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## 1.0 Introduction

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### 1.1 Purpose of the Project:

As students of a university that is dedicated to renewable energy and sustainability, we believe those values should be integrated into residences. A green dorm room would demonstrate the benefits of an energy efficient residence by reducing water use, energy use, and long term costs to Western. The green dorm would also encourage waste reduction, recycling, and composting. It would serve as the sustainable core of a student's time here at the University. The pilot dorm room will demonstrate a possible future for campus residences. It will serve as a preview to prospective and current students, along with faculty, and administrators. The final product will exhibit a dorm room Western students' want.

A pilot green dorm gives the University an opportunity to pilot test new and innovative green technologies without having to commit to doing a whole building at once. The pilot dorm will serve as a test room that always has the latest technologies in sustainability, keeping Western on the forefront of the sustainability movement. Sustainable residences will be a crucial addition to Western life in order to reach climate neutrality by 2050, in accordance with Western's pledge.

### 1.2 What is a "Green Dorm"?

In terms of description, the word 'green' is used throughout this document and presentation materials. In terms of our project, 'green' is encompassing all sustainable synonyms into one reference. A "green" dorm room must be environmentally conscious in all aspects. There must be technologies in place that conserve energy and water. The furnishings and other objects that go into the room will ideally be manufactured in environmentally friendly ways, dispensed locally, and/or have a the smallest overall footprint on the environment. Included in this, the residents must also act in environmentally conscious ways, following a set of 'Room Requirement Eco-Guidelines'; that means using nontoxic cleaning supplies, eating locally, recycling, composting, reducing overall waste, driving infrequently, turning off the lights, and other practices of that put an emphasis on conserving energy and protecting the environment.

It's important to remember that the long-term goal of this proposal is a complete overhaul to all of Western's residences. We envision a Western campus in which every residence hall is a highly efficient, environmentally conscious building, full of students who live sustainably--not only because they strive to do so, but because their campus

encourages it in every possible aspect. That is a noble goal, and a lofty one as well, something that won't be achieved for many, many years. But we know it is important to have this long term objective on the horizon, so we know what we are aiming for, and why. Energy efficiency will only become more desirable and necessary in the future, so we need to start addressing our inefficiencies today.

Our pilot green dorm will show the kinds of changes that can be made to the current residence halls, using a Buchanan Towers suite to demonstrate. It will showcase appliance and fixture updates, newer, more sustainable, and more efficient building materials, as well as environmentally friendly furniture. All of this will include updating the aesthetic appeal of the suite as well, creating an environment students will desire. We want to show prospective students as well as current students, faculty, and staff, just how green a dorm can be, and how much money it can save. We envision the room as a high tech, modern, sustainable residence that any incoming freshman will *wish* they got to live in.

The Eco-Rep program at Western already does a great job at providing students with a permanent source of information regarding environmentally-friendly living practices while in the dorms, and off-campus at Birnam Wood. Within our project is an opportunity to take the Eco-Rep role just one step further: providing them with the living space that showcases everything they are already passionate about. By having an Eco-Rep live in our pilot dorm, the hope is that it will generate more student interest by allowing prospective Reps and students to tour the room periodically, as well as achieving a higher success rate for following the Eco-Guidelines.

### 1.3 Significance to Western Washington University:

Western's Mission Statement and Strategic Plan, issued by the President of the University, offers strong support in regards to the need and significance for a project such as this:

"(Vision): Western will build a stronger Washington by being an international leader in active learning, critical thinking, and societal problem solving... (Strategic Goal): Serve as a model for institutional effectiveness, innovation, diversity, and *sustainability*."

A project such as the pilot dorm, will give Western the opportunity to showcase the commitment this University has made in its efforts towards sustainability. The dorm will highlight energy savings both in actual output and overall costs to the University as a whole. The last few years have been tough for both administration and students in regards to budget cuts and overall financial strains. By making the investment now in

cleaner, greener, and more cost-effective living quarters, Western can lessen the burden of updating residence halls in the future--when money is even tighter and people aren't as available to acknowledge the importance of this cause. Eventually, we would like to see Western make an even bolder commitment by modifying the entire building of Buchanan Towers-Classic and stemming out from there to all dormitories on campus. Our final hope with this project is to ultimately generate a massive amount of student interest in what it means to be Eco-conscious, and how easily that can be achieved in their day-to-day lives. A student's time at their University leaves a substantial impact on not only what they believe, but also how they choose to live their lives. That impact starts simply enough by meeting new people, taking interesting courses, deciding on their focus of study and then slowly evolving into something much more--discovering their passion in life. By living in a pilot dorm, students would also get the chance to be impacted on a practical level. Experiencing the realistic and achievable elements of what it means to be sustainable, and leave knowing that their University was just as committed to it as they are. That reputation will stay with Western for years to come, bringing in new students with similar ideals and commitments, who will push Western to be an even better example of sustainable practices than it already is.

