SeQuential Biofuels

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Contents

Abstract: *SeQuential Biofuels is a biofuels marketer, distributor, and producer located in Eugene and Portland, Oregon. In 2006 their first biofuels station opened in Eugene. The station has a variety of environmentally responsible features including on-site solar production, a living roof, a thermal wall, a passive solar design, and a bioswale system. Additionally, the station houses an organic food and beverage store and a Sweet Life outlet. Two HOBO devices were set up for a one-week time interval in the store, and the results from the HOBO data point to responsible and efficient business practices regarding light and heating usage. The accompanying graphs are resultant from the data points collected by the two HOBO devices. Overall, the SeQuential Biofueling and retail station is an exemplary business in its energy and environmental practices.*

Introduction

In September of 2006, SeQuential Biofuels opened up the first biofuels station in Eugene, Oregon. SeQuential was originally founded in 2002 as a biofuels marketing and distribution company, but the Eugene location is their first biofueling and retail station. Locally owned with offices in both Eugene and Portland, SeQuential both produces and distributes biofuels. The Eugene station offers five varieties of biofuels, consisting of three biodiesel blends and two bioethanol blends; the blends offered are B5, B20, B99, E10, and E85 (B=biodiesel, E=bioethanol; the numbers correspond to the percent biofuel in the blend, i.e., E10 has 10 percent bioethanol to 90 percent gasoline). In addition to biofuels, the station also offers an array of local, organic food and beverages. Eugene's foremost dealer of delightful delectables, Sweet Life, maintains an outlet at the station as well. The station is home to Oregon's only Blue Sky soda fountain, which rests in stark opposition to the beverage powerbrokers that are Coke and Pepsi.

The SeQuential Biofuels station rests on a former brownfield that housed a gas station at one time. The construction of the new station involved excavating multiple inches of contaminated soil from the site, as well as removing hundreds of hypodermic needles left by those who used the site as a drug haven. SeQuential has completely renovated the site and in so doing has created a one-of-a-kind fuel station and retail store. Their innovation and dedication to building a completely eco-friendly station has served as inspiration to the community while serving notice that it is possible, and very cool, to be totally green.

Station Features

The SeQuential biofueling and retail station is a model of what every business worldwide should be doing to limit their energy consumption and reliance on fossil fuels. Beyond their business practice (supplying biofuel), SeQuential has taken nearly every step towards energy efficiency and conservation.

Located on the canopies above the fuel pumps, a solar array consisting of 224 photovoltaic panels provides the station with 33 kilowatts of electricity. This provides between 30-50 percent of the station's energy demand. Their remaining energy needs are provided from EWEB's (Eugene Water and Electric Board) wind power program. In total, SeQuential receives 100 percent of its energy needs from renewable sources. As of February 20, 2007, the use of renewable energy has allowed SeQuential to avoid over 10,000 pounds of greenhouse gas emissions that would otherwise have been released to the atmosphere; these emissions are equivalent to that emitted by powering 163 homes for one day or the pollution emitted by an average passenger car over 371 days.

In addition to producing its own power through PV panels, the SeQuential retail station has been modeled in a passive solar design intended to cut down on the energy needs of the building. The southern wall of the building is lined with large windows that let in substantial natural light and cut down on lighting costs. A large thermal wall that runs

about 2/3 the length of the building intercepts the southern light and redistributes the heat throughout the building. This thermal wall is designed to help warm the station during the winter while also cooling it during the summer months. The front of the station is lined with nearly-floor-to-ceiling windows that let in natural light and help extinguish the need for artificial lighting during daylight hours. The windows do not quite reach the floor because of vents that can open and close to allow a breeze to permeate the building during the hot summer; these vents work similarly to Venetian blinds and drastically reduce cooling costs during the summer. The inside of the building is painted in light greens and summer sky-scapes designed to reflect light rather than absorb it, again in an effort to reduce the need for artificial lighting.

The roof of the SeQuential station further adds to its status as an energy innovator. Atop the station 4,500 plants, each one of 20 different native species, rest in five inches of soil in what is known as a living roof. Requiring little maintenance beyond occasional weeding, the living roof serves as insulation for the building and is especially helpful in keeping the building cool during the summer. Because the plants are all native, they are adapted to the months of summer drought and therefore do not require any additional watering.

