Sustainable and Energy Efficient Dorm Pilot Proposal

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ESTU 471
Winter 2012

1.0 Executive Summary

1.1 Problem

Western Washington University has committed to reducing greenhouse gas emissions levels 36% below 2005 levels by 2020 and climate neutrality by 2050 through the President's Climate Action Plan. Under the President's Strategic Goals, Western is to "[f]oster and promote life-long learning and success in an ever-changing world" and to "[s]erve as a model for institutional effectiveness, innovation, diversity, and sustainability." These commitments are three-fold - reducing greenhouse gas emissions, educate students in sustainable practices to continue past their time at Western, and to represent to the greater community leadership and innovation in addressing the problems of a secure, healthy future for both society and the environment.

1.2 Solution

To address these commitments, a Sustainability and Energy Efficiency Dorm (SEED) pilot program would be established in one room in Buchanan Towers – Classic (the original building). This room would be used by the Resident Resource Awareness Program (ResRAP) ecoReps to demonstrate to residents, prospective students and their families the benefits of energy-saving technologies and practices. Included in the room would be energy monitoring outlets that would convey to the students the amount of CO_2 or coal that would have been utilized if Western had not offset 100% of its energy. Standard lighting, faucets, shower heads, toilet and refrigerator would be replaced with much more efficient models.

By placing a demo room in the residence hall, Western and the Buchanan Towers – Classic community will gain a more meaningful involvement in student sustainability lifestyle education through a positive, hands-on, and accessible example. Western will be able to learn from the SEED, picking up effective measures from it to use system-wide in the University Residences. The SEED would also be desirable to incoming and current students, building the momentum of the application of the SEED's lessons.

1.3 Funding Requirements

Funding for this proposal can come in part or in whole from a number of responsible parties, such as University Residences, Hall Council, and the Green Energy Fee. This proposal is aiming to draw attention from all sources in hopes to divide and conquer. The compartmentalized nature of this project lends it to dividing costs. The currently estimated cost is just shy of $5,000, including installation labor. Fortunately many of these products are available on commercial sites such as Amazon for less than manufacturer-suggested retail price (MSRP). The Office of Sustainability has secured some ThinkEco Modlets, but their role has yet to be determined.

1.4 Organization

This proposal was undertaken at the request of continuation by Fall quarter's Campus Sustainability Planning Studio (CSPS) group. CSPS provides the campus community with additional research and proposals through the Office of Sustainability. The role of CSPS is to provide the best research possible going into proposals so that

the responsible primary stakeholders will have valuable resources as a basis going forward.

2.0 Statement of Need

Western's commitment to carbon neutrality by 2050 through the President's Climate Action Plan is a major commitment and any and all steps toward it should be considered. Western commitment to sustainability expands beyond just itself, however. There is a duty to instill sustainability as a mindset into Western's students, faculty, staff, and the surrounding community. Campus should also strive to become a beacon of sustainability on a larger scale, improving its image on a state, regional, and national level.

Incoming Vikings come from a variety of backgrounds and upbringings, and may or may not be exposed to a certain level of eco-consciousness. Western already is making an effort via the ecoReps and other sustainability-related programs, but more can be done to clue students in on household lifestyle practices for use once they move off campus. College should prepare individuals for the 'real world' and a lot of life skills are learned in the dorms - from learning to do laundry, to learning how to be a good roommate. Western should aim to provide Washington with the best-prepared graduates and this includes preparation beyond academic instruction. If Washington is committed to preserving our environment for future generations, it is best to have graduates equipped with the knowledge to do this in their consumer lives.

Providing students who live on campus with a more environmentally friendly space to live and work will assist in educating upcoming generations and making living more sustainably the norm. Sustainable behavior should be a part of the experience that students obtain from their time at Western Washington University. Though some of the components of making the dorm rooms more energy efficient may not be as applicable to students right away when they move out of the dorms into rental homes and apartments, they will still have an important impact by teaching students how much energy they consume and how investing in something like an LED bulb for their most used lights or a more efficient showerhead can pay off.

It is unlikely students will not leave Western and completely upgrade their rental home with energy efficient products. However, there is a need for students to receive the education and experience from Western Washington University to make the connection of the waste of water and electricity. Education of consumption through tools like the energy monitoring systems and experience of low flow and energy efficient fixtures, students will make the correlation with expenditure and be able to relate their energy and water use with coal consumption and CO_2 emissions. This will lead to wiser decisions and sustainable acts.