## **2.0 Methodology**

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In order to achieve this vision, many steps were involved. The process of gathering existing information, charting and comparing new information, and eventually meeting and discussing those findings with all the right people was a task all unto itself. The first phase of this project was deciding who our stakeholders were, the people that were going to tell us what challenges we were likely to face and how to best overcome those. We scheduled meetings with different directors of staff for Western, e-mailing and contacting individuals at other universities who had aimed for similar results as ours, and extensively researching products (pricing, availability, benefits, energy consumption rates, etc.) and alternative ideas to aid in our final report. Next, we began generating lists of our product findings and categorizing them in sections of three: lowest, middle, and highest end value. We determined that presenting administration with options based on overall cost and effectiveness would result in the greatest chances of this project's success. Lastly, by compiling all of our information into an organized format, we were able to construct a conclusion and recommendation for Western based on all of our research and verbal commitments from faculty. Within this report you will see all of the aspects mentioned above explained in much greater detail.

### 3.0 Research & Analysis

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#### 3.1 Listserv and EcoReps

One of the first steps we took was looking to find out if any other universities or colleges across the U.S. had done anything similar to a pilot green dorm room. To answer that question we wrote a message to the Green School Listserv (GRNSCH-L). A list serve is basically a set of email addresses for a group in which the sender can send one email and it will reach a variety of people. The GRNSCH-L members are typically faculty or staff at a university that holds a sustainability related position or who actively participates in sustainable programs. There are also many student users, most often looking for information as we were. We sent out an email to everyone on the Listserv and got back a large number of responses. The message we sent was as follows:

Hello,

I am part of a group of students working on a proposal at Western Washington University. As a school committed to renewable energy and sustainability we think our school ought to have green buildings as well. In order to persuade the administrators of our school to retrofit a residence hall, we are first trying to create a pilot green dorm room. The room would demonstrate the ideal dorm room, showcasing green technologies and energy efficiency. It would show administrators the benefits of having sustainable residences on campus.

My question is have you done anything similar at your school?

Any thoughts, advice, ideas, or other comments would be awesome.

Thanks,  
Bryce Moulton

We got back many responses and they were all quite helpful. Here is what we received:

- A model green dorm room at Duke University used on campus tours in the summer to highlight "green living" on campus to prospective students. While there are no physical modifications or updates to the room, it demonstrated how sustainable students would outfit the room.



Tavey McDaniel Capps  
Environmental Sustainability Director

[http://sustainability.duke.edu/campus\\_initiatives/buildings/GrnDrmRm.html](http://sustainability.duke.edu/campus_initiatives/buildings/GrnDrmRm.html)

- A guide to making your dorm room green at Macalester College. This included tips and ideas for sustainable products and easy ways to reduce your impact.

Suzanne Savanick Hansen, Ph.D.

Sustainability Manager

<http://www.macalester.edu/sustainability/greendorm/model.html>

- Suggestion that it may be easier and quicker to gather and present the data that shows the efficiency and financial benefits, as well as payback times on a variety retrofits and/or renovations. Provided links to two studies and their respective reports done by Gregory Kats on greening schools.

Wynn Calder

Director of Sustainable Schools, Director of the Association of University Leaders for a Sustainable Future, and Sustainability Consultant to National Association of Independent Schools.

**Greening America's Schools: Costs and Benefits:**

<http://www.lead.us/ShowFile.aspx?DocumentID=2908>

**Greening Our Built World: Costs, Benefits and Strategies (for purchase)**

[http://www.cap-e.com/Capital-E/Resources\\_&\\_Publications.html](http://www.cap-e.com/Capital-E/Resources_&_Publications.html)

- Suggestion of a product to incorporate into our green dorm room, the Kill-A-Watt power strip. It's a power strip that tells you the kWh and wattage, etc. of everything you plug into it.

Alex Casioppo

Coordinator of Environmental Affairs

Endicott College

- The Energy Star Guide to creating an Energy Star Showcase Dorm Room. Energy star has a program to help students create a dorm room that features Energy Star products, including office products, lighting, electronics and appliances.

Christina Notas

Campus Sustainability Coordinator

Drew University

[http://www.energystar.gov/index.cfm?c=news.nr\\_dormroom](http://www.energystar.gov/index.cfm?c=news.nr_dormroom)

- University of Notre Dame's virtual green dorm room. Features items that help reduce a students impact.

Rachel Novick

Education and Outreach Program Manager

<http://green.nd.edu/sustainability-in-action/green-your-dorm-room/>





After compiling all of the feedback we received from the Listserv, we were able to start formulating a clear vision of what exactly we were suggesting for our pilot dorm. Did we want to keep it lifestyle based and focus on the smaller aspects of student living (re-usable water bottles, clothes drying racks, smart-strip power cords, etc.) or did we want to take it further than that? We decided that only lifestyle changes wouldn't provide the statement we were aiming for. In order to showcase a room it needs to stand out, we needed to alter the design of the dorm room.

With that in mind, we constructed our next research attempts by forming a small focus group of Eco-Reps to feed and filter ideas for greening their living quarters.

### 3.2 Contacts/Meetings Input

Throughout the process of creating this report and building our presentation, we met with stakeholders for input and analysis corresponding to each new idea. We were also in consistent e-mail conversations (Index), keeping pace with questions for and from our stakeholders. This section summarizes the information we've gathered from each of those interactions and how they've contributed to our final product.