In an effort to completely wean itself from fossil fuels, the entire paved area of the station's driveways and fueling areas is constructed from concrete instead of asphalt. The concrete is lighter in color, therefore absorbing less light while reflecting more back; this lessens the need for bright lights because the concrete keeps the station naturally brighter than an asphalt driveway would. The concrete is also more durable and requires less upkeep than asphalt resulting in less energy expenditures in construction and maintenance. Lastly, asphalt's make-up is approximately two percent petroleum; concrete does not require any petroleum or other fossil fuel.

Energy Efficiency

The features of the SeQuential station are at the forefront of energy conservation technology, yet to really conserve energy and reduce one's carbon footprint, attitude is just as important as technology. In order to test the energy conservation attitude around the station, a small device called a HOBO was set up in the retail store and also in the back office. The HOBO is about the size of a standard wallet and can measure temperature, relative humidity, and light intensity (lumens per square foot) on a predetermined time interval. The HOBO data can give a comprehensive look at the temperature and light fluctuations throughout the day. This information can be used to determine if energy is being used for heat or light at times when the store is unoccupied; basically, it can be reviewed to determine the energy efficiency of the space it is in. The HOBO devices were utilized for a one-week interval beginning at 4pm, January 31, 2007, and ending on February 7, 2007 at 4pm.

To begin with, let us look at the data from the HOBO placed in the store because it is the main space of the station; the device was set to record information every fifteen minutes and was placed inconspicuously on an open wall of the store. According to Alan Twigg,

the station manager, the station's hours of operation are 6am-9pm, though in reality the building is in use daily from 5:45am until 9:30pm. Beginning with temperature, the HOBO readings are very consistent with the projected use of the space. Based on projected use, store temperatures should remain fairly constant and warmer during store hours, while cooling during the night while the store was closed. According to the HOBO data, this store's pattern is consistent with the projected use. Generally around 8pm, the temperature dropped significantly before rising multiple degrees again around 5:30, 6 o'clock the next morning (Figure 1). The light intensity of the store was consistent in that it generally plateaued at somewhere between 100-200 lumens/square foot during the daylight hours, from approximately 7am-6pm (Figure 2). This shows that light was used very efficiently throughout the day. When set against the temperature graph, it is obvious to see that temperature and light intensity ebb and flow together during the daylight hours (Figure 3). The relative humidity readings generally rose and fell with temperature, though with a slight lag in response to the temperature fluctuations (Figure 4). All in all, the HOBO readings from the store point to efficient energy practices and responsible use by the employees of the station.

The second HOBO device was set up on a wall in the station's office. The office is a small, self-contained room in the back of the building. It is a closed system in comparison to the large, open area of the store. The temperature graphs maintain a similar shape to those of the storefront, though it appears that the temperature peaks are slightly later in the day. However, the office shows the same drop in temperature through the night before warming again in the morning (Figure 5). Light intensity fluctuates more during the day than in the store, though this is most likely due to lights being turned on and off as people enter and leave the office (Figure 6). Nonetheless, the light intensity graphs of the office show a similar pattern to the storefront in that there is little light during the night hours, indicating that the light use in the office is responsible and efficient. When comparing the temperature and light intensity of the office, there is not quite the correspondence found in the storefront, mostly because the two are independent in the office (Figure 7). The storefront receives natural light, which in turn can raise temperatures; however, the office relies on more artificial lighting and heating, so the rise and fall and temperature does not correspond to the rise and fall of light intensity. Both are off at night so their times of use overlap, but their patterns are independent and not affected by the other. In the office, the relative humidity and temperature again correspond, but perplexingly, this time the temperature seems to react to changes in relative humidity as evidenced by its lag in response to humidity changes (Figure 8). One hypothesis is that the presence of people in the office tends to raise the humidity levels before the temperature is affected. Whatever the case, this relationship does little to debunk the fact that the office, like the storefront, is both light and energy efficient in its practices.

