Energy Audit

Gilda's Club South Jersey

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Executive Summary

The purpose of this audit is to find ways to reduce the energy use of your building by repairs, upgrades, and/or changes in operations. Considering your organization's non-profit status, specific attention was paid to the initial costs of projects. All costs in this report do not include labor costs or tax; however, several of the suggested upgrades could be readily accomplished with volunteer labor.

Major issues with the building were found to be the ceiling insulation and lighting. The ceiling insulation was at least 15-20% compromised. To repair this problem, we estimate an initial cost of between $1,200-$1,600. Fortunately, the payback should be quick on the order of just 8-9 months. Savings for this upgrade will probably be greatest in the summer when air conditioning needs are at a maximum.

In addition to the ceiling insulation, the other major problem was outdated lighting. Throughout the building, there are outdated T-12 fluorescent fixtures (the kind with 4 long tubes inside them). Newer T-8 fluorescent bulbs along with new electronic ballasts (what controls the flow of electricity to the bulbs) will reduce your baseline electricity costs. Replacing the T-12s in just the administrative offices near the main entrance would cost about $300 (bulbs and ballasts). The payback from the savings on your electricity should be about 2-3 months. And again, the process is relatively simple and could be completed in a day with volunteer labor.

Other projects with considerably higher initial costs are also analyzed in the "Cost-Benefit Analysis" portion of the report.

Description of Building

Walls

The building is approximately square. The north wall is 40^o off north. Therefore, the azimuths for the east, south, and west walls respectively are: 130^o, 220^o, and 310^o. Total area of the walls comes to 3,430.1 ft^2 (including windows and doors).

All walls above the ground from the inside-out consist of drywall, 1 inch polystyrene board, hollow concrete block, and a layer of brick. This brings the walls' insulative value to about R-10. From the inside, the walls seem to be perfectly intact. On the outside, the walls also seem to be in fairly good condition. However, throughout the brick on the outside of the building there is missing grout. Although this isn't of the greatest concern, filling these areas in may provide better protection from pests, water, and wind. While the insulative value of the walls is relatively low, an upgrade would be expensive and have a payback in excess of ten years.

Windows

There is a generous amount of glass on the building. In total, the windows take up 404.2 ft^2 of the exterior wall space. All windows are single pane glass with an extra storm window attached. None of the windows were found to have a low-e coating. A reasonable insulative value for these windows is R-2. Higher-performing windows are available, and would improve the overall efficiency of the building. However, the initial cost would be relatively high.

Upon exterior inspection, all windows seemed to be in fair to good condition. The most common problem found was cracking, flaking, and missing sections of caulking around the windows. Fixing these problem areas will have similar benefits to fixing the grout of the exterior brick. Plus, caulking is very simple and can be done without having to hire outside help.

Doors

There are three exterior doors in your building. The front door facing New Road is about 46 ft^2 of wood (with decorative recesses) and glass and has an approximate R-value of 1.3. However, this door is not sealed very well. In several spots there are noticeably large openings to the outdoors. Therefore the R-value of this door is lower than if it was sealed correctly. Rehanging or replacing the door is recommended. Further inspection could be done using a "blower door" to evaluate how bad the seal really is; however, it is clear that repair of this door would provide a significant and immediate energy cost savings.

On the opposite side of the building is your main entrance. This door is in noticeably better condition. Like the front door, this door is also a combination of wood and glass but is smaller at about 23 ft^2. We have approximated the R-value of this door at about 2.28.

There is also a hollow metal door leading into the basement of your building. Hollow metal doors do not have very high R-values, probably something around R-1. This door also has a hole in it which could increase convection inside the door and therefore reducing the insulative value. However, if the basement is not to be air conditioned than having a poorly insulated door here may not be as significant of a concern as it was for the front door.