Meeting with Scott Stilts (Facilities), to discuss the possibility of single-room monitoring in Buchanan Towers, we also learned what they are currently working on in regards to electrical output within the dorms, how electricity is used and stored, what sources provide the majority of energy for on-campus sites, and the options we had for harnessing the input to each building in order to record its usage. Scott has been in touch with us, as well as others from his department, through e-mail answering any questions we have in regards to product changes and installation times. He's been an

ally in this project because he is as equally motivated and enthusiastic about this idea as we are.

Meeting with Martin Reed (Residences), to explain our project and gather feedback as to how do-able he thought our options would be. At the meeting were a couple of secondary stakeholders that provided suggestions as far as composting within the room, and asked us plenty of questions as well. From this meeting we learned that replacing the windows in only one suite wouldn't go over well with many people in charge of that sign-off, as well as any other major design change (new floors, wall installation, knocking down walls, etc.), which definitely helped us narrow our focus and prioritize what we were willing to compromise on. We met with Martin, Hui-Ling, and Derek (an RD in BT) numerous times throughout the quarter to follow-up previous meetings. By the end of the term we had a verbal commitment from University Residences for the go-ahead of this proposal. There was even talk of Residences contributing to some of cost of the overall renovations. Martin would like to see work beginning as early as Winter Break 2011 to address changes in appliances and fixtures. Larger projects such as flooring, wall color, and toilet installments will have to wait until Summer Break 2012 in order to have enough time and room vacancies.

We were also able to present our project to all Eco-Reps at their Oct. 25 meeting and allowed time for input and questions--other than those we received from the focus group. Outside of face-to-face time, we've been in touch through e-mail frequently with others involved in ResLife whose opinion is not only valuable to our research, but crucial to our project's success. Karen Neely, Interior Designer for ResLife, has answered questions about future furniture purchasing, mattress and bedding, permanent design elements, and any-and-all aesthetic elements of the room.

Our final stakeholder meeting was with Willy Hart, Director of University Residences. Because Willy is potentially the person to sign-off on this project, it was important to us to get him excited about what we had planned. The feedback we received helped direct us away from the more physical changes of the room and more into the intellectual changes this room could stimulate. He forced us to answer the question of "What is this room providing that Western currently isn't planning for"? He pointed out that Western is already aware of the benefits of energy-efficient products, so what will the Pilot Dorm prove in the form of benefits that are new to the University. The challenges Willy pointed out mainly revolved around this point so our focus shifted somewhat in order to address them. The concept of developing Learning Opportunities (4.4) for both students and the campus at large stemmed directly from this conversation.



### 3.3 Case Study Research:

#### **Carnegie Mellon University: Henderson House**

When researching other institutions across the United States, we came across multiple sites with impressive success stories that stemmed from the same sort of projects we are seeking for Western. Carnegie Mellon University of Pittsburgh Pennsylvania received the first LEED certified resident hall in the nation back in 2003. When they started renovating Henderson House (HH) dormitory in 2004, their mission was to expand upon that legacy and set a further example of what sustainable campus-living could and should envision. Much like Buchanan Towers, HH has a 'suite'-esque layout that originally slept 40 students. The renovations included an expansion of the top floor which upped the occupancy level to 60 students. Unlike our immediate goal of a pilot room, Carnegie Mellon was able to re-design and re-construct their entire building over a two year time frame for a total of \$3.9 million. The timeline for completing this renovation lasted just over two years (a time commitment that unfortunately Western cannot match at this point), which included a year's worth of design consulting and architecture review along with another year for the actual demolition and renovation process to start and complete. Despite Carnegie's overall success rate, the process wasn't as smooth as intended. The challenges of retro-fitting an older building in general is always tricky, which is something Western will most likely be sharing in once the push for an entire retro-fit on BT-Classic is achieved. One of the most important goals of the Resident Director was keeping the original character and integrity of HH (stone walls throughout, interior and exterior entrance way design, etc.) intact post renovations. Conflicts with designers arose on how to achieve this. Issues also came up when attempting to meet certain LEED certification requirements. LEED standards are much easier met when starting a building from scratch, mainly because that was the program's original intent; so retro-fitting an older structure proves harder when incorporating all of the new materials in order to exceed LEED. In the end, all challenges were provided solutions and the results speak for themselves. Henderson House is packed with energy-efficient, sustainable features. Each of its contemporary suite-style rooms has mechanical fresh air circulation and individual air/heat controls, fulfilling LEED requirements that the building exceed codes for indoor air quality. All furnishings in the residence all are "green", meaning they're made from certified forests or recycled content. Intended future projects include an overhaul of more residence facilities across the campus.

*Although Carnegie is not a peer institution, their project is very similar to what we are looking at doing for Buchanan Towers. Focusing on the necessary renovations (water conservation, double paning windows, smart strip power cords, etc.) and moving up from there. This renovation included an entire additional floor, which I'm sure figured into their budget, which is most likely much larger than Western's. Also, that money went to*

*renovating an entire building, and the goal of piloting one dorm room specifically would definitely cut back on costs.*

### **Appalachian State University: Frank Hall**

We discovered this project when looking online some peer universities of WWU. This project, while not a pilot green dorm project, is a complete retrofit of a residence. Since that is the ultimate goal of the Pilot Green Dorm room, it was very applicable. Also, because it was done at a peer university, we know it is something that is within the scope of Western's actions.