Extras

In addition to its conscientious energy practices, SeQuential Biofuels has taken a variety of other eco-friendly steps to further reduce its footprint on the local environment. All SeQuential employees use biofuels in their personal vehicles, for which they receive a

five percent discount on fuel purchases. While SeQuential believes in its products and the benefits of biofuels, they also recognize that they still do pollute; in turn, they offer incentives for employees to take the bus, ride a bike, or walk to work. For every 20 times an employee commutes by bus, bike, or foot, they receive a $12 gift card to the station that can be used in the store or on fuel purchases.

As mentioned in the introduction, SeQuential put significant effort into cleaning up the site of their station. In an effort keep the site clean and limit pollution into the Willamette River—located within a 1/2 mile of the station—SeQuential has developed a system of filters on site. All water runoff drains through filters that separate out the oil and other pollutants. The water then flows into a bioswale system that slows its flow and holds the water on site. The bioswale plants filter the remaining pollutants and sediments out of the water before it flows into the Willamette. Microorganisms living in the soil then break down the toxic pollutants, leaving the station clean and the water bound for the river even cleaner.

Lastly, the SeQuential station used all recycled wood products on the interior of the store. All the food and drink shelves were previously used by the Eugene REI store, and all of the wood paneling on the store's interior is from recycled wood products.

Recommendations

Nothing is perfect, including SeQuential. Despite their terrific environmental record, there are a few areas for improvement. First, SeQuential could participate in some sort of carbon-offset program to completely account for their carbon dioxide emissions. Though their emissions levels are already low, this step could help decrease their energy footprint even more. Next, though SeQuential does not have a great need for heated water, a solar water heater could further reduce energy usage by using solar energy for water heating. Granted, their energy already comes from solar panels; however, a solar water heater would further reduce the need for electricity and help to make the station more self-sufficient and energy independent by reducing their need for wind power from EWEB. The more energy they are able to conserve, the farther their solar produced energy will be able to go. Third, the station could install a rain catchment system. By harvesting the natural rainfall of the area, they could reduce their need for water delivery while moving one step closer to self-sufficiency. A rain catchment system is likely to be added, but is currently benched due to bureaucratic and permit struggles. It is likely that once these issues have been resolved, we can expect to see a rain catchment system installed.

Conclusion

When SeQuential built their station last year, they set out with the intention of making a completely eco-friendly facility, and they have largely done that. The SeQuential Biofueling and retail station is an exemplary business in its energy conservation practices. In all aspects, from their on-site solar production to their energy efficient lighting and heating practices, SeQuential performs in an environmentally responsible manner. They are truly leaders in energy conservation and efficiency, and will serve as a wonderful

example for their community, and beyond, for years to come. SeQuential hopes to open more stations throughout the Pacific Northwest, particularly in Portland, and will surely be a major component in the biofuels industry as we move towards a renewable, sustainable society.

