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Energy Efficiency at SLC

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Energy consumption accounts for thousands of metric tons of carbon dioxide emissions and trillions of dollars spent annually. Due to economically inefficient and environmentally unsustainable practices, much of the energy consumed that is contributing to these statistics is wasted. Sarah Lawrence College has the potential to drastically reduce its energy consumption through simple and effective measures including implementing energy saving lighting practices, installing energy efficient electronic appliances, and installing power saving software on computers. These changes hold the potential to significantly reduce the institution's carbon emissions while saving costs by lowering energy bills.

LIGHTING

PROBLEM

13.3% of the U.S. total energy consumption is used in lighting, which releases large amounts of Co2 and contributes to climate change and the greenhouse effect (EIA 2015)

SOLUTION

Light Emitting Diode (LED) offer a more sustainable and efficient way to provide lighting. These lights should be implemented in any remaining buildings or rooms across campus. This includes desk lamps, light fixtures, street lamps and the lighting system in Heimbold. Dimmable or diffused lights can be implemented in places that would require different lighting, such as Heimbold. The administration should encourage students to bring LED lights on suggested materials and packing lists on MySLC. Posters should be placed in academic buildings that remind students and teachers to turn off the lights when finished.

BENEFITS

LED lights only use 2-17 watts of electricity, which is around 1/30th of what incandescents use (Eartheasy, 2014). An LED light only emits 45 pounds of carbon a year whereas an incandescent emits 225 (Boston University Sustainability 2016). This leads to the ability to save thousands of dollars

INITIATIVES ON OTHER CAMPUSES

- **Boston University** upgraded the lighting systems for buildings, which has helped them reduce energy consumption by 53% (Boston University Sustainability 2016)

APPLIANCES

PROBLEM

58% of energy produced in the United States is wasted. Of that 58%, 20% is wasted by inefficient equipment (Battaglia 2013). Outdated appliances hike up electricity costs by wasting energy.

SOLUTION

Energy efficiency is the fastest, most-cost-effective way to use less energy and reduce harmful emissions. Energy Star appliances reduce consumption by 10-50% per appliance, mitigating waste and cost produced by energy inefficiency (Energy Star 2016).

BENEFITS

According to the EPA, Energy Star appliances have saved customers 24 billion dollars in 2012 alone (Energy Star 2016). In the more than two decades since Energy Stars inception, the program has prevented 2.1 billion tons of greenhouse gas emissions from entering the atmosphere (Energy Star 2016).

INITIATIVES ON OTHER CAMPUSES

- **Ithaca College** began saving half a million dollars annually once they switched their washers, dryers, refrigerators, freezers and air purifying and cooling systems to Energy Star (Foderaro 2010)

COMPUTERS

PROBLEM

Computer monitors use more energy than all other office equipment combined, with computer monitors from universities alone contributing to about 1.5 billion dollars worth of wasted energy every year (Clark 2003).

SOLUTION

Sarah Lawrence can download government sanctioned programs for free from the Energy Star website. The EPA's Energy Star EZ Save Software Program allows IT departments to manage power settings across entire networks of computer monitors from a central location, while the EPA's Energy Star Computer Monitor Power Management Program "Sleep is Good!" sets monitors to sleep mode automatically after 10 minutes. Sarah Lawrence can also encourage students, staff and faculty to power down at the end of the day.

BENEFITS

Downloading these free programs has the potential to save Sarah Lawrence up to 200,000 kWh per year for every 1,000 computer monitors, which can lower energy bills by thousands of dollars a year.

INITIATIVES ON OTHER CAMPUSES

- **Harvard University** saved $15,000 annually by switching 800 network computer monitors to incorporate Energy Star's EZ save program. This process took only four hours (Potier 2003)
- **Mount Holyoke** saved 574,000 kWh and 411 tons of carbon dioxide emissions from computer management software (Patrick 2008)
- **Penn State University** saved 740,000 kWh a year, about 17,000 dollars in energy costs a year, and 780 tons of carbon dioxide emissions a year from computer management software (Brink 2002)