We did online research involving reading articles and exploring the ASU website. We also contacted Andy McDonald, Appalachian State University Housing Project Coordinator. He has been with ASU for 23 years, most of them as their maintenance supervisor for their 20 residence halls. He was very informative as to how their school approached this project and all the other steps they have been taking to make their campus more sustainable.

The Frank Hall project demonstrates that existing buildings can be retrofitted to incorporate sustainable or green features. ASU and ASU Housing has always been energy conscious and concerned with doing what is right for the environment even before sustainability came to the forefront. Frank Hall is a 203 beds residence. The retrofit took one year to complete, summer 2008 to fall 2009, and cost around 6 million. The project was initiated by the University Housing Office. Other stakeholders include David Sweet, architect with Appalachian's Office of Design and Construction, who supervised the project, Andy McDonald, project coordinator of University Housing, Ged Moody, campus sustainability director, and of course the students. For the upgrade, students voted on the design features they wanted. The Frank hall renovation was met with great reception, and it continues to propel ASU's commitment to sustainable practices. Sustainability seems to be an accepted campus wide initiative that everyone strives for, including new buildings.

The renovations haven't come without difficulty though, especially when striving for LEED certification. When refitting an existing building, some items included in the LEED certification checklist aren't available, and you have to work a bit harder to qualify for the certification. Each residence hall had its own unique challenges from age of the building, and the condition of the infrastructure (plumbing electrical and mechanical). ASU halls on the east side of campus were primarily built in the late 60's while their halls on the west side were built from early 70's through the early 80's and beyond. Defining project initiatives and meeting those goals in their project cost were just some challenges in their renovation process.

Energy efficient renovations to Frank Hall include solar thermal panels installed on the building's roof to provide hot water for the building's occupants, low-flow

shower and sink fixtures, and water-source heat pumps in each room versus use of the campus-wide steam system for heat. Other features include energy efficient electric hand dryers, dual flush toilet valves that save up to half a gallon of water per flush, energy efficient T-8 and T-5 florescent lighting utilizing motion sensors in public areas, energy efficient windows, non-PVC resilient floor tile and recycled/reused lobby furniture, pervious concrete under exterior brick pavers to help control water runoff, insulation was added to exterior walls, whenever possible building materials were purchased locally to reduce fuel consumption related to transportation, and materials made from recycled items were used when possible. Each floor of the building has a recycling center where students recycle plastic, aluminum and paper products that are collected by the University's recycling program. There were also plans for a computerized monitoring system in the residence hall lobby lets students see how water and electricity is being used floor by floor, but we haven't confirmed if this was established. The building received LEED Gold Certification. It part due to the Frank Hall renovation the school was included in the Sierra Club's America's Top 100 Greenest Schools, and the Princeton Review Guide to 286 Green Colleges. Attaining LEED certification makes people aware of the University's commitment to sustainability. Excitement of both parents and students on move in day when Frank Hall reopened. The University's commitment to sustainable practices and policies, student involvement in eco-conscious living has catapulted Appalachian State to fame as a "cool school" and a plethora of other eco-savvy titles. Frank Hall is home to the University's popular "Living Green" community, which has prompted further eco-conscious personal living and campus-wide changes, such as a compost station, future hydration station and a petition to on-campus restaurants for eco-friendly to-go containers.

But Appalachian State hasn't stopped with Frank hall. Cohn Hall was completed in August 2010 and will also help create a campus legacy in environmental design. Over the past year, they constructed Mountaineer Residence Hall, a 460 bed modular residence hall in one year during 2010-2011. As for future projects, ASU Housing is in the process of building a 10 story 333 beds high rises on a footprint of an old residence hall in the middle of campus scheduled for fall 2012 completion. They have begun the design process of renovating another 10 story high rise scheduled for renovation in 2013. They have also begun the interview process on choosing a design firm for the next residence hall renovation scheduled for 2014. A little more than half way through a 14-year renovation plan, state leaders are making sure that every new or renovated dorm will get a green makeover that's LEED certified.

### **University of North Carolina: Morrison Hall**

The University of North Carolina recently renovated one of their older dorm facilities; Morrison Hall originally built in 1965 was renovated in 2007 to help UNC

become a more efficient and sustainable campus. The renovation cost around 22 million dollars. The school used funding from a referendum to raise student fees 4 dollars a semester to support renewable energy on campus, RESPC committed 184000 to ensure that solar panels would be included in the renovation. Also in January of 2005 the State Energy Office provided additional funds with a 137455 dollar grant. The renovated Morrison Hall can house up to 860 students. The solar panels provide domestic hot water for the residents. These are just a few basic features that came with the renovation of Morrison Hall: The main lobby lounge is outfitted with soft seating, pub chairs and Internet connectivity; a recreation room with billiards tables, ping pong table and a wide screen television; kitchen, ice machine, lounge and conference room on each floor; vending machines; lighted basketball court, picnic tables and charcoal grills; laundry; mail room; and a South Campus package center.