3.0 Project Description

3.1 Objectives

This proposal aims to provide the campus community with an energy efficiency demonstration dorm in Buchanan Towers – Classic that will educate incoming and prospective students about the simplicity of saving energy to combat climate change,

be replicated across campus in the future after the room acting as a testing ground for new products, and fortify Western's image as a leader in sustainability in the Northwest. By creating an experimental and innovative example, a blueprint is laid out to be built upon for further energy efficiency efforts throughout University Residences in the future.

3.2 Methods

These objectives will be pursued in part by applying energy efficient technologies in appliances and fixtures to demonstrate how easy savings can be. The measures would be new LED light bulbs, low-flow faucets and shower head, dual-flush low-flow toilet, a highly efficient refrigerator, an induction cooktop, and energy monitoring equipment. These installations would be done over the summer when fewer students are in the dorms. The idea behind these applications is to automate energy efficiency where possible with no detriment to the students' lifestyle.

Educational outreach will be built upon the SEED will reach students through climate change impacts, such as typical CO_2 emissions or coal consumption. Although Western purchases 100% renewable energy or offsets, the point of teaching through coal and CO_2 is to give students something they can take away when they inevitably move off campus. With climate change becoming an increasingly important topic and the largest North American coal port proposed here in Whatcom County, coal and CO_2 are the right medium for reaching students. They mean more than kilowatt-hours (kWh). For this reason, the signage in the room for tours would focus on these two mediums of impact.

The SEED would be involved in the Discovery Days program to give prospective students and their families a chance to experience how energy efficiency interacts with the student lifestyle in the dorm, showing that it is helpful rather than inconvenient. The goal is to get prospective students to wonder why only this room is so equipped, giving some momentum to the program to be spread through the University Residences on a larger scale and fortify Western's image as a leader in sustainability.

Refrigerator:

The most efficient refrigerator models are in the 16.5 cu. ft. with a top-mounted freezer, which was determined to be the most efficient setup by last quarter's group. The federal standard for annual energy consumption is 463 kWhr per year. Our model would be 35% more efficient, only consuming 300 kWhr per year. Hotpoint and GE have models meeting these statistics for $550 MSRP.

Induction cooktop:

The inclusion of an induction cooktop is a smart choice over the typical electric cooking range because of the direct transfer of heat to the pan, rather than through a heating coil, to the pan, then to the food. They are safer, generating little heat on the cooking surface itself, and are easily cleaned.

A portable 2-burner model would be convenient because of the lower likelihood students would need 4 burners and the lower cost than an installed 4-burner model; the portable model from BergHOff is $399, whereas the installed 4-burner range and

convection oven from GE is $2,889. The portable option would suit this room if extra counter space is installed to replace the old oven and a countertop convection oven, akin to a toaster oven, is also provided (Black and Decker has a model for $99.99). The cost of cabinetry work installation would have to be weighed against replacing the oven with the GE model. It is likely simply adopting the GE model is most aesthetically appealing and simplest.

Most modern cookware is compatible with induction, so long as it has a magnetized bottom to contact the induction surface, but if this is an issue for students, some cookware could be provided as room equipment, for which the students would be responsible. Interface disks also exist, which permit the use of pots and pans that may not be compatible to be used with the induction range.

Energy monitoring:

The energy monitoring equipment is included to teach students how much their personal electronics or lamps consume and to prevent vampire drain. Vampire drain occurs when fully-charged gadgets or unused, off electronics are plugged in. A small amount of power still courses through the circuit. Unplugging the devices or cutting off the circuit eliminates this waste. A couple kinds of devices would be included in the SEED to meet different needs. A Belkin Conserve Smart AV would be included for each student's desk and a Belkin Conserve Socket for their phone chargers. The Smart AV is a power strip with a master plug that shuts off all other circuits when power is no longer passing through it. The student's computer would ideal be plugged into the master plug (which is colored green to denote its role) so that when he or she turns off her computer, all related gadgets such as monitors, external hard drives, printers, and the like are also shut down. The Smart AV also included two unswitched circuits for things that would remain always on or require constant access like a clock or desk lamp. For other outlets, a P3 International Kill-a-Watt Wireless Sensor would collect the energy usage from up to 8 wireless transmitters, which could be installed on any outlet in the SEED. This component is particularly useful because it can relay the usage information to the users as CO_2 or coal in addition to kilowatt-hours. ThinkEco has agreed to send the Office of Sustainability some of their Modlets, an energy monitoring outlet that reports energy use to a computer via USB dongle and cuts standby or vampire power drain. ecoReps will be given these to trial in their dorms before the SEED is applied. Modlets also can be scheduled. The device reports in kilowatt-hours, but converts to impacts like pounds of carbon reduced, gallons of gasoline saved, or trees planted.