Ceiling

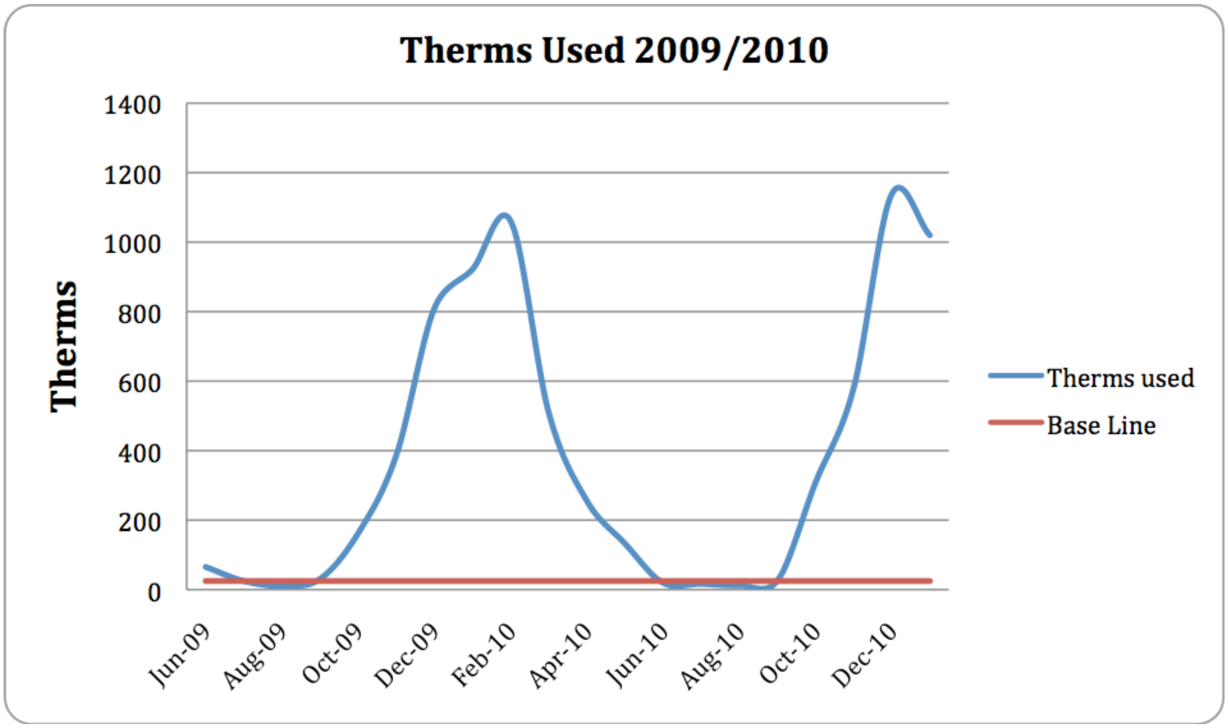
A drop ceiling is used throughout the building. Above this drop ceiling are ceiling joists spaced 24 inches apart with fiberglass batt insulation in between them. This batted insulation is un-faced (no plastic vapor barrier) and has a listed insulative value of R-30. If this insulation was perfectly installed, the ceiling as a whole could be expected to have an insulative value of about R-29 (because the joists are un-insulated).

Heating and Cooling Demand

Heating and cooling are the most energy intensive operations going on in most buildings. You have provided us with two years (2009 and 2010) of gas and electric bills which helped us get a sense of your baseline needs. Baseline needs are the amount of gas or electric you use consistently and year-round to operate basic building appliances such as lighting, and computers, but not including heating or cooling demands. So for gas the off season would be summer when you are not heating. For electricity the off seasons are the fall and spring when neither a lot of heating nor cooling is required.

The trend of your gas usage looks very typical with peaks in the wintertime and valleys in the summer time. Your baseline for gas is very low at about 25 therms. In the wintertime, there are peaks around 1,100 therms. So all in all, nothing really looks out of place. The graph on the next page gives you a visual representation of your gas usage.