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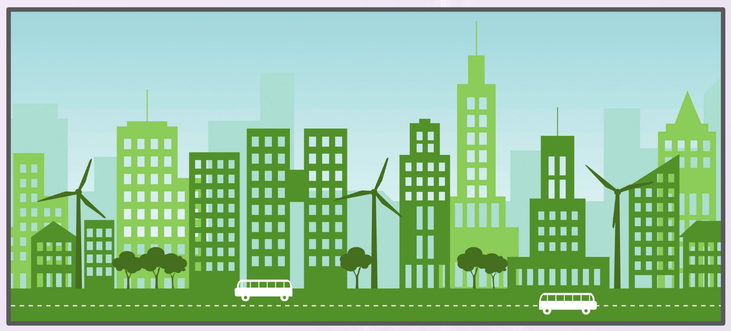

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Economics of the Ecological Crisis
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Potential Energy Savings as a Result of Sustainable Lighting, Computer, and Appliance installation

Abstract

Energy consumption accounts for thousands of metric tons of carbon dioxide emissions and trillions of dollars spent annually. Due to economically inefficient and environmentally unsustainable practices, much of the energy consumed that is contributing to these statistics is wasted. Sarah Lawrence College has the potential to drastically reduce its energy consumption through simple and effective measures including implementing energy saving lighting practices, installing energy efficient electronic appliances, and installing power saving software on computers. These changes hold the potential to significantly reduce the institution's carbon emissions while saving costs by lowering energy bills.

Introduction

It has become apparent the the rate at what we use energy needs to drastically decrease. The United States is one of the leaders of energy consumption; therefore it should be our job to be the leaders in changing our behavior towards energy and the way we consume it. There has never been a more important time to make these changes than now. Global warming is real, and we are seeing the very serious affects of it today. Oceans are rising, storms are becoming more intense, years are becoming warming, while ecosystems and resources are becoming destroyed.

Although a large cause of global warming is because unsustainable practices are institutionalized by our economy and culture, individuals can do a surprising amount to make our planet more sustainable and cut down on carbon emissions. Implementing sustainable light bulbs, sleep smart computer software and buying energy efficient appliances, are all changes that we are able to make which also cut down our energy consumption drastically.

Lighting

Being able to turn on the lights is something that many people take for granted. You simply flip a switch or pull a string and the room is illuminated. However, much more actually goes into being able to light up a room than we often think about. It first starts by the need to mine finite resources such as coal, oil; there are some power plants that are beginning to use solar and wind to to generate the power needed for electricity (Energy and Environmental News, 2011). Most of the electricity that is generated in the united states is produced in thermal power plants. Here what happens is that the resources are burned to produce steam which then is used as power to turn a turbines which then turns the mechanical energy into electric energy (Energy and Environmental News, 2011). This energy is then carried through a transmitter along a grid and into the building where the electricity is needed.

The leading cause of global warming is the combustion of Co2 into the atmosphere, which creates the greenhouse effect which traps the heat within the atmosphere. Although people normally do not think that ,lighting and the choices they make when it comes to lighting their home has a large impact on the environment and status of the world but it does. The U.S. Energy Information Administration has estimated that in 2014, about 412 billion kilowatt hours

of electricity were used in the residential and commercial sector, which i is nearly 12% of total electricity consumption (U.S. Energy Information Administration, 2015). In U.S. homes lighting accounts for 10% to 25% of total energy consumption (U.S. Energy Information Administration, 2015). The manufacturing sector in the us also spent and used a considerable amount of electricity of 52 billion KWh which is 1.3% of the US total electricity consumption (U.S. Energy Information Administration, 2015).

A significant amount of carbon dioxide is emitted into the atmosphere due to the lighting industry, but there are some ways in which we can reduce these emissions through government intervention and policy. For example, there could be policies directing the stop to the production of the highly inefficient incandescent light bulbs. In continuation of this, there could be subsidies placed on the LED and CFLs light which have traditionally been more expensive but much, much more efficient. This subsidy would help allow lower income people to not be burdened with the loss of the the cheap incandescent light bulbs. Another policy that would help lower the emissions from lighting would be to expand and invest in solar and wind energy (Harris, Roach 2013). What makes lighting unsustainable is that to produce the electricity to light homes and buildings, fossil fuels are burned, which emits co2. However, if we could generate the power needed to make electricity, without burning fossil fuels, through wind or solar, it would decrease emissions.