LED Lighting:

BT Classics current rooms are equipped with a mix of compact fluorescent and incandescent lighting. With proposed LED lighting, LED lights use approximately 29% less energy than CFL's and are 83% more efficient than incandescent lighting. Though LED bulbs are far more expensive than CFL, they have a life span of 4-5 times longer. With combined energy savings and the life expectancy of LED lighting being 4-5 longer, the total cost is approximately equal, this is shown more thoroughly in the table below.

Western Washington University will not be saving a large amount of money by switching over to LED lighting, but the environmental impact will be greatly reduced. On top of the 29% lighting energy saving, one LED light for every five CFLs will be kept from landfills, as well as CFL's contain harsh components such as mercury that pollute the environment.

Contact has been made with Randy Pipp from Eagle Lighting, but more extensive research is needed such as the current lighting angles, model numbers and the warmth of the lighting desired, to most accurately replace current lighting.

Table 1. Current and Proposed Lighting

Room	**BT Classic Lighting**	**Cost of LED Bulb**	**Wattage of LED Bulb**	**Bulb Comparison**
Bedroom	2/BEDROOM: 42 Watt PL 4-pin fluorescent	$39	8	comparable to 32W
Living Room	42 Watt PL 4-pin fluorescent	$39	8	comparable to 32W
Bathroom	Vanity 2- F17 T8 flourescent	$29	10	2 foot
Shower	Screw-in CFL	$29	6	Use A19 in E27 (40-60 watt)
Range Hood	60 Watt incandescent	$39	6	
Countertop	Screw-in CFL	$39	9	PAR30 60-75 watt

Table 2. Bulb Comparison

Component	**LED**	**CFL**	**Incandescent**
Light bulb projected lifespan	50,000 hours	10,000 hours	1,200 hours
Watts per bulb (equiv. 60 watts)	10	14	60
Cost per bulb	$35.95	$3.95	$1.25
KWh of electricity used over 50,000 hours	300 500	700	3000
Cost of electricity (@ 0.10per KWh)	$50	$70	$300
Bulbs needed for 50k hours of use	1	5	42
Equivalent 50k hours bulb expense	$35.95	$19.75	$52.50
Total cost for 50k hours	$85.75	$89.75	$352.50

(Table courtesy of eartheasy.com)

Shower Head:

Currently, the shower heads that are in use in the bathrooms of BT classics dorm rooms use water at a rate of 2.2 GPM (gallons per minute). By updating the showers with new low flow shower heads like the Brecor EcoFit, the water flow will be reduced to 1.25 GPM through air flow technology. With the average American shower lasting

eight minutes, updating the shower heads would bring the water use of one shower down from 17.6 gallons to 8 gallons per shower. In comparison, for just one student living in the dorms for fall through spring quarters, would bring water consumption from showers down from 4,752 gallons down to 2,160 gallons, saving 2,592 gallons of water per dorm resident just from their shower usage.

Toilet:

Through application of the one2flush system, the existing toilets can be retrofitted with a dual flush low flow system. With a cost of $22.95 and approximately 30 minutes of labor, the existing toilets can be upgraded to a low flow dual flush toilet. Giving you the choice of using .8 GPF (gallons per flush), or 1.4 GPF. With the one2flush system, toilet water usage will be cut by 59-77%, with the current flush rates of 3.4 GPF.

Kitchen/Bathroom Faucet:

Replacing the kitchen and bathroom faucets with low flow Delta models will reduce faucet water usage by nearly 1/3. Delta manufactures high quality brass faucets at a modest price. Through the application of the low flow faucets, shower head and toilet, water usage in the dorm rooms will be reduced dramatically.

3.3 Administration

The SEED would be occupied by ecoReps, who would use it to instruct current and prospective students about sustainable lifestyle practices. ecoReps are the ideal residents because of their commitment to sustainability, which would drive them to fully utilize the energy efficient equipment and report back on it. Their role would be to educate beyond the room, as well, continuing their current practices of putting on sustainability events in the hall, such as the Go for the Green Challenge. ecoReps would serve as the interface between students, the SEED, and ResRAP.