The trend of your electric use also looks fairly normal. However unlike your gas use your electricity base line is very high, at almost 8,000 kWh. Other than that, peaks are where we would expect in the winter and summer. Valleys are also located in the spring and fall months as they should be. So the high baseline is probably due to normal operations of building such as lighting, computers, appliances, and other electrical demands including heating and cooling. See the second graph on the next page for your electricity usage. Take note of how high the electricty baseline is compared to the gas baseline.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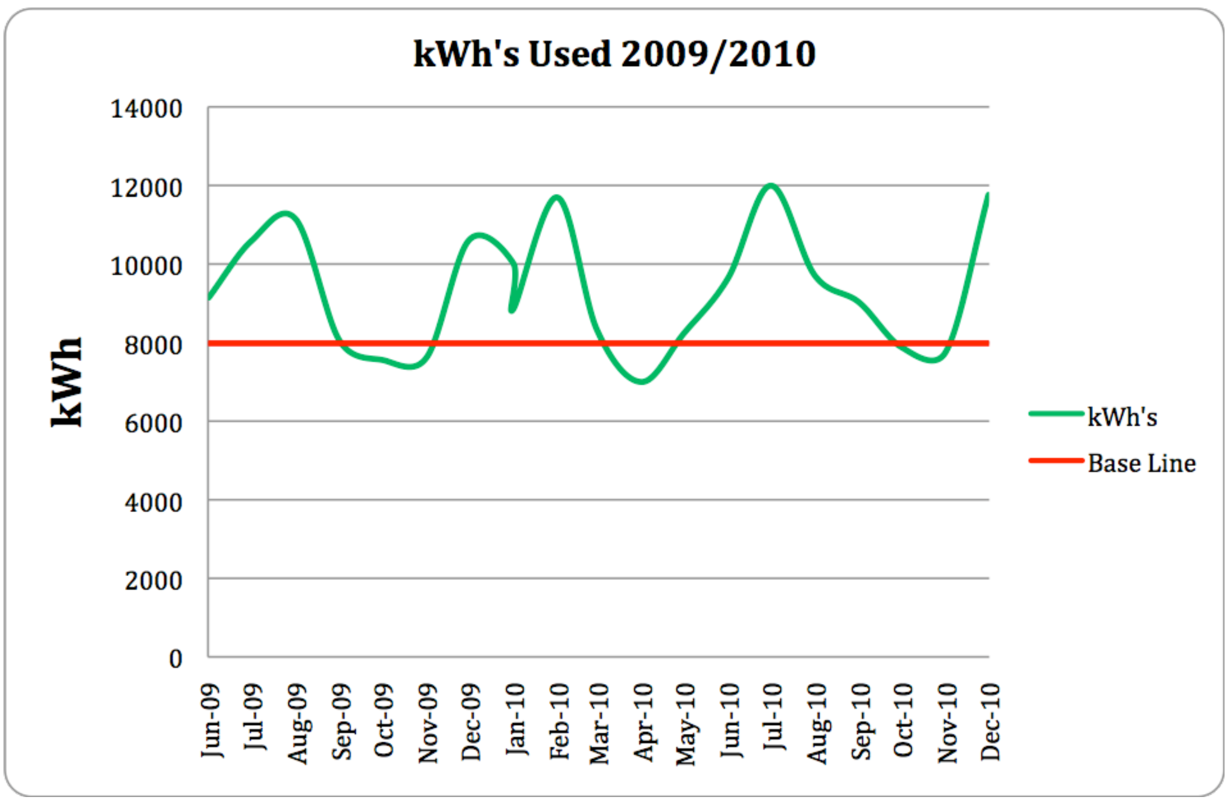
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Therms used
Base Line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10000
8000
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4000
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0
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Jul-09
Aug-09
Sep-09
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Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
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Dec-10
kWh's
Base Line

Description of Findings

Envelope

The building's envelope is what keeps conditioned air inside the building and outside air out. Any weakness in the envelope can cause conditioned air to leave the building and/or outside air to enter. All in all, this means the building is not operating at peak efficiency because the HVAC unit will have to compensate for these unwanted air losses and gains.

We found a very significant weakness in your building's envelope. Above your drop ceiling panels is R-30 fiberglass batt insulation. However, the condition of this insulation is very poor. Throughout the building there are batts drooping, fallen, or even missing from between the ceiling joists. There are two reasons that are most likely responsible for this. First of all, the insulation was not properly secured in the first place. It seems as if the original installers simply wedged the insulation in between the ceiling joists; only using staples in some places. This allowed gravity and pressure differences between the attic and main floor to pull/push the insulation down. Secondly, there are places where it is apparent that duct and electrical workers removed insulation to do a job. When they were done they simply did not replace the insulation they had moved.

It was imperative that this problem be resolved. We estimated that about 15-20% of the ceiling insulation was compromised. It is not unrealistic to think this number was even greater. In fact, the sever condiction of this ceiling lead us to initiate repairs ourselves with student volunteers. All identified failures in the ceiling insulation were repaired or replaced with new batts. Dramatic reductions in heating and cooling costs should be seen with this repair. This is because less conditioned air will be lost through the ceiling. Therefore your heating and cooling units will have to run less frequently than they currently have to. However, we urge you to conduct simple annual inspections of the insulation to ensure its continued integrity. In addition, whenever repairs are conducted on the building that require work in the ceiling, a Guilda's Club representative should inspect the site before the contractor leaves to ensure that all insulation was properly placed upon completion of the repair.