One way to reduce the amount of energy needed to light the residential and commercial sectors is to install compact fluorescent bulbs or light emitting diodes. These lights produce light differently than the generally used incandescent light bulb where electric current runs through a wire filament in order to heat up the filament until it begins to glow (Energy Star 2014). What

makes incandescent lights so inefficient is that to produce light, it first must produce heat. The heat is a wastes a lot of electricity and requires a greater input of power than in other types of light bulbs. In compact fluorescent bulbs electricity is shot through a tube within the light bulb which contains argon and a little mercury vapor. This produces ultraviolet light which reacts with the fluorescent coating to generate light (Energy Star 2014). A light emitting diode, or LED for short is another strategy that will more drastically cut down on energy use. The LED is a two lead semiconductor and works by supply electricity to the bulb, electrons react with electron holes; in the midst of this process, light is produced (EarthLed 2007). This light bulbs last longer and are quite a bit more efficient than CFLs.

Although compact fluorescent bulbs are more expensive than incandescent light bulbs; they are about 8-12 each, they are an incredibly worthy and smart investment. They use 75% less electricity than incandescent light bulbs and lasts ten times longer (Tufts Climate Initiative, 2015). CFLs use less watts, A watt, on the other hand, is the amount of electricity a light bulb uses to produce light - it's not an indication of brightness (Consumer Energy Center 2016). Meaning that a 13 watt CFls produce as much light as a traditional 60 watt incandescent light bulb (Consumer Energy Center 2016). This results in massive savings and in the energy bill and in the amount of energy needed to produce electricity. On average it costs 8 cents per kilowatt hour, with an incandescent light bulb, it would cost 35.04 whereas if you had a compact fluorescent bulb, it would cost 8.06 whereas a Compact fluorescent bulb would save around 550 kilowatt hours over the course of its lifetime (Consumer Energy Center 2016). Also, if the electricity that is pr when coal is the generator of the electricity , that savings translates to 500 pounds of coal not burned which then translates to 1300 pounds of carbon dioxide and 20 pounds

of sulfur dioxide will not get into the atmosphere, just by switching one bulbs with a CFLs can save 25-70. Over a CFLs lifetime is prevents 1,000-2,000 pounds of carbon dioxide from emitting into the atmosphere as well as 8-16 pounds of sulfur dioxide (Consumer Energy Center 2016). This is crucial to making the transition into a green lifestyle. To light the united states, it takes a considerable amount of energy and power is needed. These create emissions which contribute to the greenhouse effect and the warming planet. It takes a small investment and little effort to take a step that would vastly improve the status of light.

Compact fluorescent lights are great in cutting emissions, LEDs are even more energy efficient. Although a bulb is more expensive, around $15-20, they use a considerably less energy. a LED light only uses 44 KWh a year where a CFL use 55 KWh a year (EarthLed 2007). Since it uses so much less energy, it therefore emits a lot less carbon as well. One bulb emits 45 pounds a year whereas to a CFL which emits 56 pounds a year, compared to an incandescent light bulb which emits 225 pounds of carbon a year (Boston University Sustainability 2016). a LED light, although more expensive also has a significantly high life span, one of 25,000 hours, than that of the other types (Boston University Sustainability 2016).

Although transitioning to LEDs is the most impactful thing to do in terms of reducing emissions generated by lighting, there are also other things individuals and institutions can do to lower unnecessary light use. This includes the implementation of motion/thermal sensors and lighting timers in public spaces. Thermal sensors, also called occupancy sensors is a light switch which has both an infrared sensor with a timer, which automatically turns off the lights after the timer if there is no bodily heat or motion (University of Oregon Environmental Leadership Program 2016). The lights will go back on if the sensor detects any sort of motion, such as

walking into the room. It is also convenient these controls can also be canceled by simply switching the switch as well. These sensors have the most potential to save energy and money when installed in institutions or public buildings. Sensors are an extremely worthy investment because they have the potential to lower the lighting bill and consumption up to 50% and only cost between 20- 60 dollars (University of Oregon Environmental Leadership Program 2016).

