ESLP

Education for Sustainable Living Program

Recreation Action Research Team

Final Report: Energy Audit of John Wooden Center

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Denita Toneva
Madeline Berger
KellyAnne Tang
Natalie Queally
Danna Creager

Rich Mylin
Head of UCLA Recreation

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Executive Summary

At the start of winter quarter, our stakeholder presented us with a myriad of possible projects in UCLA Recreation's facilities. After deliberation, our team decided to focus on the John Wooden Center because we found out that Recreation would be replacing half of the air handlers in the next couple months. Air handlers are huge machines that control a building's temperature and airflow and are usually the main energy-consuming feature of a facility. This inspired one of the first objectives of the project, which was to determine the effect of the new air handlers on the utility bill. Our expectations were that they would save money and energy, and we would use this knowledge to recommend the other handlers be replaced sooner rather than later. Because this task presented as fairly simple, we broadened our view to a full energy audit of the gym, and brainstormed ways to increase efficiency, reduce usage, and change behavior to improve sustainability.

After researching green gym projects and reading through past Action Research Team reports that focused on the Wooden Center, we developed an idea of how to increase overall energy efficiency in the gym. A primary objective became updating old light bulbs with newer, more efficient models. To complete this we surveyed light bulbs in the larger rooms within the gym, and researched suitable replacements if available. We built upon this idea by attempting to rid the gym of unnecessary appliances, such as computers and televisions that, according to our own surveys, are rarely used. We also wanted to assess if the maximum amount of energy was being saved based on whether staff turns lights off when the facilities are not in use.

Finally, after giving our midterm presentation, at the urging of UCLA Chief Sustainability Officer, Nurit Katz, we decided to expand the project by applying for a grant from the Green Initiative Fund (TGIF) to put solar panels on the Wooden Center. We received $88,000 from TGIF and additional matching funds of up to $100,000 from UCLA Recreation, as well as the possibility of reapplying to TGIF for further installations.

Throughout the whole process, a side goal was to promote ideas of sustainability to other students, which we attempted through several activities. Through the survey process in Wooden, we inherently spread the intent of our project to many of the gym-goers. We also spread the word and provoked thought through our bike-powered blender at UCLA's Earth Day Fair. Finally, we hope to get other students excited about sustainability with the future installation solar panels on the John Wooden Center.

Background

In 2013, UC President Napolitano set a goal for the UC campuses to achieve carbon neutrality by 2025 (UCLA Sustainability). Carbon neutrality, or a net zero carbon footprint, means that the university would remove as much carbon dioxide from the atmosphere as it emits. Electricity is the largest source of U.S. greenhouse gas emissions and U.S. buildings are responsible for 39% of energy consumption and 72% of all electricity consumed in the country. Of the energy consumed by buildings, 78% of that energy is electricity (Earth Day Network, 2013). By increasing energy efficiency in buildings, the amount of energy consumed as well as the carbon emissions associated with the energy production can be reduced.

Higher education has been a leader in implementing sustainable buildings, with many examples of student recreation centers and gyms across the country taking initiatives to increase sustainability. Gyms typically consume large amounts of energy in order to power lights, workout equipment, and temperature controls. Many universities have taken steps towards reducing energy consumption and have achieved high LEED certifications through renovations or new constructions. One standout example is the California State University at Fullerton, where the student recreation center includes a state of the art air handler system that conserves huge amounts of energy while still keeping the building at a comfortable temperature (Associated Students, CSUF, 2009). The University of Arizona gym achieved LEED platinum, the highest possible LEED certification, in part by implementing passive solar orientation and daylight strategies. Both these techniques use the sun's energy to accomplish building functions that would normally require high energy consumption (Green Source Magazine, 2010). Other schools such as Chapman University and Tennessee Tech have installed cardio machines that convert the kinetic energy produced by users into utility grade electricity that can be used to power TVs, computers and lighting.

These examples provided inspiration for the basis of our own project at Wooden. Increasing efficiency and reducing energy consumption in Wooden will reduce UCLA's carbon footprint while also reducing costs for UCLA Recreation. This is the fourth year that Wooden has been studied by an Action Research Team. The 2010 team looked at reducing water consumption with efficient showerheads and reducing energy consumption using motion sensors. In 2011, the ART team focused on Collins Court light renovation, a Tanks 4 Towels campaign that encouraged gym users to save water and energy by bringing their own towels, and a Green Well Being program that replaced fake plants with real plants. Finally, the 2012 team looked at

installing energy efficient hand dryers and light sensors, introducing water refill stations to outdoor facilities, and improving the recycling infrastructure.