Lighting

Fluorescent bulbs are found throughout your building. This is a choice that saves you money compared to the use of incandescent bulbs. However, there are outdated T12 fluorescent fixtures in the building. These are the fixtures you see with 4 long, straight fluorescent bulbs inside them; in the administrative office area for example.

There is a more efficient type of fluorescent bulb on the market today. These bulbs are T8s. The benefit to these bulbs over T12s is three fold. First all they simply use less energy.

Your current T12 fixtures are using a combination of 34 and 40 watt bulbs. T8s are only 32 watt bulbs. Secondly, in addition to using less energy, T8 bulbs give off more light than T12s. This means that the same amount of luminosity can be achieved in a room using fewer bulbs. Lastly, T8 bulbs have a longer life than T12s. This means you spend less money on replacements than you currently do.

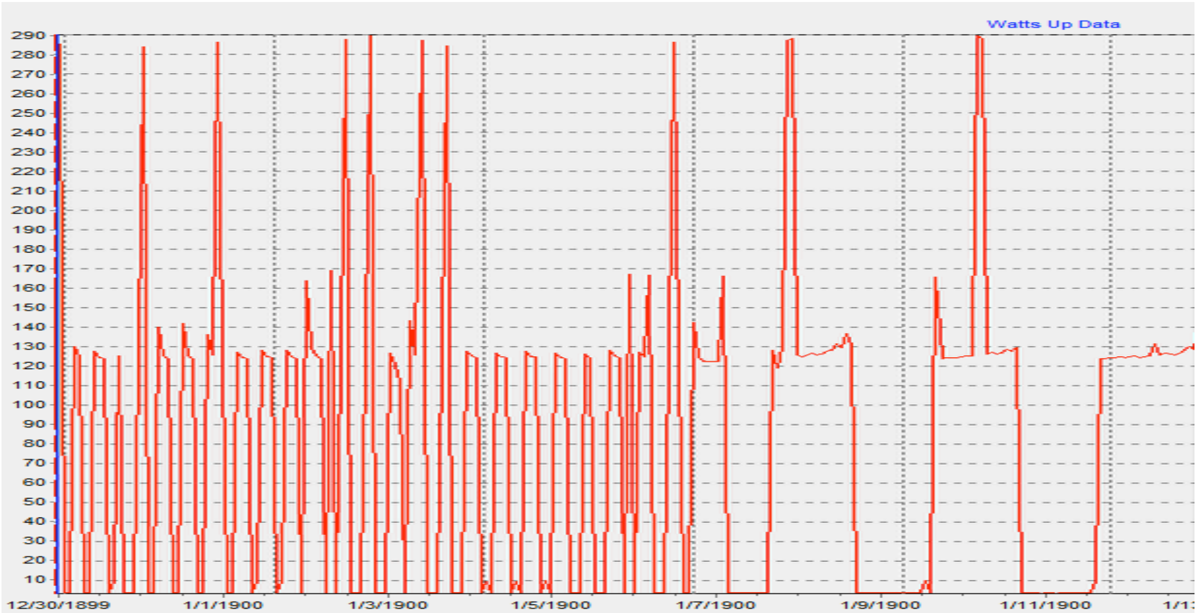
It is important that the ballasts of these fixtures be changed if you pursue this upgrade. Currently, your T12 fixtures use magnetic ballasts. These are relatively inefficient compared to more modern electronic ballasts; and T8s operate only on electronic ballast.. Plus, electronic ballasts don't "buzz" like magnetic ones do. One new ballast would be required for each fixture upgraded. These units are relatively simple to replace, requiring only basic wiring skills. The T8 tubes will fit in the fixtures you now have, so to upgrade in the overall fixture is needed.

A lighting upgrade makes a lot of sense for you considering the lights are on most of the time when the building is occupied. This reduction in electricity use will decrease the base load that you see on your current electric bills. Plus, the upgrade is relatively simple and could be done in the matter of a day.

