

Executive Summary

The Steelstacks Performing Arts Center is a very unique building. The design for this building is very unique because it is a multi-purpose venue with 2 cinemas, a nightclub/cafe, banquet facility, full kitchen plus several concessions and bars, an open common area, and outdoor patio. Each space has very different design conditions which presented very interesting considerations.

The primary factor of importance for the owner was thermal comfort for those visiting the Center, as well having comparable electricity consumption. Thermal comfort was very important because an uncomfortable visit could hurt the audience viewing experience which in turn could hurt the reputation of the building.

The Steelstacks building is conditions by roof top units as well as one interior air-handling unit with an outdoor condenser unit. The units basically serve each of the large areas. This was done so that each space could run independently of each other. This was essential in the design because the building needs to be able to cost effective at full capacity as well as just holding small gatherings.

In order to optimize the building systems, analysis were performed in order to lower the building energy consumptions. Designs were done to flatten the loads of the building as well as overall consumption. Ground Source Heat Pump (GSHP) was investigated to handle both the cooling load and heating loads. A complete changeover from air-cooled system to a ground loop was implemented with the same decentralized system, but rather with heat pumps instead of RTUs. Also thermal storage was looked into to account for the large peak loads. A solar analysis was done on the building for the plausibility of the addition of a solar heating system. A study into how that would help with the total hot water and heating load was then looked into. Initial cost, maintenance cost as well as payback period was looked out to determine the best choice system.

After investigation into all of these choices there were pros and cons to each system. The

solar system was the least effective of the group, the system had a hard time overcoming the large initial cost, while only needing to heat for the building during the winter months. An ice storage system had a very positive effect on the energy use of the Steelstack building but once again it could only be used for a limited amount of time during the year. The thermal storage system had a lot lower cost so the payback period was much more reasonable and this would be a valuable asset to the building. The GSHP system provided itself to be a very valuable advantage to the building and would easily payback in a reasonable time and then continues to save the building owner a considerable amount of money.

The GSHP presented itself to be the best choice of system for the owner over the term of the building. With a building of this nature, the owner is planning on running regularly throughout the year. The relatively low upkeep cost as well as running at a uniform efficiency throughout the year makes the GSHP the best choice of system.