Calvin Redundant Data Center

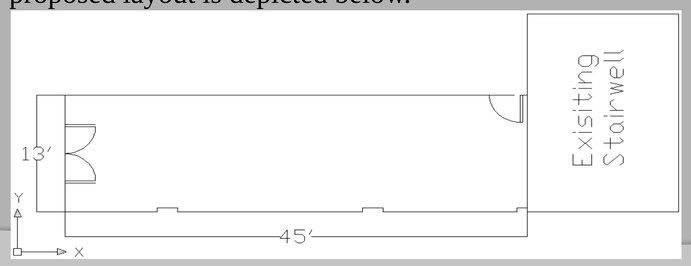
Engineering 333 Class – Spring 2010

Abstract

Calvin is developing plans for a new data center to provide business continuity and quick recovery in the event of a disaster. The new data center will not replace the existing data center; rather, it will provide redundancy for the operations of the campus. This new data center will be placed in the Spoelhof Complex. Because of the energy demands of data centers, there is a worldwide push for energy efficiency. So-called "green data centers" provide the same functionality as a normal data center with reduced energy usage and reduced energy costs. Calvin, like most organizations, must weigh the long-term economic benefits of energy efficiency projects against higher initial cost. The Calvin Energy Recovery Fund (CERF) may be used to finance energy efficiency increases. The money saved on energy costs is then returned to the fund for a specified amount of time. The purpose of the fund is draw attention to the value of increasing energy efficiency campus-wide. This project is broken down into five main groups: Power, Envelope, HVAC, Instrumentation, and Finances.

Envelope

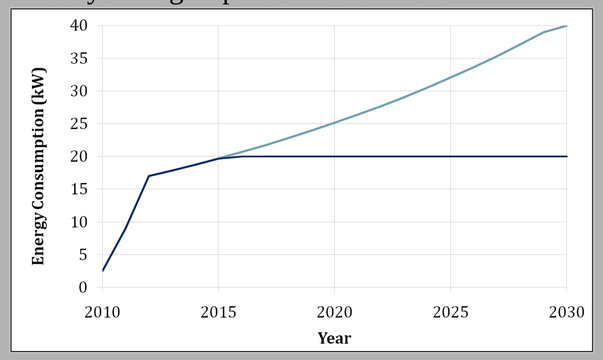
The envelope of the data center consists of the aluminum walls, ceiling, floors, and security doors. The goal for the envelope design serves two purposes; equipment protection and heat removal in case of HVAC failure. The final design of the walls specifies corrugated aluminum sheeting supported by wooden studs. The single door will have keycard access only, while the second set will be a double to allow for increased accessibility and better airflow in case of emergency. The envelope design does not qualify for CERF spending but may be pursued by CIT. The proposed layout is depicted below.



Power

An Uninterruptable Power Supply (UPS) must be used to protect the servers. Both the current data center and the new data center use online systems which are a series of batteries in-between the servers and the grid

The two server power consumption scenarios used by each group are shown below.



UPSs act as large, stable energy storage systems designed for a short, high power release in the case of grid failure. The UPS also regulates power quality and eliminates surges and dips.

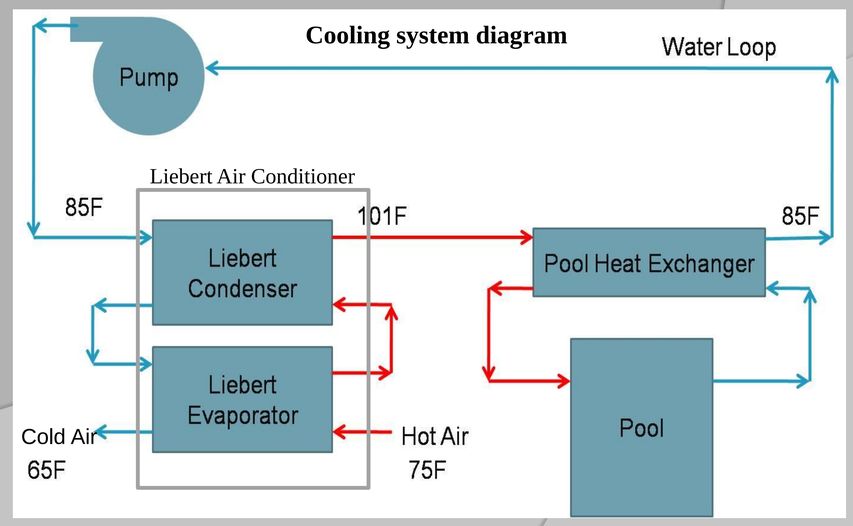
The current data center UPS is a Liebert AP346 which delivers up to 32kW and operates at 89% efficiency. The base case UPS selected by CIT for the new data center is an Eaton Blade UPS which operates at 97% efficiency. The only efficiency increase for the UPS can come from equipment upgrades. A comparison of five main UPS options was completed for the two power consumption scenarios.

The Eaton Blade as initially selected by CIT has been confirmed by the Power Team as the best UPS option based on financial and environmental sustainability. As a result, no CERF recommendations can be made.

HVAC

The base case for the cooling system is a Liebert air cooled air conditioning unit paired with a condenser. This system was quoted to Calvin College by Hedrick Associates. However, the goal of this project is to investigate more efficient systems for the data center. After investigating some alternatives a very efficient system was discovered. Liebert air conditioners come in water cooled models as well. These water cooled models can use water up to 85F for their cooling. Since the data center will be in the Fieldhouse, the nearby pool can act as a perfect heat sink. The pool is heated year round, so it can always accept the heat from the data center. Therefore the final design consists of a water loop going from the data center to the pool. With this system all the heat from the data center is put into the pool. The system provides considerable energy and cost savings. This system is the only way to conserve and recycle all the heat from the data center. Therefore it takes less energy to cool the water because the water simply runs through a heat exchanger with the pool. Secondly, this system saves on pool heating costs. The air conditioning system essentially transports the heat from the data center to the pool.

This system saves money and energy for the college and is clearly the best option for the new data center design.



CALVIN
MINDS IN THE MAKING