Appendix: HOBO Data Graphs

Figure 1

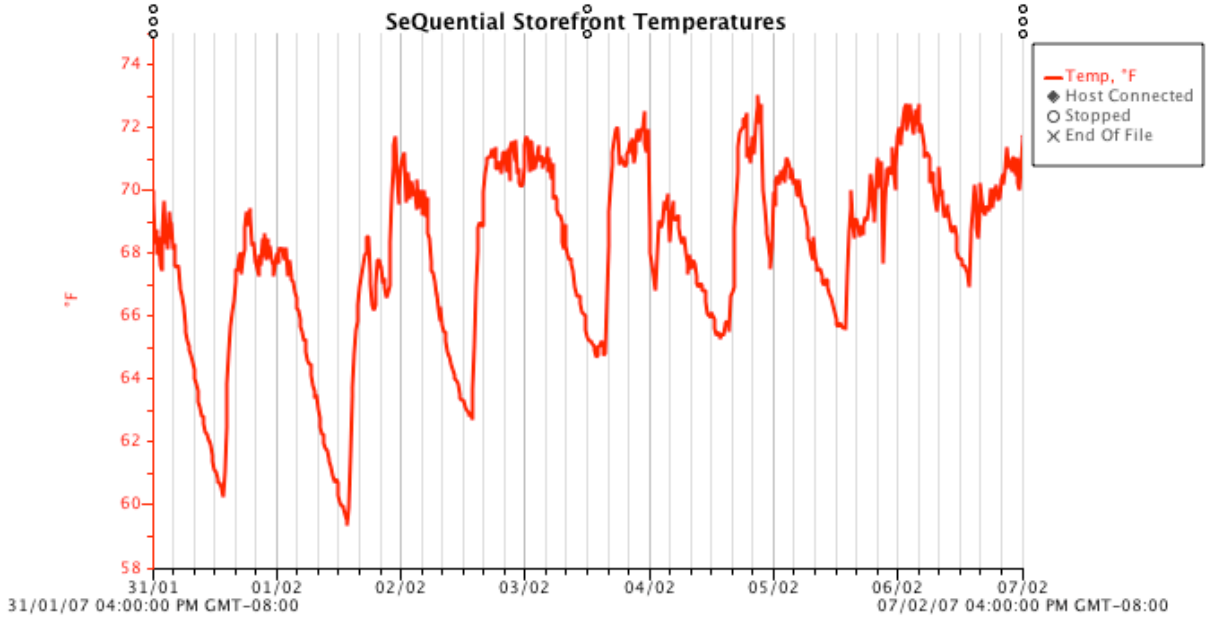
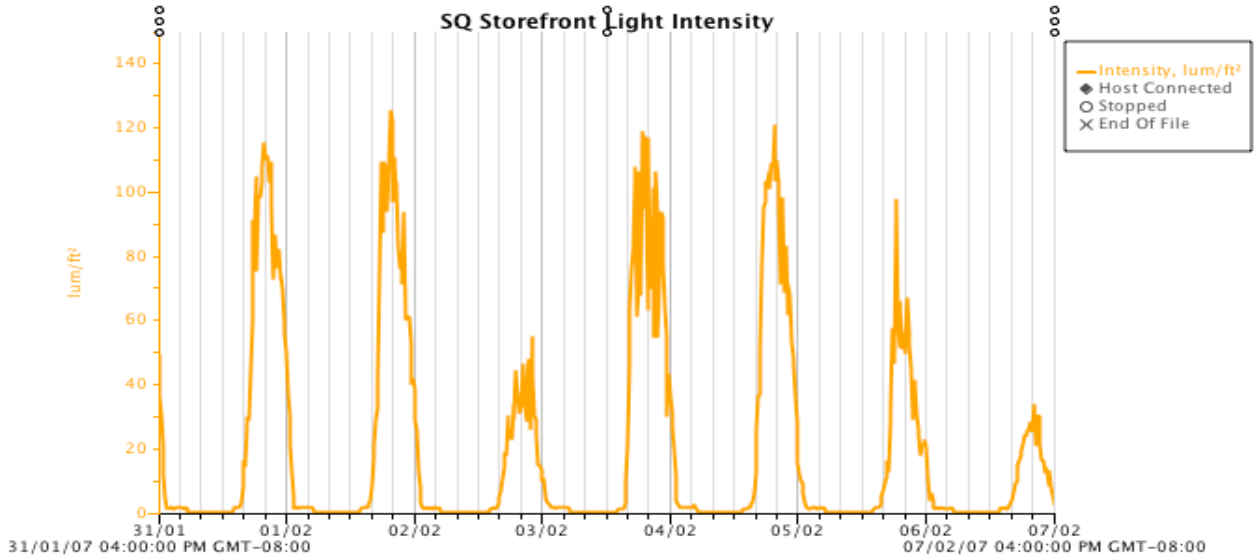