What made this renovation an interesting case study for us are the renewable energy features included in the dorm. Morrison Hall has a real time consumption meter that monitors electricity, steam and chilled water use in 12 zones of the building. The data is from the monitoring is available online and through a kiosk found in the lobby. It also features 176 rooftop solar panels for hot water heating. 75% of the building is now day lit. Also during renovation air conditioners were removed. Morrison's heating and cooling system are now connected to the University's highly efficient chilled and steam water loops. On average solar energy provide 40% of the hot water use. The average room size in Morrison Hall is measured 13' x 14' fir the front rooms and 10'7" x 16' for the back rooms. The renovations started in 2006 and were completed in 2008. It was a 2 year process.

## **4.0 What's Inside the Pilot Room?**

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### **4.1 Appliances & Fixtures**

The first major change within the room will be switching out the existing appliances. The refrigerator and free standing range have been inside the suite since its debut, in 1971. By simply updating the appliances alone to Energy Star (ES) quality, Western will be reducing energy use by a minimum of 20%. In order for a product to be considered Energy Star certified it must meet all requirements set forth by EPA. In the case of refrigerator, ES products are required to use at least 20% less energy than the current market alternative. This means, a fridge that was purchased in the 1970's, as in Western's case, and is then replaced with an ES fridge instead, will save on average \$200 a year in utility costs. Furthermore, top mounted freezers use 10-25% less energy than

bottom or side-door versions, and a 16-20 cu. ft. capacity is the most efficient size in terms of cost and consumption rates.

Replacing the stove proved to be a little more challenging. Energy Star has yet to certify any line of stove-tops due to the fact that energy use is relatively equal. A newer model is always a little more energy efficient but nothing as substantial as a refrigerator.

Induction cook-tops on the other hand are extremely efficient, but in a slightly different way. Induction cooking works by way of transferring magnetic energy. Heat is generated directly into the pot or pan, as opposed to being generated in the stove-top by electrical coils or burning gas. The positive aspects of this include absolutely no wasted heat, because the cookware is required for heating in the first place, quicker and more precise cooking times which eliminates energy that would have otherwise been used.

After replacing all of the appliances, our next obstacle was reducing the amount of water that students use for everyday purposes, such as showering, doing dishes, and even flushing the toilet. In the bathroom we looked at the current water rates for both the shower head and the toilet. The shower ate up 2.4 gallons of water per minute. To replace it, we found an EPA WaterSense certified shower head that will bring that number down to 1.0 gal/min at a pressure of 50psi. Along with that, we want students to be more aware of how much water they are using for any amount of time they spend in the shower. With that in mind, we would like to install a self-monitoring water device that connects directly to the shower head and counts the gallons internally as the water runs through. It will display the reading as its counting, forcing the student to make visual connection to their water consumption, and how quickly it adds up. The toilet will be replaced with a high efficiency dual-flush, low flow system. Reducing water consumption per flush by three gallons! The faucets in both the kitchen and the bathroom will be replaced by Delta Motion Sense technology, low flow faucet heads. In order to reduce the amount of energy that is lost through the six single-pane windows throughout the suite, we are installing Energy Film window insulation. The window film is a thin layer or coating that can be applied on the inside of any glass surface. As the sun's heat contracts the surface, energy saving window film acts as a sunscreen to reflect and absorb the amount of heat that passes through the glass, both inward and outward. The film will produce energy savings for Western year-round. It helps reduce heat gain the spring and summer months by up to 77% and retains up to 60% of household heat during the fall and winter. Those percentages are really impressive, especially since the US Dept. of Energy estimates that 60% of a home's cooling is lost through the windows in the summer, and more than 25% of their heating is lost during the winter. The film will result in students needing heat on in their dorms for extended periods of time, and hopefully eliminate the need for a personal space heater--which consume large amounts of energy with little output.

Our last hurdle will be to change all the lighting to LED fixtures, including all of the pot lights in the kitchen and living space, the mounted ceiling lights in the bedrooms, and the floor lamps provided in the main room.

#### 4.2 Furniture & Aesthetics

The furniture in most of the rooms is already highly sustainable in the sense that it has lasted the University well over 20 years and been reupholstered once before. If we decide to reupholster the furniture again, we would like to strive for an organic fabric to decrease the carbon footprint associated with non-organic fibers. As of now, the only fire code compliant "organic" fabrics are 100% leather and wool and would need to be extremely durable (60,000+ double rubs) in order to meet Western's requirements. Changing the paint color in the room will also be critical in order to give the room the appeal we are aiming for. A soft 'green' will help the room stand out, describe our purpose physically, and be visibly different than the basic dormitory. Western already uses VOC-free paints in all of the occupied common spaces so we will not have to address switching brands or making any price adjustments. Providing the room with an updated, modern visual appeal will also require making changes to the window coverings, addressing the flooring, and possibly adding accessories throughout. With these improvements, we still need to consider issues with asbestos treatment (with floor removal) and fire code requirements with any new fabric or upholstery.