Thermal/motion sensors work well in places such as Universities/colleges because they have so many common places and public buildings. Other schools have made the investment of implementing lighting sensors and have seen drastic results. For example, Saint John's university in Queens, New York installed thermal/occupancy sensors in their lighting fixtures and saw immediate positive results. Saint John's has 33 buildings which take up 2.2 million cubic feet (Leviton Manufacturing CO. 2012). They had a goal to make their campus more holistic and energy efficient. They therefore contacted Leviton and Energy Conservation and Supply, Inc, and installed sensors in classrooms, labs, offices and other rooms. These sensors have saved the universities $13,293 and cut kWh usage by 73,848 a year (Leviton Manufacturing CO. 2012). The sensors implementation cost $10,442 and saw a full return on that investment in only nine months (Leviton Manufacturing CO. 2012).

Another example of an educational institution to making successful changes that benefited both financially and environmentally is Boston University. B.U. took an initiative to make the campus more sustainable back and part of this initiative was to improve lighting efficiency. Therefore, the school replaced all of incandescent light bulbs in many of the buildings with LED or CFLs (Boston University Sustainability 2016). These projects have resulted in a savings of 5,794,883 kWh/year and 2,706 metric tons of CO2e/year, which equals

497 cars or 69,385 trees (Boston University Sustainability 2016). Boston University has also upgraded the lighting systems for the new buildings. This has helped them reduce energy consumption by 53% than if they were not changed (Boston University Sustainability 2016). The university has also found perks in the fact that since LED and CFls last much longer than incandescent light bulbs, there has been a significant reduction in maintenance and costs because the bulbs do not have to be replaced not really as frequently. This has allowed for the maintenance crew to focus their attention on other areas.

From looking at the success stories from other schools, we can see that motion sensors and LED are an extremely smart and worthy investment to make here at Sarah Lawrence College. Not only will it reduce the school's energy bill, but will also decrease the school's carbon footprint and ensure that the institution is committed to a sustainable and green future. To ensure the maximum benefits from these investments and transitions, it is important that the school replaces all non LED light bulbs in every building and fixture. This includes hall lights, library desk lamps, decorative lights and more. The school should also make effort in encouraging students to buy these for dorm room desk lamp. Sarah Lawrence College should also take action on installing motion sensors in hallways, classrooms, study rooms, bathrooms and laundry rooms. The college's administration should also take steps to ensure that lights in student's dorms are the most sustainable option as well. They can do this by encouraging students to bring LED lights on packings lists and only selling LEDs in the bookstore or Hill2Go. Making these types of appliances will definitely cost something, but compared to the rate of return and the amount of money that will be saved in the future, it is a very small amount.

Computers

Computer monitors use more energy than all other office equipment combined, and from universities alone, contribute to about 1.5 billion dollars worth of wasted energy every year (Clark 2003). This energy gets wasted because on average across universities, more about 60 percent of computers are left on overnight, and more than 40 percent of computers not equipped for power management (EPA). At Sarah Lawrence, computers exist in faculty offices, staff offices, student spaces, and the library. When turned on, computer monitors use energy even when not actively in use. In order to curtail the amount of energy that the college puts into running computers, the college could apply software like the EPA's Energy Star Computer Monitor Power Management Program, "Sleep is Good!," which sets monitors to sleep mode automatically after 10 minutes, or the EPA's Energy Star EZ Save Software Program, which enables IT departments to manage power settings across entire networks of computer monitors from a central location, allowing for IT to put network computers into a low power sleep mode when not in use and to turn computers off at the end of the day. These government sanctioned programs can be downloaded for free from the energy star website and has the potential to save up to 200,000 kWh per year for every 1,000 computer monitors (EPA). The EZ Save Software Program will reduce energy consumption by computers and monitors during operating hours and overnight; the reduction in energy costs has the potential to save the college thousands of dollars a year while reducing carbon emissions and consequently the college's ecological footprint.