This year, we've focused specifically on the Cardio/Weight rooms, Yates, Pardee, and several upstairs rooms working with our wonderful stakeholder Rich Mylin, Director of Recreation Sports Venues and Event Operations here at UCLA. Our research allowed us to recommend more efficient lighting fixtures for some of the rooms, make suggestions for changes to the lighting protocol and TV use, and perform a cost analysis of the new and old air handlers. Reducing energy consumption and increasing energy efficiency in Wooden will help UCLA take strides towards its 2025 goal of carbon neutrality while also saving money for UCLA Recreation. Energy efficiency improvements in the gym also present an exciting opportunity for outreach as the Wooden Center is a facility used by a large portion of the UCLA population.

Project Goals

From the start, we had three main focus areas including improving efficiency, reducing usage, and changing behavior. The general goals were to observe the effects of the new air handlers, replace old light bulbs with more efficient ones, eliminate usage of unnecessary electronics, and reduce the amount of time that certain light fixtures were kept on.

Because the Wooden Center conveniently switched three air handlers during the term of our project, we made sure to incorporate a study of their effectiveness. To do this we would have to collect energy bills from before and after the switch and simply determine what the difference was. We were motivated to do this because it is an easy way to encourage the gym to replace the other air handlers, based on the assumption that the new, more efficient air handlers would reflect a favorable decrease in energy usage.

A more elaborate main objective was to decrease energy use from light fixtures and various electronics. We decided to focus on increasing lighting efficiency in three big rooms, Pardee Gym, Yates Gym, and the Cardio/Weight rooms. We focused on these rooms because they all have light fixtures currently using light bulbs of very high wattages, and as such present large and easily identifiable sources of energy use that can be improved just by looking for a better light bulb. A related original idea was to cooperate with the Wooden staff to adjust lighting schedules in such a way that would save energy. The goal was both to maximize energy savings and encourage the gym staff to consider the environment in everyday practices.

Another focus was on the computers, televisions, and eco-friendly treadmills used in the gym. The motive for investigating these came from personal experiences of noticing that not many gym-goers seemed to use them. To confirm these suspicions, the team watched the computers at various times throughout the week and surveyed users about the televisions and eco-friendly treadmills to see if they were used. Whereas the hope for the computers and TVs was that we could ultimately remove them, the hope for the eco-friendly treadmills was that we could promote further usage of them because they save energy and burn more calories.

Later on in the term, a side project came about for the Earth Day fair on campus. Our team applied for a small TGIF grant of $470.58 to rent a bike-powered blender. We bought smoothie supplies with the remaining TGIF money and let fair visitors blend their own smoothies just by riding the bike. The idea was to get people excited about alternative energy sources and remind them that one day a good project for the Wooden Center would be to have the exercise machines feed energy back into the power grid. It was a fun detour from the main project that gained our team more exposure and promoted ideas of sustainability on campus.

Methodology

From the start we had three main components: improving efficiency, reducing usage, and changing protocol. Although we were not able to perform some aspects of our project for practical reasons and due to time constraints, we definitely researched a wide variety of energy sources so that we could make appropriate recommendations.

Improving Efficiency

Our attempts to improve energy efficiency focused on large-scale lighting and air handlers. For lighting we decided to focus on the lighting in Yates, Pardee, and the Weight/Cardio rooms because Collins Court was recently remodeled and the other areas already had relatively efficient T8 fluorescent lighting. We started by asking our stakeholder, Rich Mylin, for the models of each light. From this list, we researched the wattage of each bulb. We also collected information on how many lights of each type there were in our focus areas as well as an estimate to how many hours and days these lights are on. We assumed that the lights in these three areas were on at all times while the building was open. Using the equation:

Watts x hours per day x days per year)/ 1,000 wh/kWh = kilowatt hours (kWh)

we calculated how many kilowatts each bulb used. We then obtained the amount per kilowatt UCLA pays by examining the utility bills for the Wooden Center. By multiplying the rate by the kilowatt-hours by the number of bulbs, we were able to calculate an estimate to how much money per year it costs to light these three areas under current conditions.