#### 4.3 Other Products

An electric composting unit will be placed in the kitchen. It will reduce food waste by 80%. It is easy to store and clean. It is dirt-less and worm-less composter making it easy for novices to use. The unit we're focusing on is the Kitchen Eze 90 min 2 gallon Electric kitchen composter. It has a high tech green catalyst deodorant reducer. This will eliminate the odor coming from the composter. The composter fits the standard household outlet with a standard voltage of 110V. The Kitchen Eze composter has a chamber that heat up to 200 degrees to eliminate and kill food pathogens. It also has a one touch start so beginners can learn to compost right away. The Kitchen Eze composter is made from recycled plastic weighs 26 lbs and has the following dimensions 15Lx 10.6Wx 19.6H inches.

A smart strip power cord will also be provided in each of the bedrooms and the main living area. The power cord works as a master power switch for all other inputs. This unique energy-saving power strip automatically switches devices on and off and uses less than one watt of power when fully energized. The Smart Strip has 10 clearly marked

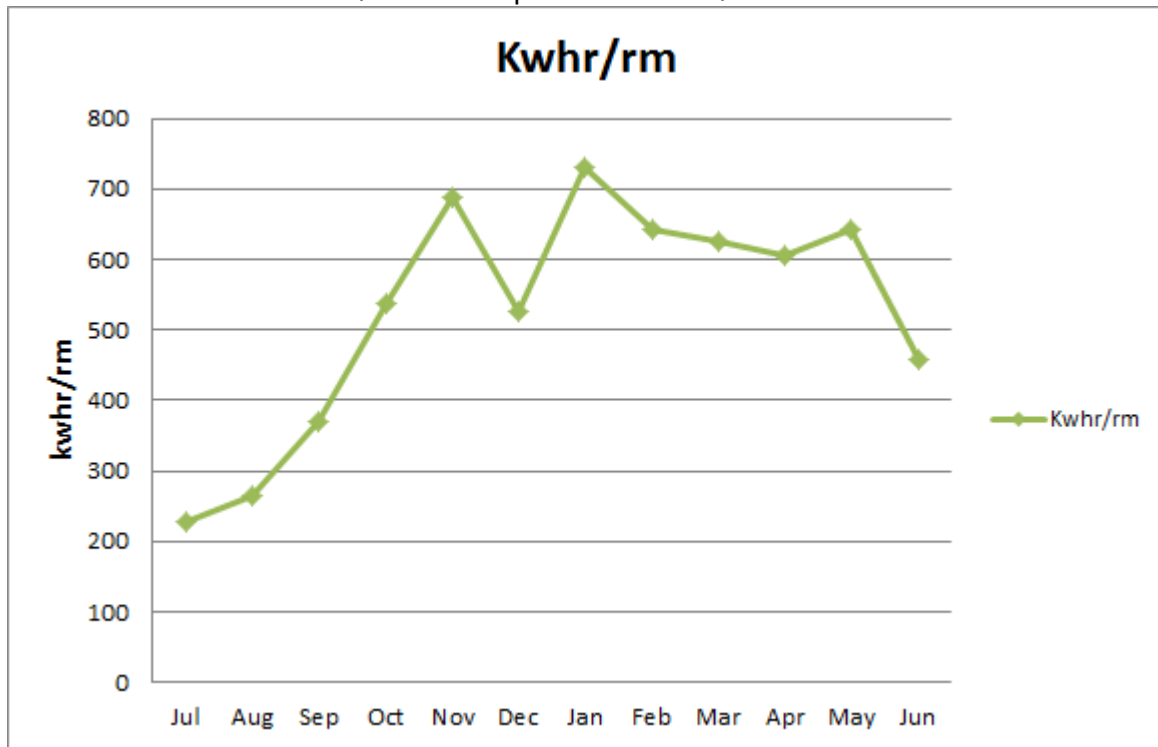
outlets that you plug your computer or home entertainment center peripherals into. When you power down your computer or stereo, the Smart Strip automatically shuts down the power to your computer's and entertainment's center peripherals. This unique feature not only saves money and helps the environment; it also makes shutting down your systems fast and easy.

In addition to the changes mentioned above, we will also provide the room with a Kill-a-Watt (KAW) outlet metering device. The KAW allows users to see, via a display screen, which electronics are using the most power, and then to further figure hourly, daily, weekly, monthly, and yearly costs for running any specific electronic device. The KAW is portable, easy to use, inexpensive (\$40), and a great addition to the single room monitoring we are aiming to install as well.