Figure 2



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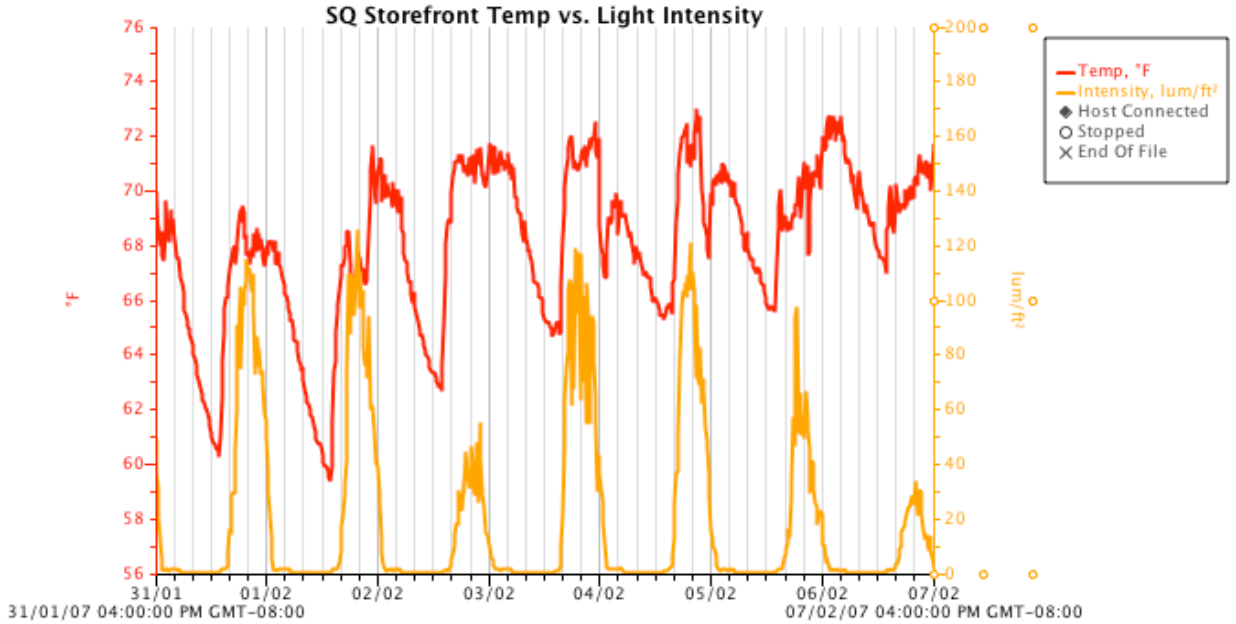

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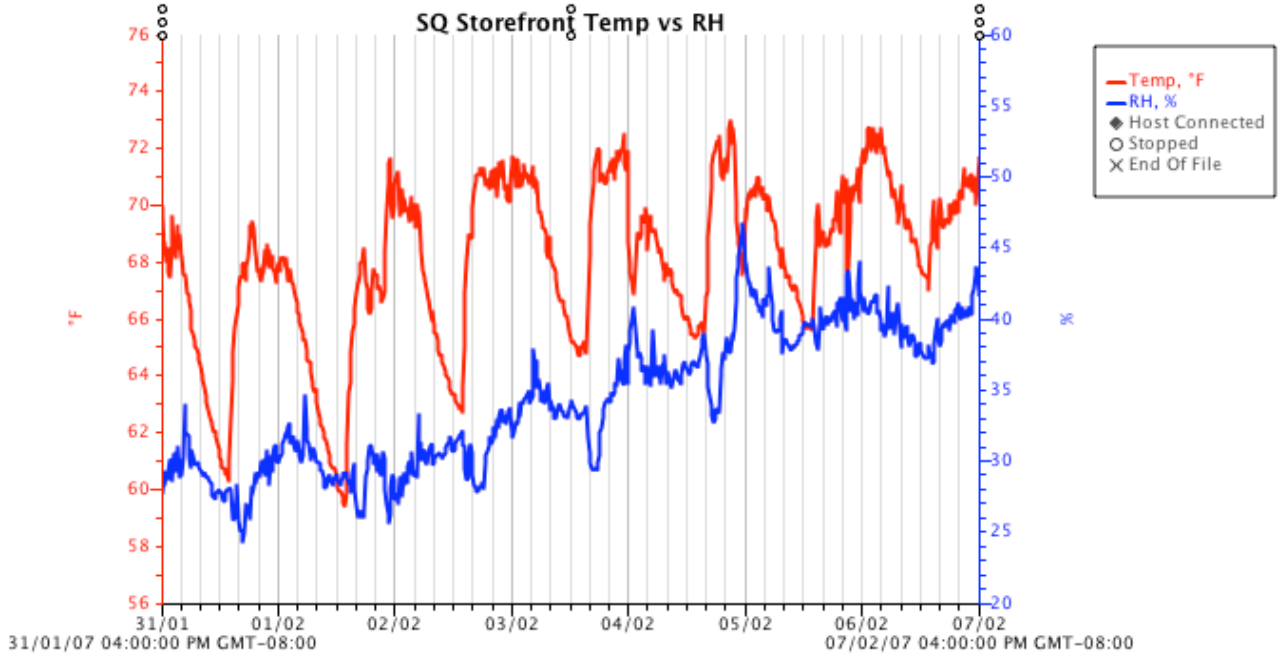