In addition to our lighting calculations data, we also contacted the UCLA Recreation's lighting vendor, Glinda Shipley, with the help of our stakeholder to get estimates on lighting replacements and retrofitting. Glinda provided us with a cost estimate and energy analysis for the three possible options in terms of improving lighting efficiency. The first option is retrofitting the 400W metal halide lamps in Pardee and Yates which would provide the same level of light using less energy. The second option is retrofitting the 250W metal halide lamps in the Weight/Cardio rooms which would similarly improve efficiency. The third option is replacing all the T8 fluorescent hallway lights with LED lights which would require replacing over 500 lights, but be the most efficient in the long run. Once we received the cost estimates and energy analysis, our stakeholder asked us to rank these options in consideration of cost saving and payback period.

Our final efficiency analysis was looking at the change in energy usage with the installation of three new air handlers. This was one of the reasons why we chose to focus on an energy audit of the Wooden Center, so we were expecting to see a reduction in energy once half of the air handlers were replaced with more efficient models. We wanted to compare three study times depending on when different air handlers were on or off, so we obtained the Wooden Center utility bill from June 2014 to March 2015. Before November 2014, all 6 old air handlers were on. Between November 2014 - February 2015, only 3 air handlers were on while 3 new ones were being installed. And after February 2015, there were 3 old air handlers and 3 new air handlers. By looking at the difference in average electricity and chilled water costs during these three times, we wanted to calculate how much money Recreation could save per year by replacing the other three old air handlers as well.

Reducing Usage

To reduce energy usage, we looked into all the electronic devices used in the John Wooden Center and decided to focus on televisions, computers, and treadmills. One of our initial thoughts was that there are many televisions in the Cardio room and lobby, and with current technology, most participants don't seem to watch television because they have their phones and

tablets for entertainment. To test this, we created a survey with the help of Allison Kanny who works for the Student Affairs Information and Research Office. Two of the questions asked about preferences on the number of televisions available in the Cardio room and Weight room. We tabled in the lobby of Wooden six times for about an hour each time and incentivized participants to take the survey with free Vitamin Water or Kind Bars which allowed us to get a high sample size. The Vitamin Water was provided by our stakeholder Rich Mylin and the Kind Bars were provided by a fellow ART participant and water team leader, Amanda Mattes. We decided not to focus on the televisions in the lobby because they are under contract with MTV so they would be harder to remove. We initially wanted to implement a change by turning off some of the televisions and surveying again to see if gym users noticed a difference. However, we decided not to do this component because we realized that staff cooperation would be too difficult to give us reliable data. However, we did collect data on the amount of energy that would be saved from removing some of the televisions. We installed kill-a-watts (meters that plug into electronics and measure how many watts the devices use) for a week to measure the kW hours of energy used and the wattage of a single treadmill. We calculated how much energy Recreation can save by removing some of the televisions and this along with our survey responses helped us make recommendations that reduce energy usage without sacrificing participant experience.

Another observation we had was that not many people use or even know about the available computers near Collins Court. Similar to the televisions, we wanted to measure their energy usage and participant preference to see if we could remove some of the computers. To do this, we performed 10 hours of observations over a week to see how many people actually used the computers. If any participants did use the computers, we asked them a few questions about how many times they have used the computers, what they used them for, and how often they used them. According to UCLA Recreation, the intended purpose of the computers is to give participants a place to sign up for the offered classes. For this, we included a question to gauge whether participants used them more at the beginning of the quarter to sign up for the classes. To measure energy usage, we also installed kill-a-watts for a week to measure the kW hours of energy used and the wattage for both the touch screen and the normal computers. Our goal was to show that removing some of the computers will not drastically affect participant experience and would save energy.

