As energy becomes more precious and expensive, technologies that reduce energy consumption become more interesting to engineers, homeowners, and anyone who has payed an energy bill. One vital component of developing new technologies is the ability to compare the performance of new developments with current technologies, as well as competing developments. Standards for testing help to meet this need, and the use of standardized testing methods helps engineers and entrepreneurs make honest improvements that help everyone in the long run.

The purpose of this project is to build, calibrate, and test a testing unit, hereafter “hotbox”, to be used for testing new window technologies. We are building the hotbox to conform with ASTM (American Society for Testing and Materials) and NFRC (National Fenestration Rating Council) standards regarding hotbox construction and operation. This will allow the hotbox to give comparable results to other hotboxes meeting ASTM specifications, and will allow Calvin to be a destination for companies and inventors looking to test and validate new fenestration products.

The current design consists of two insulated boxes, one held at 70° F and the other held at 0° F by a heater and a freezer, respectively. The specimen to be tested is mounted in a frame, and the system will then be brought to equilibrium and the rate of heat input into the hot side will be measured.

The current state of the project is testing to make sure the required chamber temperatures can be achieved. As of right now, there are still some heat leaks on the cold side that must be insulated before the cold side will drop to the temperature we require. We were planning on testing the first set of windows in mid-August, but because of the trouble with the cold side, this will be delayed about 2 weeks.

Through working on this project I have learned much about project management, planning, and practical problem-solving. Although we have learned how to design, model, and do calculations to test designs in class, the real world adds another layer of complexity to engineering. Every requirement must have an extra safety factor on it because of unexpected loads. For our hotbox, we had to correctly estimate the required cooling capacity of the refrigeration system (in our case a freezer). However, our models did not include the various spots in the construction where the insulation was not as good as planned, or the additional heat-generating equipment needed to condition the chamber correctly. To correct, we need to increase the insulation in some specific places, and we might have to duct the heat from our fan motor out of the chamber.