To more effectively reach students, the ecoReps would administrate a blog that would provide tips to students and highlight their experiences and savings living in the SEED. They would also be involved in Discovery Days, giving tours to prospective students and their families. This would be aided by placards by each important installation to illuminate differences between the SEED and a normal dorm. Again, the focus would be on tangible impacts like CO_2 or coal.

The future of the SEED could be expansion to an entire floor as a sustainability living community or first-year interest group. Here students would be much more involved in learning sustainable practices and educational outreach. It is likely this option would be quite popular and would represent Western's commitment to combatting climate change very well. On a larger scope, the goal is for the SEED to provide the opportunity for further adoption of sustainable practices and technology use throughout the University Residences system as the Capital Plan's updates and remodels are undertaken. This means the SEED would eventually become equivalent to or even outdated compared to the norm in Western's residence halls, at which point it would need updating itself. The SEED can be seen as a renewing entity meant to stay

on the cutting edge of energy efficiency and monitoring innovation to guide campus to carbon neutrality and energy efficiency.

3.4 Evaluation

Though direct monitoring and accounting of energy use of a single room in Buchanan Towers – Classic is difficult due to the plumbing and circuitry, this proposal adopted an approach that would more or less guarantee savings through more efficient equipment and bring in student involvement through energy monitoring equipment. As the adage goes, we manage what we measure. This will draw the residents in to a kind of game of energy saving as they track their CO_2. This data will be tracked by students and would be available to those who would seek evaluation of the SEED. Winter months would naturally show an increase in energy use as lighting needs increase and students invariably spend more time inside. The savings of the SEED are likely difficult to exactly calculate because of the wiring and plumbing issues, but an estimation could be made through a comparison of the standard equipment to the energy efficient fixtures in the SEED. This analysis is currently greater than what has been undertaken for this proposal.

3.5 Financial Sustainability

The natural expectation with the SEED is that will be financially self-sufficient because of the energy saving technology and student involvement in monitoring their use. By putting energy consumption into the students' hands, they will experience their impact and work to decrease it. However, the pilot trial nature of the SEED does not necessitate financial success immediately in the room itself, but rather to act as a proving ground for technologies and practices to be applied to the entire University Residences system in the future. This provides an opportunity to evaluate the worth of each component of the SEED to determine whether its application beyond that room is worthwhile.

4.0 Budget

The cost of proposed components is currently $4,349.96 at MSRP, excluding installation. The total estimated installation time is 6-8 hours at $68 per hour, adding an additional $544 for a total of $4,893.96. This does exclude potential delivery costs and our means to truly evaluate the time necessary to do this work is limited. It may also be necessary to create a simple handbook for the residents of the SEED to have on hand, as some of their equipment is substantially different enough from typical household appliances and fixtures. This would ensure proper use to minimized waste, accidents, and any possible harm to the room, equipment, or students. A manual would not need to be lengthy; simple and clear instructions would be best.

5.0 Campus Sustainability Planning Studio

Campus Sustainability Planning Studio (CSPS) is an ongoing research class put on by Office of Sustainability Coordinator Seth Vidaña. CSPS provides the campus community and relevant stakeholders with important research and proposals in pursuit

of a more sustainable Western, dating back to Fall 2008. The reports and proposals created by CSPS are available on the Office of Sustainability website for future reference by both stakeholders and future CSPS students looking to pursue similar goals.

The SEED is a continuation of a Green Dorm proposal by a group of Studio students from Fall quarter. The three students who prepared that report were Reginald Christor, Alyssa Lewis, and Bryce Moulton. Moulton approached Sewell about the possibility of continuing their project prior to registration for Winter and the author agreed. In CSPS, topics to be researched were brainstormed and supported by the instructor, Seth Vidaña and a nomination and signup process occurred to select which topics would be researched by which students. This secured the pursuit of the Green Dorm proposal and brought the authors together.

6.0 Conclusion

The SEED pilot will provide Western with a more direct approach to instructing student residents about lifestyle sustainability and energy efficiency, while improving the University's image as a leader in sustainable innovation. The SEED will trial energy efficient technologies for campus at large, which will benefit from this limited application experience before any technologies are adopted on a systemic level. By being a demonstration, the SEED will make energy efficiency technologies desirable. The fears or misconceptions will be dispelled, or if some prove to be real, the problem is limited to one room with involved students.

The price of this proposal is fitting for the benefits it will provide as it saves energy over a long timeframe, instructs Vikings about their energy consumption at home, present to prospective students and their families Western's dedication to sustainability, and help meet the 2050 commitment to climate neutrality. The SEED is a worthy investment for the University in the long run, paying out year after year as its benefits expand.