Figure 5

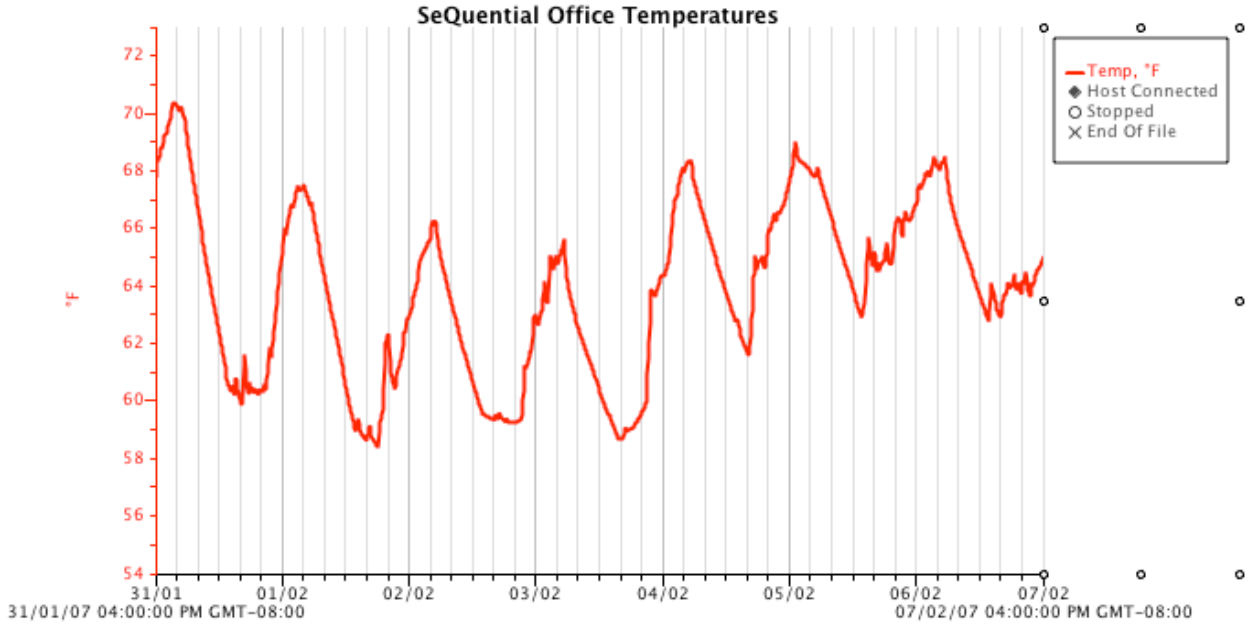

Figure 6

