

Executive Summary

This objective of this report is to analyze the previously described building, the Ed Roberts Campus, and implement potentially energy efficient changes to the mechanical system as part of a primary depth investigation. In addition, two secondary breadth investigations will be conducted into the structural and electrical systems of the building. These investigations are purely for academic interest and may result in positive or negative changes to building operation. They do not suggest that the current design is flawed in any way.

The depth investigation consisted of two sections: the conversion of a Water Source Heat Pump based system to a Variable Refrigerant Flow system, and the installation of a Solar Thermal Hot Water system for the building's domestic hot water and limited space heating requirements. The focus of the analysis will be recognize any potential to save energy and evaluate the economic feasibility of any change. Additionally, two investigations were performed into the effects the mechanical renovations may have on other building systems. First, a structural analysis of the roof was performed to determine what effect the solar thermal panel array might have. Second, an electrical analysis was performed to determine if any changes were necessary to the electrical system in the building.

The results of these investigations were as follows:

Mechanical Depth

- Variable Refrigerant Flow System
 - First Cost: \$364,300
 - Annual Energy Savings: 14.3%, \$23,610
 - Payback Period: 20 years
- Solar Thermal Hot Water System
 - Domestic Hot Water and Radiant Floor Space Heating
 - First Cost: \$75,000
 - Annual Energy Savings: \$3,020
 - Payback Period: >25 years
 - Domestic How Water Only
 - First Cost: \$25,000
 - Annual Energy Savings: \$2,016
 - Payback Period: 18 Years

The results of the mechanical investigation led to recommendations into the Variable Refrigerant Flow system and a Solar Thermal system for domestic hot water, which both showed potential to save energy with reasonable payback periods. A solar thermal system for space heating application proved too costly compared to the limited energy benefits provided. The structural and electrical breadth investigations both came to the conclusion that, while it would be possible to downsize some elements of those building systems, it would not be necessary to make any changes as part of a mechanical system renovation.