With treadmills, we noticed that there were several eco-friendly treadmills that most gym participants avoided even though they do not use any energy. Eco-friendly treadmills do not need to be plugged in as they are self-powered by the user. We hypothesized that participants did not want to use these treadmills because of their curved shaped and because they are not as familiar with how they work compared to the conventional treadmills. However, after doing some research, we discovered that the eco-friendly treadmills burn 30% more calories than the electric treadmills. We decided to include questions on our participant survey to gauge their opinion on the eco-friendly treadmills. We first asked how often participants use these treadmills and then asked if participants would use them more often once they knew that the eco-friendly treadmills actually burned 30% more calories. This served the dual purpose of not only informing us about their use but also informing participants about the eco-friendly treadmills in an attempt to encourage participants to try using them. At the start of the project, we had discussed doing observational studies to measure the number of people who use the eco-friendly treadmills, and then measure again after we had implemented an outreach program to encourage their use. Although we did not have time to do this component of the project, we actually found out that the Energy Grand Challenges team had done that exact study. The Grand Challenges course is an undergraduate research course where teams work with a Sustainable LA faculty member inaugurated this year as part of UCLA's overall Grand Challenges initiative. We contacted the team leader, Keith Mertan, and we ended up collaborating by giving him our survey data, and using his observational data to supplement our research. Keith and his team had documented the change in use of the eco-friendly treadmills before and after a week of intervention and relocation of the treadmills. Based on their initial observations, they spent a week advertising the benefits of running on the eco-friendly treadmills and relocated all 4 of them in a strategic location of the Cardio room that they felt would get the most participant traffic. Using both our survey data and this observational and outreach study, we made recommendations about how Wooden should proceed with its attempt to install more eco-friendly treadmills while still reflecting participant preferences.

Changing Behavior

The final component was changing the staff protocol for lighting in the Weight room, the racquetball courts, and the upstairs Gold, Blue, and Pyramid rooms. When doing lighting calculations in the Weight room, we noticed that although there are three different types of lights

that were all turned on, there are also huge windows that run the length of the room. We decided to explore if we can design a lighting schedule that harnesses the natural light at certain times of the day and therefore reduces the need for electrical lights. To implement protocol changes we first needed to assess participant preferences for lighting in the Weight room to ensure that we are not negatively affecting the participant experience. Another part of our participant survey asked about the level of lighting in the Weight room at the current moment. We tabled in the lobby of Wooden six times: two in the morning, two in the afternoon, and two in the evening, to see if participant preference for lighting changed depending on the amount of natural light in the Weight room. We had wanted to table in the Weight room so participants who took the the survey could actually see the amount of light, but our stakeholder said it would cause too much traffic in the limited space. Initially the plan was to implement a new lighting schedule that would have some of the lights off during times of high natural light and doing a second round of surveys to see if participant preferences had changed. However, we realized that coordinating with the Wooden staff who is in charge of turning the lights on and off would be too difficult and unreliable, so we decided to just base our lighting recommendations on the survey results we already had.

We also wanted to gauge the opinions of the Front Desk and Fitwell Desk student staff, who are in charge of the Weight/Cardio rooms, racquetball courts, and upstairs recreational rooms. We created a separate staff survey for the Fitwell desk including the same questions about lighting in the Weight Room and televisions in the Cardio room. For the racquetball courts and recreational rooms upstairs, we wanted to determine what protocol the Front Desk Staff followed in terms of when lights should be turned on and off, so we created a Front Desk staff survey asking them if they knew the protocol and if it was easy to follow. This helped us assess what behavioral changes we can implement and which areas need stricter monitoring to ensure that lights are not on when they are not being used.

Results

Lighting Measurements

Area	Model of Light	Description	Bulb Count	Wattage	Yearly cost per bulb	Total cost per year
Cardio Room	Sylvania 64458 M250/C/U 250W M58/E	Large pendant lights in weight and cardio rooms	16	250	144.2	$2,307.20
	Grainger T-8 4PL16 (24')	Square ceiling lights	8	32	18.46	$147.68
	Phillips PL-T 42W/41/4P – Compact Florescent Bulb	Small round lights	5	42	24.22	$121.13
Weight Room	Sylvania 64458 M250/C/U 250W M58/E	Large pendant lights in weight and cardio rooms	29	250	144.2	$4,181.80
	Grainger T-8 4PL16 (24')	Square ceiling lights	16	32	18.46	$295.36
	Phillips PL-T 42W/41/4P – Compact Florescent Bulb	Small round lights	20	42	24.22	$484.40
Pardee Gym	HIDirect MP400W/BU/ED28UVS/PS Item 12445	Hanging metal halide lamps	24	400	229.54	$5,508.98
Yates Gym	Grainger 2V658	Hanging metal halide lamps	12	400	230.72	$2,768.64

Table 1: Lighting Calculations for Focus Areas

This table shows the models and types of lights in all four of our focus areas. It includes the wattage of each bulb, the number of bulbs, and the overall cost/year of each bulb based on the equation outlined in the methods.