#### 4.4 Single Room Monitoring

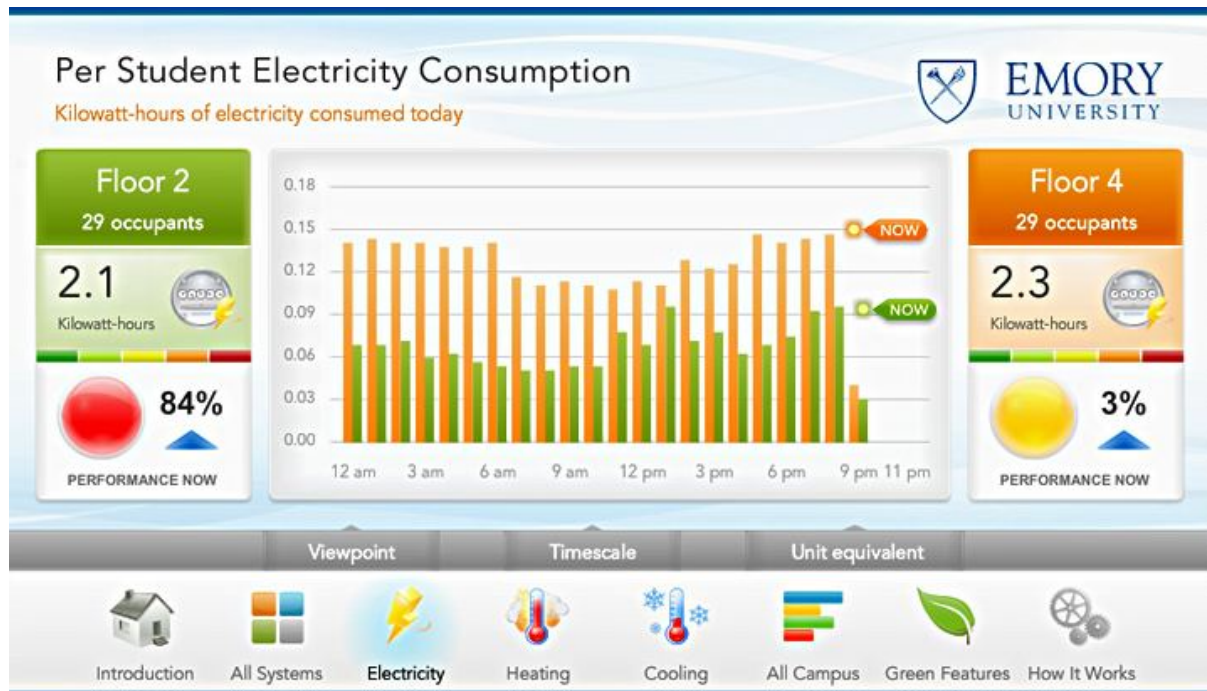
In order to draw comparisons in energy consumption rates to new products for the suite, we needed to figure out what the typical consumption pattern was currently. Because single room monitoring isn't in place, and would be extremely expensive to have installed, we were forced to make an educated estimate instead. Using the yearly energy-use tables provided by WWU's Office of Sustainability, we were able to see the monthly usage for each dormitory and then divide that total by the number of rooms within the building for an average to base our comparisons. The months November and April were chosen to show current energy usage rates per room. These months were chosen because it gives us an idea of how energy usage fluctuates during different times of the year. November is the first month when it starts to get cold and the heaters are turned on, it also gets dark earlier in the day. April is a month when there is more sunshine and days last longer resulting in higher amounts of sunlight and overall less electrical usage for lighting purposes.

November- 722.29 kw-hr/room & April- 643 kw-hr/room



Part of our vision for the Pilot Green Dorm Room is to have a monitoring system to track the energy and water use for both the pilot dorm and a standard BT Classic suite. The data would be displayed in the hallway or in the green dorm room on a digital output. This way, visitors could compare the energy and water usage of the old and new. Ideally they would display unit equivalents to make the information more understandable. For example looking at electricity use, they could see it in kilowatt hours, tons of carbon, or dollars. We have seen some examples of this system that we liked from Lucid Design Group. They have a system called Building Dashboard that can has info on electrical, water, heating, as well as green features, competitions, and diagrams.





<http://www.luciddesigngroup.com/kiosk/features.php>

Elon University has implemented the Building Dashboard into 50 of their buildings in 2009.

Here is the link to their Building Dashboard: <http://www.buildingdashboard.net/elon/>  
You can read about their campus energy use initiatives here: <http://www.elon.edu/e-web/bft/sustainability/ci-energyUse.xhtml>

Check out their other campus initiatives as well.

However the Building Dashboard tracks the usage of a whole building, not a single room. It would be great to have the building dashboard incorporated into our campus, but for now we only need it in a couple rooms. We have talked with several staff members within facilities about their ability to put in a single room monitoring system. The response we got was it is possible, but very complicated and therefore difficult. We received this information from Greg Hough, the Utility Manager here at Western:

A single dorm suite on an individual floor isn't served by any dedicated services. Heat is a combined system with maybe 16 other suites. This is hot water heating in radiators and is likely piped vertically. The power outlets might be wired together with two other suites, the lights maybe four other suites. The services pattern for electrical is probably adjacent rooms on the same floor. So any measurements need to measure incoming and the outgoing energy from the designated suite, then calculate the difference to get the readings we are after. The electrical

panels and baseboards likely don't have the space for the physical equipment, and Maintenance doesn't already own this measuring equipment – which isn't cheap.

Facilities Management would need funding to even begin figuring out how to do it, and it will probably run thousands of dollars before complete. A WAG, maybe \$15,000 to \$30,000, from the time planning seriously begins until useful data is formatted into an Excel spreadsheet.

After receiving all of this information and weighing our options, we aren't sure the costs of single room monitoring would be worth it, but Greg said the metering equipment could be potentially useful for other trending efforts. He also had some tips for alternative methods:

If you want some ideas to simplify your study:

- 1) Get plug in watt measuring devices then route all convenience loads through those.
- 2) Lighting consumption could use a lighting data logger, and then estimate consumption based on time.
- 3) Other electrical loads like cook stove, and heat could be estimated.
- 4) An alternative building that would be simpler to study is Birnam Woods because it's built like an apartment with individual electrical panels.

