Executive Summary

The focus for research of this thesis analysis is the NASA Langley Research Center Administration Office Building 1, located in Hampton, VA. This building is a 3 story office building, approximately 75,000 ft^2. The glazing system is made up on insulating laminated low-E glass produced by Viracon. The design of this building focused largely on energy efficiency and "green" building design. This report investigates the use of alternative glazing systems, such as triple insulating glass, multiple layers of low-E coatings, and photovoltaic glass. Interpretation of this analysis focused on the following two key points:

1. Lowering of energy use, thus greenhouse gas emissions, from the original design
2. Maintaining a low construction cost that allowed for a payback period less than the life span of the glass

The mechanical depth analyzed the impact of the glazing systems on the building loads and air handling equipment. The building loads could not see an increase over the design capacity of the geothermal transfer field, as the site does not allow room for expansion of the field. Load and energy comparisons were made for all alternatives, and a 20 year life-cycle cost analysis for each option was performed. This cost analysis consisted of prices of the glass, air handling equipment, and yearly utility costs.

Two supporting breadth analyses were done to accompany this depth. The first was a lighting analysis, which investigated an alternative lighting plan for the open offices and a daylighting comparison for the PV glass. The new lighting plan not only reduced the number of luminaires in the open offices, but was also found to decrease the yearly energy consumption. The daylighting comparison for the PV glass was performed because the PV glass had a significantly lower visible light transmittance (VLT) than the other alternatives. Because the building utilizes dimming schedules based on daylighting performance, it had to be determined if the PV glass would negatively affect the ability to naturally light the space during the work hours. This analysis showed that the PV glass would not be a problem in this regard.

The second breadth, an environmental analysis, studied the emissions of the life-cycle of the PV glass. This life-cycle included the emissions during manufacturing and emissions saved through energy generation on-site. This research showed that the CO_2 paid back the emissions of manufacturing after 13 years of being installed in the proposed location of the mechanical depth, which is only 65% of the minimum anticipated life span of the glass.

With the results of each breadth considered and the results of the mechanical depth, summarized in Figure 1 on the next page, the final recommendation for the building was to implement the new lighting plan and make no changes to the existing glazing system.

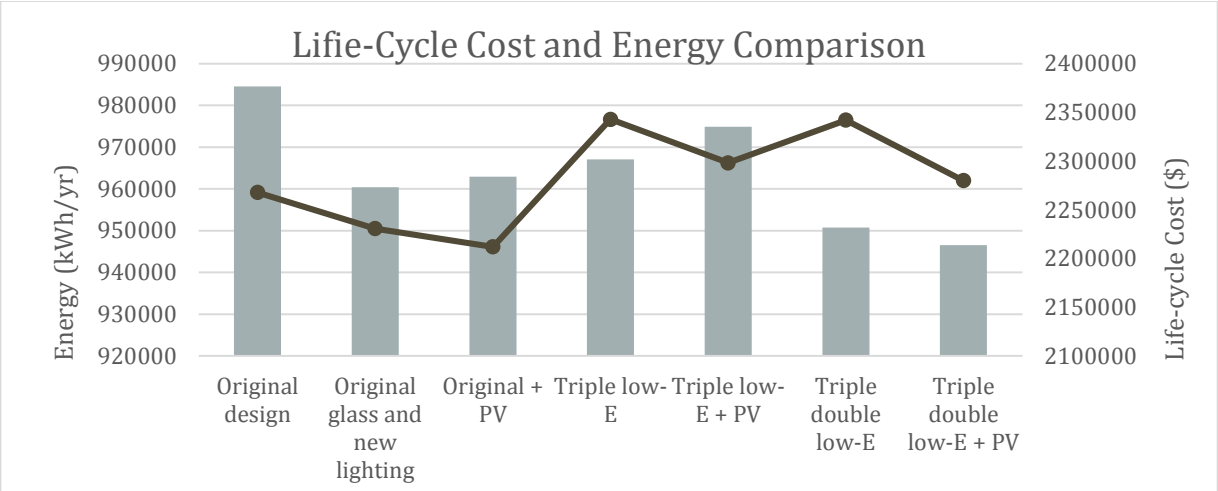

Figure 1 - Summary of depth analysis for energy consumption and life-cycle cost