

1.0 Executive Summary

Freetown Elementary School is an 83,000 square foot building located in Glen Burnie, MD. The existing mechanical system is made up of a chiller/boiler two pipe system. With strong recent pushes towards being as energy efficient as possible, this system will be compared to alternative systems that could replace more efficient equipment or help reduce energy use to cut down on emissions that are effecting the world.

After assessing the existing mechanical system, an opportunity for energy savings exists. The existing chiller EER is rated at 9.4. Alternative system will be analyzed to compare to this efficiency. An opportunity also exists to save on emissions. Freetown Elementary School uses a great amount of electricity which is a carbon intensive energy source.

Applying alternative systems such as a ground source heat pump for the entire building load and solar panels for hot water and space heating, a decrease in energy use and a decrease in emissions will make the system more beneficial.

The ground source heat pump allows for elimination for one of the boilers and using the other existing boiler as emergency backup. The chiller is eliminated because of the ground loop rejects all of the load from the building. The use of a ground source heat pump instead of a chiller allows for an increase in efficiency and decrease in emissions.

The solar panel analysis first started for sizing the entire heating load to be accommodated by the heat gain from the panels. After discussion, the payback would be too long considering it only saved about 500 therms per year which results in only \$430 savings a year in natural gas. The first cost of this system is extremely high because of the cost of a solar panel. Then it was determined that the solar panels should be sized to accommodate the domestic hot water load because hot water is used all year round as the space heating is only used in the winter months and would just be useless the rest of the time. The payback period became less but is still extensive compared to the first overall cost of the system.

A breadth topic for lighting was analyzed for daylighting controls. This analysis demonstrated the use of a dimming ballast to adjust to the amount of daylight in a space according to a sensor. The model resulted in energy savings of the lighting but required more energy to heat spaces because of the lowered internal loads. With a greater heating load because of the decrease in internal loads from the lighting, the cooling load decreased because of the decrease in internal loads.

A second breadth of sustainability was analyzed to create a rain water collection system to support the water usage of toilets and sinks in Freetown Elementary School.