Caleb Froelich Optimization Project Proposal 05/06/2020

Problem Formulation:

For my project, I plan on optimizing the water flow rate through a secondary water coil from a ground source heat pump system installed in a traditional heat pump system. The blower assembly consists of a York MV16CN21C. The overall objective of the optimization is to minimize the cost per BTU of cooling, while meeting the required heating and cooling demand. To complete this project, I will be working with my dad, an engineering graduate from Walla Walla University, to determine a model for the thermal efficiency of the additional water-coil. Since the ground source water coil was salvaged, we will have to determine the parameters. A major part in this project is going to be the determination of the overall thermal efficiency of the system. An economic evaluation of the results will be made, comparing our system to a state-of-the-art mini split with a high SEER rating. The Fujitsu 9RLS3 (33 SEER) will be used for comparison purposes due to the ease of access to engineering data and familiarity with the device.

I am trying to keep the model as simple as possible, but another factor that could be considered is the addition of a proportional flow control value. This could be used to modulate the water flow through the coil based on incoming water and air temperatures.

Variables:

The two major variables are the:

- CFM (cubic feet per minute) of airflow:

This is controlled by a microcontroller giving a constant CFM regardless of duct work: 716 to 1433 CFM in twelve different steps. For normal operating conditions this will be a constant.

- Water flow rate:

Objective Function:

The objective that we seek is to minimize is the cost per BTU of cooling. We will have to measure the current to determine the I^2R power losses and thereby determine the efficiency of the system. We could do this for several test points and then fit a curve through the data.

Constraints:

Some of the constraints involved are:

- Constraints on max water flow rate.
- Limitations on airflow rate.