4 – Electrical System Integration

4.1 – Electrical Analysis

Monmouth University has a very unique situation that has developed over the last few years. The university is set within a residential grid system which is not set up to provide the typical amounts of power that a typical university needs. Therefore, over the last number of years with the expansion of the university the power supplied has hit a wall with the utility not being able to provide the university with any more power.

Additionally, the university has hit the upper limit with the transformers that are currently installed on the campus. This also limits the amount of construction that can be done on the campus. The addition of the MAC building would surpass the amount of power that the transformers could handle.

4.2 – Considered Alternative

A considered alternative to combined heat and power is to have the utility provide a direct connection to the campus that would be able to handle the power that is required for the MAC building. With the addition of the power lines, the university would still need to add another transformer. Analyzing the addition of a new transformer will go into trying to figure the size the university would want to purchase. It is doubtful the university would add an additional transformer and switchgear to just serve the MAC building. They would most likely want the system to have the ability to serve the MAC building as well as some additional construction that will happen in the future.

This option was determined not to be researched further because of the assumption that would need to be made about what Monmouth University desires for the future development of the campus. The addition of power for the campus will most likely be needed eventually but for this project it was determined to analyze the system as it currently exists. As a result, the cost data that follows in section 6 does not go into detail about how much it would cost to add the additional line, transformers, switchgear, etc. to

operate the MAC building. Consequently, there is no savings that is going to be accounted for from not needing to add the additional power equipment.

4.3 – Electrical Redesign

The power generated from the generators will be connected to the MAC building and then the excess power will be connected to the main bus terminal to serve the other building on the campus. The main focus is to provide the required amount of electricity to the MAC building. The over produced power will be used by other buildings which will lower the amount of power required from the utility.

The Hess generator can be run in parallel with the utility or completely separate. For this application it was chosen for the generator to run in parallel with the system. The Hess system can also provide three different voltages to the system: 120/208, 120/240, or 277/480. The voltages are all 3 phase with the power factor ranging from 0.8 lagging to 0.8 leading. The MAC building is already designed to be connected for 277/480, therefore the generator will provide the building with the 277/480. There are already transformers within the building that will step the voltage down further to the required 120/208.

The following schematic is a one line diagram of how the generators will be connected to the 480V MAC building bus as well as the main feeder circulating around campus. This schematic is a general diagram that does not represent the details of what is needed with the interconnection of the building to the rest of the campus. The exact schematic and diagram will be dictated by the utility provider.

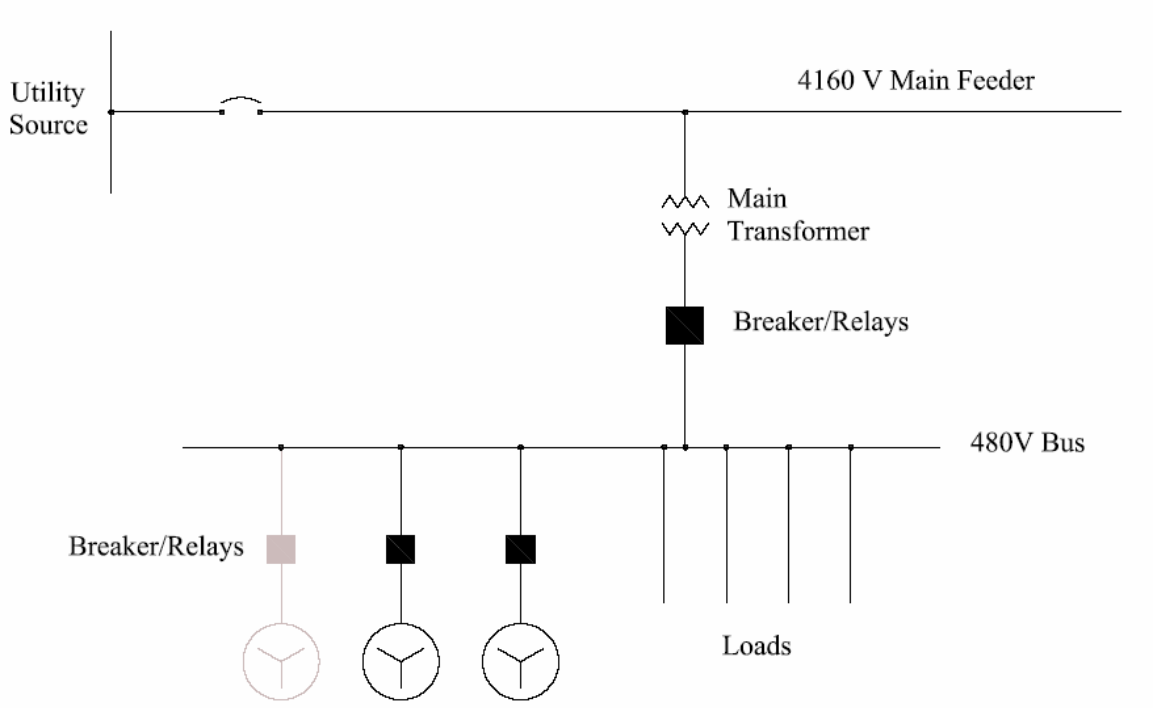

Figure 4.1 – Electrical System Interconnection

Additionally, the excess power will be connected back to the main bus that is serving the campus. A line from the generator will be connected to a transformer to step up the voltage to meet that existing bus terminal at 4160 volts.

4.4 – Electrical Conclusion

The original MAC building started to be designed in 2001 but as a result of the unresolved power issues the building is still yet to be built. As a result, this project and report is confined by the existing power constraints as they are at the time being. Furthermore, since the MAC building is part of a larger group of buildings it is very feasible to overproduce power and have that power be used elsewhere on the campus. This can be very cost effective if you consider the power that is being used elsewhere on the campus is power that the building does not need to buy. This can be further analyzed to determine whether this will lower the buildings demand charges and rates from the electrical utility provider. These calculations were not included in this report because the electrical bills and tariffs for Monmouth University could not be obtained.