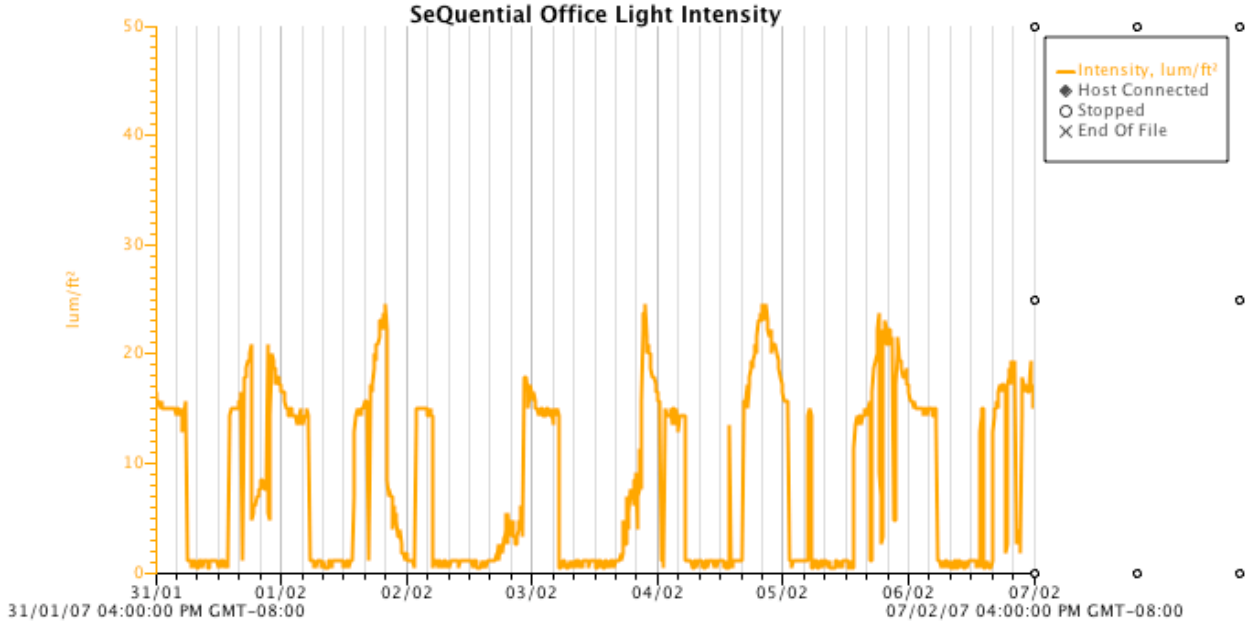

Figure 7

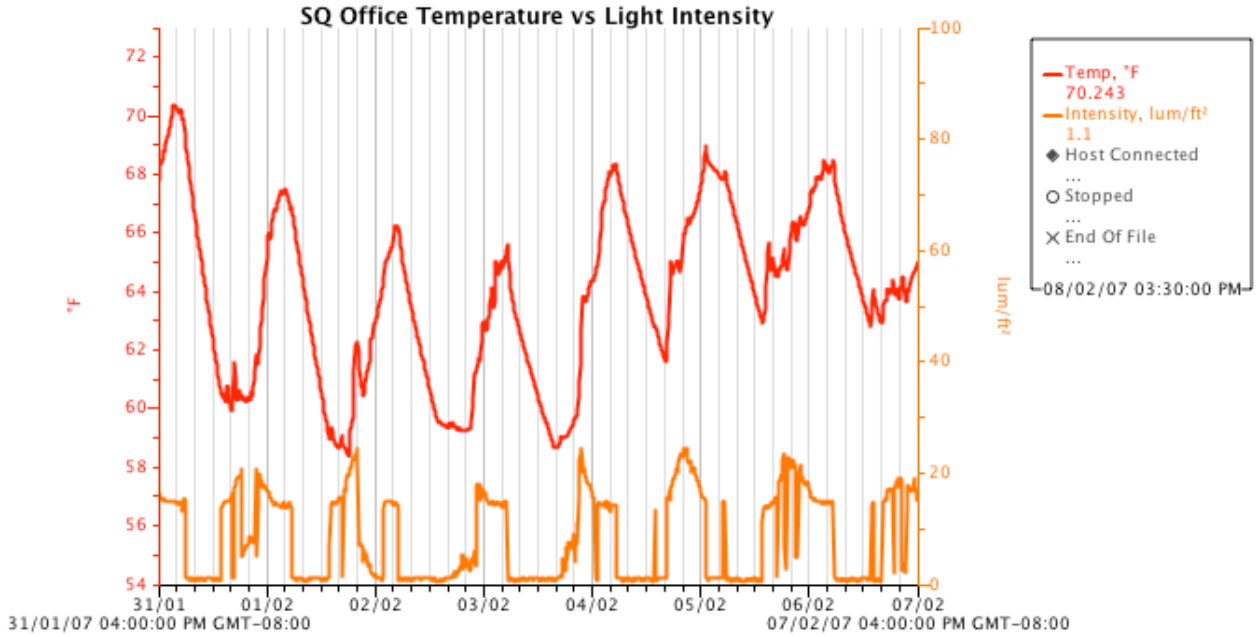

Figure 8