Basement Refrigerator

In your basement, there is a refrigerator and freezer combo located in one of the storage rooms. This refrigerator/freezer was relatively empty upon inspection during the time of the audit. Not only that, but the refrigerator was set to about 32^{o}F which is much colder than the suggested temperature of around 37-40^{o}F. It was so cold that a carton of creamer inside the refrigerator was frozen.

Refrigerators are on all the time. As you can see from the graph below generated by a logger attached to the refrigerator for several days, your basement refrigerator is routinely using 130 watts of energy or more. If this refrigerator is not seen as a necessity to your operations, we suggest that it be decommissioned. You could go about this in one of two ways. First, you could simply unplug it and sell or donate it to someone. If that is not an option, then perhaps the refrigerator could just be plugged in prior to a big event. Plugging it in with enough time for it to cool down to the right temperature before an event and then unplugging it afterwards would save money over having it run all the time.

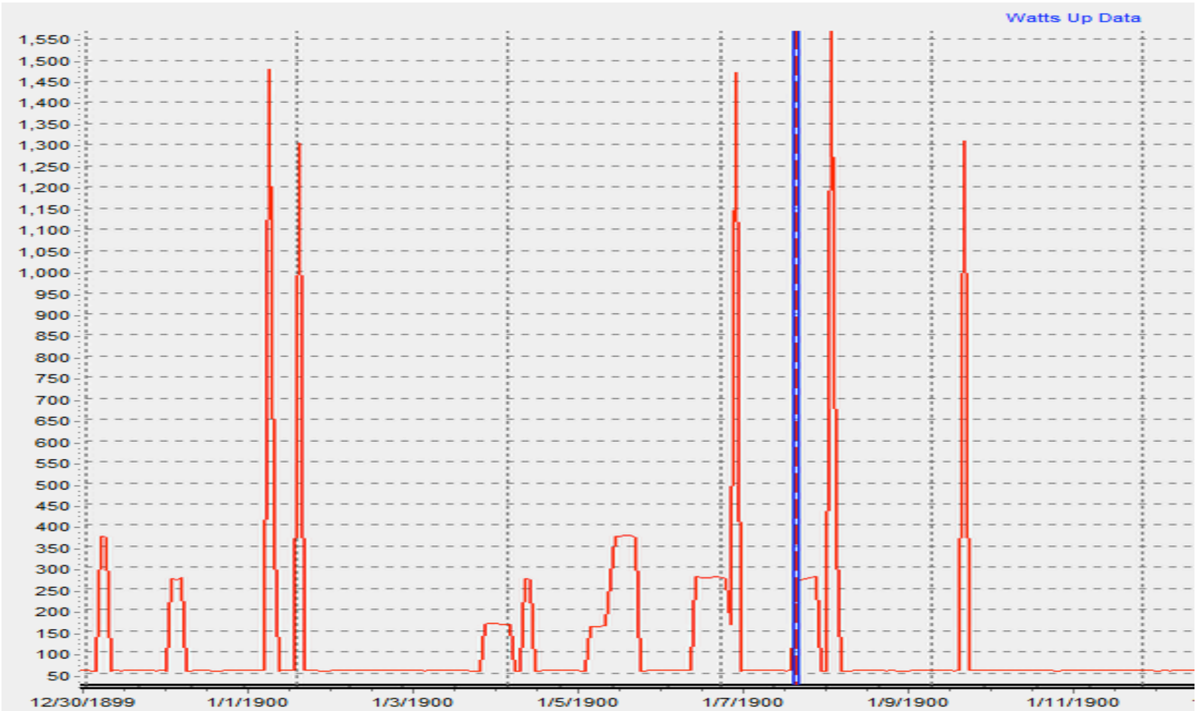


Basement Refrigerator Energy Use

Coffee Maker

Your coffee maker may not seem like a big energy user, but it's using more than you might think. When the unit is turned off, our energy meter still registered about 52 watts. This is called a phantom load. You can see this phantom load on the graph below as a straight red line just above the 50 mark. So basically, even when you are not making coffee or keeping some warm there is still plenty of electricity being used.

To remedy this, we suggest one of two things. You should either replace the coffee maker with one that does not have a phantom load or simply unplug the maker before exiting the building so it does not waste energy all night. Even simpler would be to use a timer on that outlet to only allow the coffee maker to work during hours of operation. This option would eliminate the need to remember to unplug the machine.