Several institutions have benefitted financially from establishing computer sleep and power protocols. Harvard University, for example, has taken advantage of Energy Star's EZ

Save Software Program by installing it on 1,000 faculty and staff computers, resulting in 15,000 dollars worth of savings annually (Potier 2003). The school was able to accomplish this by enabling all networked computer monitors to manage power through the network itself through EZ save. Harvard was consequently honored by the EPA for its power saving initiative. The entire process of switching 800 network computer monitors to incorporate Energy Star's EZ save program took Harvard only four hours. Meanwhile, Penn State's Energy Program Engineer Doug Donovan used the EZ Save software to analyze almost 300 computer monitors' power management status before enabling them for power management, saving the university 740,000 kWh a year, about 17,000 dollars in energy costs a year, and 780 tons of carbon dioxide emissions a year (Brink 2002). Other universities have benefited from similar practices; power management systems on computer monitors at University of Ohio has saved 15,150,000 kWh and 15,000 tons of carbon dioxide emissions and Mount Holyoke 574,000 kWh and 411 tons of carbon dioxide emissions (Patrick 2008). As climate change continues to grow as a threat to the planet, the college cannot afford to not make such a simple change to reduce emissions.

Conclusion

More efficient lighting and computer use holds the potential to reduce the college's energy consumption significantly; continuing on this path, the college can benefit further by applying sustainability to larger appliances such as refrigerators, air conditioners, dishwashers, stoves, and ovens. In fact, some peer institutions have already begun to implement such changes. In the past few years, Ithaca College has moved towards sustainably developing their campus. To begin this transition the school has invested 1.3 million dollars in purchasing Energy Star

appliances (New York Times, 2010). Energy star appliances, labeled through the Federal Trade Commission, are appliances that are more energy efficient than minimum guidelines (Environmental Protection Agency). With an estimated energy reduction of between 10 percent and 50 percent per appliances, it's not surprising that Ithaca has saved half a million dollars annually on heating and electricity costs (New York Times, 2010). The purchase of energy star appliances has essentially paid for itself in thirty-one months.

This transition has earned Ithaca College the government's energy star label, which is based on their utility bill and accounts for factors such as building size, computer use, local climate and occupancy (New York Times, 2010). The energy star label achieved by Ithaca College has attracted them the attention of the New York Times who praise Ithaca "for its embrace of all things sustainable"1. And, within the past few years, Ithaca's environmental and sustainability programs have thrived. Ithaca College is recognized as "one of the nation's leading education institutions in environmental and sustainability education and action" (Energy Star, 2010).

Following Ithaca College's lead, Sarah Lawrence can take similar measures to reduce energy consumption. If Sarah Lawrence invests in purchasing energy star appliances, the school would not only see massive costs savings, but a government sanctioned label and a guaranteed space on the map of environmentally sustainable universities. Thus far two colleges in New York, Ithaca and Hamilton, have earned energy star labels, helping to bolster their environmental and sustainability programs (New York Times, 2010).

Beyond substantial savings and school promotion, the energy star appliances have the potential to make a big difference in reducing waste and power usage. For instance, energy star

washers and dryers have been installed at Tufts University, saving the school 17,000 gallons of water per year and cutting carbon emissions by more than 30 tons annually since their installation (State of Massachusetts, 2008). Additionally energy star vending machines installed at Tufts have cut consumption in half (State of Massachusetts, 2008). In the 90 machines installed 100 tons of carbon dioxide were saved annually (State of Massachusetts, 2008). When the University of Maryland replaced 50 old refrigerators with Energy Star refrigerators the university cut carbon emissions by 45 tons annually (University of Maryland, 2016).

With a relatively low startup cost and a very quick payoff, it is in Sarah Lawrence's best interest to purchase energy star appliances; such a purchase would allow the college to continue to grow in a sustainable manner.

Maura Beard, spokeswoman for the Energy Star program, explains that every year "colleges and universities spend almost 2 billion dollars on energy" (New York Times, 2010). She goes on say that a lot of people believe the solution to the running of a environmentally sustainable university lies in the "latest gizmo or newest technology" (New York Times, 2010). But there are things universities can do that are relatively simple. It could be as easy as swapping out light fixtures and monitoring computer power usage or a small upfront investment in the purchase of more efficient appliances. The idea is extricating waste into our atmosphere and within this report we've described ways for Sarah Lawrence to do so without overrunning the current system. The adoption and implementation of these programs will both save money and help towards creating a better, more environmentally sustainable university.

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