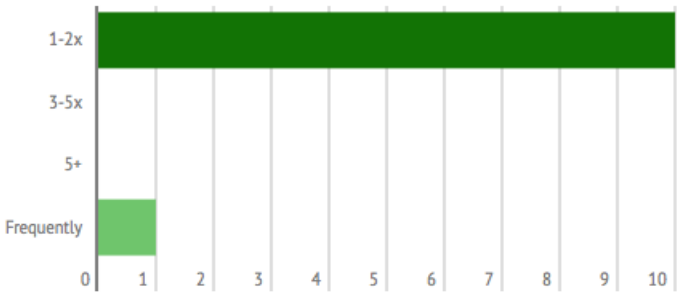
Lighting Replacement Cost Analysis

After meeting with Glinda from All-Phase Lighting, she calculated the payback period for each of the three changes we discussed. Replacing the 400W metal halide lights with ceramic models reduces wattage per bulb to 210W, and will save an estimated $66,759 over the next 10 years. The payback period is a short 20.7 months. Replacing the 250W metal halides in the Cardio/Weight rooms with ceramic models reduces wattage per bulb to 140W. The system wattage will be reduced by 51% and save $62,162 over the course of 10 years. The payback period is 22 months. Lastly, replacing T8 fluorescents in the hallways with LED lights would reduce wattage per bulb from 32W to 16W, and save an estimated $149,000 over a period of 10 years. The payback period is only 15.9 months.

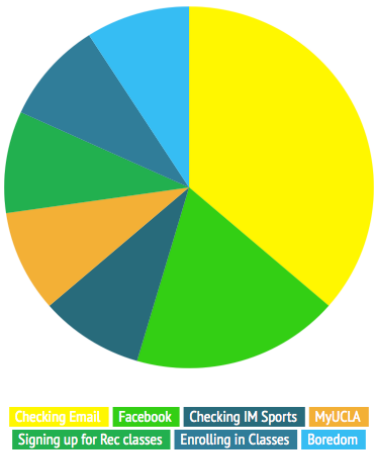
Computer Observations

In total, we only observed 11 people using the computers during the 10 hours we spent at Wooden monitoring the area. The answers they gave to our three questions are presented below:

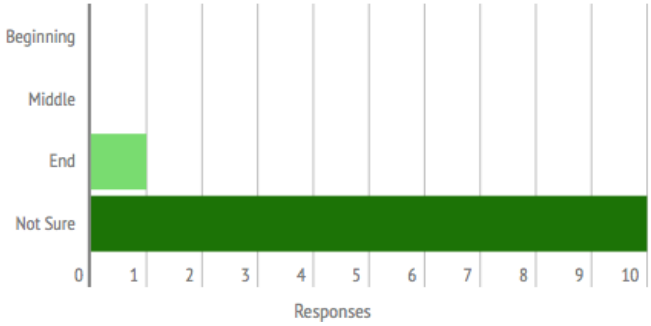
1. How many times have you ever used the computers?



2. What do you use the computers for?



3. Do you use them more at certain times of the quarter?



Images 1-3: Results from Computer Observations and Questions

Kill-A-Watt Measurements

Type	Wattage (on)	Wattage (idle)	kWhrs
Regular Computer	28-30	11.7-12	3.78
Touchscreen Computer	49-51	0.6-0.7	6.31
Television	59-63	59-63	6.06
Treadmill	400-600	14-16	33.19

Table 2: Kill-A-Watt Readings from Various Electronic Devices

The wattage includes measurements for when the device was being used as well as when it was on idle mode. The results are a range because the kill-a-watt meter constantly fluctuates when it gives an immediate wattage reading. The kWhrs reading is after one week of measurement, so it should be an average of the amount of time the device was on and idle.