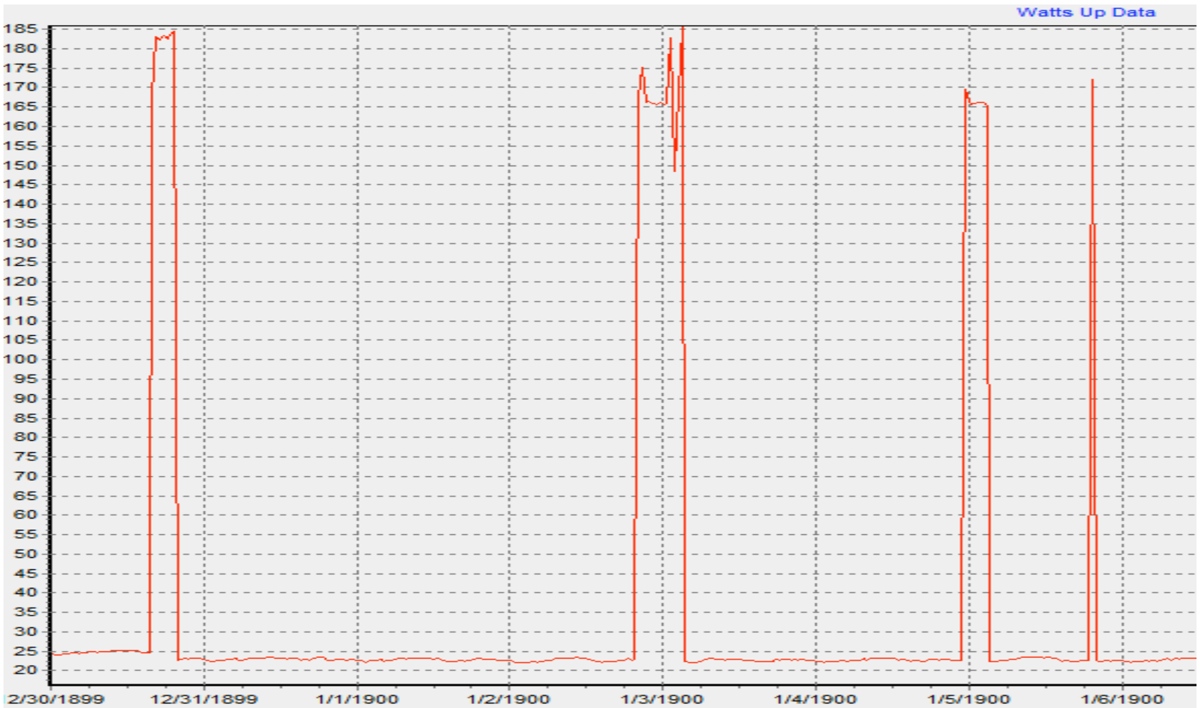


Coffee Maker Energy Use

Computers

Computers are another phantom load that most people do not know about. Out of the 4 computers we logged with energy meters, one in particular came out to be the most energy intensive while turned "off". The computer on the left when you enter "Noogie Land" was found to be using 22 watts of energy when not in use (depicted in the graph below). This phantom load could be because the user(s) are not completely shutting down the computer, there is another electronic device connected to the same power strip being left on, or the computer is just inefficient.

To remedy this we suggest that first the computer be completely shut down at the end of the day. This does not mean stand-by or hibernate. Then we would suggest that the power strip the computer is connected to be completely shut off to avoid any unintended phantom loads from the computer or other devices (as long as there is no device that needs to be powered up overnight).



Energy Use of Left Computer in "Noogie Land"

Cost-Benefit Analysis

Ceiling Insulation Repair

As we mentioned earlier, the compromised ceiling insulation is the most significant problem that we found in your building. However, it is not that difficult of a repair. Simply replacing moved insulation, placing new insulation where needed, and using insulation supports can greatly increase the efficiency of your building. We estimated that the cost for this repair could be around $1,600 depending on how much new insulation you need to purchase. Of course, we undertook this repair for you at minimal cost. However, as mentioned previously, continued regular inspections of the ceiling insulation are warranted.

According to our analysis, if the project costs $1,600 and the repair gets your ceiling's R-value to around 29 you can expect to save roughly $1,500 annually. This is a conservative estimate, your savings may exceed this amount considerably.