The other approach you might consider is how the rooms are exactly serviced, and then get all those rooms involved in the study, then average the results. There is a lot more research and exploration to be done to figure out how single room metering could be achieved. We believe that it would be one of the greatest aspects of the Pilot Green Dorm, as it would educate the community on the value of water and energy saving devices.

#### 4.5 Learning Opportunities

The Pilot Green Dorm gives Western the opportunity to receive student input on design and layout of the room. This also gives the University the chance to see what is applicable to a student's lifestyle; a real inside view of what changes a student will have to make in order to adapt to a "green" lifestyle. Residents of the Green Dorm Room will have the opportunity to partake in a self-living assessment where they will record and measure their sustainable practices. By doing this they will be able to see improvements

in their living etiquette. To couple with the self-living assessment, students living in the Green Dorm will be encouraged to document their living experiences through some type of social media (i.e. blogging, twitter etc.). By doing this students can share not only their successes, but the challenges as well for maintaining a sustainable lifestyle in the dorms with their peers. By completing the documenting process we believe the residents should be given the opportunity to receive credit for the time and effort of alternating and improving their living practices which in this case, would be done through blogging. By living in this dorm students will have sustainable living practices ingrained in them and it will serve as a sustainable core they can take with them into the real world.

## **5.0 Conclusion**

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Throughout the quarter we have made substantial progress in achieving the goals we set forth for this project. All of our stakeholders are at least on board, if not outwardly excited about the opportunities this room is providing. The following is a short list of our most accomplished outcomes and where the next group can take our work. The Pilot Green Dorm has the potential to be an amazing addition to Western's campus and an incremental inclusion to Western's future.

Based on the progress we have made so far we can conclude a few things:

1. Stakeholders seem to be very interested and excited about the potential of this project.
2. The project has received positive response from both the EcoReps and University Residences.
3. Single room monitoring is very complex and could be the most expensive aspect of completing this proposal.
4. The Next Steps and Future Works section (follows) will be necessary to complete in order to see full success with this project.
5. The Green Fee Project Proposal is due sometime during Spring Quarter 2012. If this project is going to pursue the funding of the Green Fee, then completion of the proposal needs to meet that deadline. \_\_

## **6.0 Next Steps & Future Works**

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The following are steps that are ready to be completed next quarter and should be the focal point for getting started:

- Student involvement--blogging updates, challenges with room, suggestions for new methods and products, etc.

- Continuation of single room metering research
  - Future communication with BT Hall Council
  - Determine which suite will be renovated
  - Develop room assignment process (who will live in the room)
  - Future cost analysis of renovations
  - Green Energy Fee Program Preliminary Project Proposal submission.
- [https://esign.wvu.edu/admcs/process/forms/AS/AS%20Green\\_Energy\\_Proj\\_Overview.aspx](https://esign.wvu.edu/admcs/process/forms/AS/AS%20Green_Energy_Proj_Overview.aspx)

Develop a signage system to display each component of the green room. These following steps are steps that are going to take longer to implement and should be addressed as long term goals due to the fact they are more complex and time consuming.

- Implementing credit system for the dorm
- Implementing single room metering
- Consider Birnam Wood as a viable option for implementing Green Dorm Room as it may be a better option for implementing single room metering
- Research other changes or additions, such as:
  - In line water heating
  - Solar heating
  - Rain water catchment
  - Increased insulation
  - Furniture selection

## 7.0 **Index**

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### 7.1 Contact List

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## 7.2 Product Table

Product	Description	Energy Consumption	Cost	Rank (1, 2, or 3)
Refrigerator	Whirlpool; Top freezer, 15 cu. Ft. ES certified	20% less energy than current fridge ~ \$185/yr utility savings	\$749 Available at DeWard & Bode, + \$30 eco-rebate	1
Free Standing Standard Range	Danby 20" Free Standing Electric Range	~ same as current energy use	\$385.90	3
Free Standing Induction Stove	Samsung; four-burner	NO wasted heat	\$1,999.00	2
Magnetic Cookware	Kenmore Elite 30"  4pc Stainless Steel cookware set, required for use with induction top	N/A	\$2,549.99  \$ (Local Purchase)	1
LED Lighting		10x longer lifespan Mercury Free 1/3—1/30 <sup>th</sup> the electricity used	Pot lights x6 + Ceiling Lights x4 + Floor Lamps x2 + = \$	1
"Energy Film"	Self-installed window film for inside lining	Retain up to 60% of lost heat in winter months	48 x 84" \$46.20 (x6 windows)= \$277.20 + hourly installation fee	1
Toilet	Retrofit commercial (Sloan Uppercut); residential style w/tank	Dual Flush; FloWise, certified EPA WaterSense Program	\$200-500 + hourly installation fee	1
Shower Head	Bricor EcoFit	1.25 gpm	\$29.95	2
	Bricor B100 Max	1.0 gpm	\$74.95	1
Faucet	1 gpm aerators, Delta Touch Sense motion/touch sensor	Reduction of 1.4 g/m from original faucet	Bathroom: \$350 Kitchen: \$445+	1 1