designer were calculated by Carrier HAP, a different energy simulation tool. The need for an energy simulation was dictated by the application for LEED energy credits. The same location was used as that of the designer of Erie, PA, as this is the closest location to the building site at Clarion University in Clarion, PA.

An energy simulation was run to provide the design loads and energy consumption of the building. After analysis, the individual systems in the building were broken apart and compared with the as-designed, while also seeing which systems required the most energy. The utility rates provided were added into the simulation to determine the overall cost for each system and the overall building consumption cost.

The results obtained by the Trace analysis for the design loads varied to be more or less than that of the design calculations depending on the air handling unit analyzed. The percent error between the loads was no more than 30 percent for any air handling unit. The energy consumption varied due to the variances in the load calculations, with the receptacles and the heating consumption being less than the design values. The lower heating consumption resulted in a lower energy cost for the steam when compared to the design documents, while the electricity cost was higher mostly due to the receptacle consumption being larger than design calculations. In this report, the emissions for the building were calculated based on the electricity consumption, along with the natural gas consumption. The natural gas is used at the central plant in a gas fired boiler and is used to power the micro turbine used to generate on-site energy. Overall the block load model gave a reasonable estimate when compared with the designer's room by room analysis. Variances do exist in the calculated data, which may be explained by the different methods, programs, or assumptions made to allow the simulation to be completed in a timely manner.