Lighting Upgrade

Replacing all T12 fixtures with T8 bulbs and electronic ballasts in your building would be relatively costly. Therefore, we will first consider changing 12 fixtures in your administrative offices. To do this, you would need to purchase 12 electronic ballasts ($20 each from Home Depot) and two 25 packs of T8 bulbs ($30 per pack at Home Depot). This would bring the total cost of materials to about $300 without tax.

As mentioned earlier, T8 bulbs provide more luminosity than their T12 counterparts. Therefore, you will not need to use 4 bulbs in all 12 fixtures. According to our software, only the equivalent of 8 fixtures is needed to get the same amount of light as your current 12 fixtures with T12 bulbs. This means only 32 bulbs will need to be used total in the 12 fixtures instead of the 48 you use now. To accomplish this, 8 fixtures should use 3 bulbs and 4 fixtures should use 2 bulbs. Areas where there are desks and/or a need for task lighting should have 3 bulb fixtures over or near them. Areas like the bathroom and copy machine area may be lit enough by fixtures with only 2 bulbs.

If you go with 32 bulbs total, you can expect see a payback in about 10-11 months. However, if you decide to keep 4 bulbs in all the fixtures are the T8 upgrade; you will more likely see a payback on the order of 2.5 years. Either way we think this upgrade is a great option considering the quick payback you will see. This reduction in energy usage will also help lower your baseline electricity use seen in appendix of energy use.

Obviously upgrading all your T12 fixtures in the building will cost more. For this you are looking at an initial cost of around $900 based the same prices used above. However, you will also be saving a lot more energy this way and could see a similar payback period despite the increased project cost. Therefore, if you have volunteers ready to undertake this project or a low-cost electrician available, you should seriously consider this option or perhaps upgrading more fixtures outside the administrative offices as money becomes available. One of our volunteers could be made available to provide instruction to your staff or volunteers on how to upgrade these units easily.

Windows

Your exterior windows were found to be in fairly good condition. Re-caulking the seams may be all that is needed. However, windows don’t last forever and you may want or need to replace them at some point.

If you do want to replace them you are looking at a relatively high project cost. Replacing 28 exterior windows at about $300-325 each could cost you around $9,000 initially. If you purchase windows with an R-value of 3.5 (higher than your current windows which are about R-2), you can expect a simple payback of over a decade. So, upgrading your windows may not be the most cost effective upgrade unless it is absolutely necessary.

Efficiency Measures with no Initial Cost

Basement Refrigerator

Decommissioning your basement refrigerator is another option to save your company some money while reducing electricity usage. We logged this refrigerator with an energy meter for a week. Over the course of that week the meter registered about 14.5 kWh of electricity use. Assuming this energy use is the same for most weeks means that this refrigerator uses about 754 kWh per year. With an electricity rate of $0.15 per kWh it costs you $113 dollars per year to run this refrigerator.

Therefore, completely decommissioning this appliance will save you over $100 per year. If it is needed every so often for big events however, it could be used still. Using it just for these events and then unplugging it while it is not being utilized is another way to save money and energy.

Coffee Maker

When logging your coffee maker with an energy meter, we found that it was still pulling about 52 watts of electricity even when everything was turned off. This is almost the equivalent of leaving a 60 watt incandescent bulb on all the time in your building. Therefore we suggest that you either unplug the machine when it is not in use and at the end of the day or replace the machine with one that does not pull as much electricity while off.

To give you an idea of the money and energy being wasted by the appliance consider the following. If the coffee machine were to remain shut off indefinitely in your kitchen it would continue to pull 52 watts of energy. That means every day the machine would use 1.25 kWh of energy. This equates to a mere 18 cents per day. This may not seem like much, but per week this adds up to $1.31. By the time one year passes by this coffee machine has cost you about $68 and you never got one cup of coffee out of it! So, if you assume that the coffee machine remains off for 16 hours a day during the week, you stand to save $45 per year by unplugging it during those periods of non-use.

Noogie Land Computer

The computer on the left when you walk into "Noogie Land" has shown to have a standby or phantom load of about 22 watts. Per year, this standby energy alone would cost you just under $30 assuming 24 hours of standby time. Turning off the computer completely by turning off the power strip it is connected to will eliminate these standby costs.