Participant Survey

Question	Answer Choices	Count	Percent
How would you describe the amount of lighting in the Weight room right now?	Way too bright	9	2%
	A bit too bright	57	14%
	Just right	296	70%
	A bit too dark	57	14%
	Way too dark	1	0%
	Don't use weight room	41	
How often do you watch the TVs in the Weight room?	Frequently	48	11%
	Sometimes	177	42%
	Never	150	35%
	There's TVs?	48	11%
	Don't use weight room	38	
How would you describe the number of TVs in the treadmill room?	More than enough	98	24%
	Adequate	245	61%
	Not enough	57	14%
	Don't use cardio room	61	
How often do you use the EcoMills in the treadmill room?	Frequently	33	10%
	Sometimes	90	26%
	Never	222	64%
	Don't run on treadmills	116	
If you knew the EcoMills burn 30% more calories, would you use them more often?	Definitely yes	153	38%
	Maybe	183	45%
	Probably not	54	13%
	Defintely no	16	4%
	Don't run on treadmills	55	

Table 3: Participant Survey Results and Percentages

This table shows the percentage of each answer choice that was given for each question from a total of 461 responses. The last answer choice was for those who could not answer that particular question because they did not use that part of the gym. Those responses were subtracted from the total responses for each question and are therefore not included in the percentages. The survey questions use the term "EcoMill" because that is the brand name of the eco-friendly treadmill and we changed Cardio room to "treadmill room" so that survey takers could better understand which room we were referring to.

Eco-Friendly Treadmills

		If you knew the EcoMills burn 30% more calories, would you use them more often?					
		Don't run on treadmills	Definitely no	Probably not	Maybe	Definitely yes	Total
How often do you use the EcoMills in the treadmill room?	Don't run on treadmills	43	1	9	42	21	116
		37.1%	.9%	7.8%	36.2%	18.1%	100.0%
	Never	11	13	37	97	64	222
		5.0%	5.9%	16.7%	43.7%	28.8%	100.0%
	Sometimes	1	2	6	38	43	90
		1.1%	2.2%	6.7%	42.2%	47.8%	100.0%
	Frequently	0	0	2	6	25	33
		.0%	.0%	6.1%	18.2%	75.8%	100.0%
	Total	55	16	54	183	153	461
		11.9%	3.5%	11.7%	39.7%	33.2%	100.0%

Table 4: Cross Tabulation of Eco-Friendly Treadmill Responses from Participant Survey

This table shows the percentage of people who responded to one question in relation to the second question regarding the eco-friendly treadmills. An example of how to read this table would be that 18.1% of respondents who initially said they did not run on treadmills answered "definitely yes" as to whether they would use the eco-friendly treadmills once they knew that they burned 30% more calories.

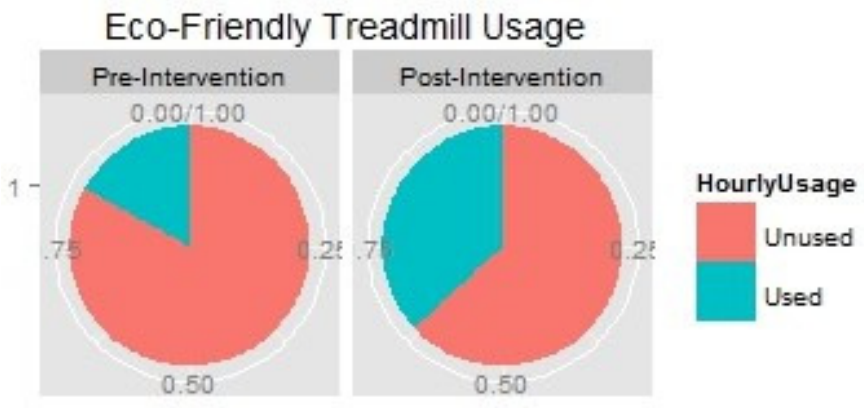


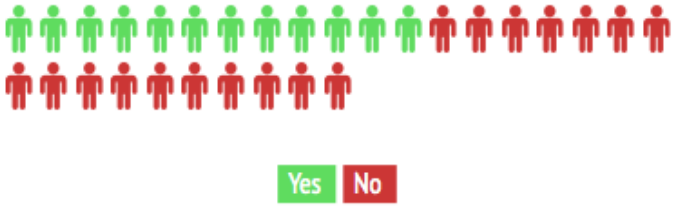
Image 4: Results from Energy Grand Challenges Team Intervention

This image demonstrates the increase in eco-friendly treadmill usage after a week of outreach and relocation of the treadmills to a strategic location.

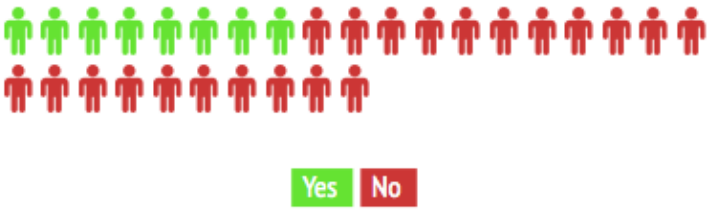
Staff Surveys

For the Front Desk staff, we asked questions regarding the racquetball courts and the upstairs recreations rooms because those are the areas where the staff is in charge of lighting. In total, we received 31 anonymous responses. Some of our results include:

Are you aware of the current lighting guidelines for the racquetball courts?



Are you aware of the current lighting guidelines for the Pyramid, Blue and Gold rooms?



Images 5-6: Results to Front Desk Staff Survey

These illustrations show that a majority of the Front Desk staff claim that they do not know the lighting guidelines for the areas they monitor. The survey included additional questions for those

who claimed that they did know the lighting guidelines, however, those that did answer yes had conflicting descriptions of what the protocol was. Confusion over what protocol is for the Pyramid, Blue and Gold rooms was particularly evident, with four responders answering that lights should be on all day until closing, and the rest answering that lights should only be on when the rooms are in use.

Question	Answer Choices	Count	Percent
Are you aware of the current lighting guidelines for the racquetball courts?	Yes	12	41%
	No	17	59%
Are you aware of the current lighting guidelines for the Pyramid, Blue, and Gold Rooms?	Yes	8	28%
	No	21	72%
How easy is it to follow the current lighting guidelines?	Very Easy	7	24%
	Somewhat Easy	4	14%
	Normal	12	41%
	Somewhat Difficult	6	21%
	Very Difficult	0	0%
How often do you observe people using the computers by Collins Court?	Frequently	1	3%
	Sometimes	15	52%
	Almost Never	13	45%

Table 5: Front Desk Staff Survey Results and Percentages

This table shows the percentage of each answer choice that was given for each question from a total of 31 responses.

For the Fitwell Desk who is in charge of the lighting in the Cardio/Weight rooms, we asked the same questions that we asked in the participant survey about lighting and televisions to see the staff perspective. However, we only received 7 responses and all of them had relatively neutral answers, so we could not come up with specific conclusions.

Utility Bill Analysis

Air Handlers	Month	CHW (Chilled Water)	ELE (Electricity)
6 Old / 0 New	Jun 2014	$24,167.42	$35,783.40
	Jul 2014	$20,458.47	$33,160.60
	Aug 2014	$28,938.47	$43,184.60
	Sep 2014	$15,878.96	$34,406.80
	Oct 2014	$15,769.28	$48,979.40
3 Old / 0 New	Nov 2014	$21,309.77	$37,489.10
	Dec 2014	$24,398.07	$33,155.30
	Jan 2015	$23,128.41	$29,896.60
	Feb 2015	$22,491.94	$28,346.00
3 Old / 3 New	Mar 2015	$18,275.30	$35,941.86

Table 6: John Wooden Center Utility Bill

Our analysis of the utility bill did not elicit any clear responses. We were hoping to detect a clear change from when all six old air handlers were in use to when only three were in use, and then compare both to when there were three old and three new. The costs per month did not change in any significant way, even when only half of the air handlers were in use which should have resulted in a significant decrease in the cost of chilled water and electricity. Similarly there was no significant change when the three new, more efficient air handlers were in use when we expected to see a decrease as well. There were fluctuations throughout the entire year, so it is difficult to assess the cause of the monthly variations. The utility bill provided by UCLA Facilities Management is included in the appendix.

Discussion

Improving Efficiency

In order to find how to improve energy efficiency, we studied energy usage in Pardee, Yates, and the Cardio/Weight rooms. After calculating the cost per year of lighting in these rooms of focus within Wooden, we saw that the largest cost by far comes from the big bulbs, with the two highest at $5,508.98 annually for hanging metal halide lamps in Pardee and $4,181.80 for large pendant lights in the Weight room. This is much more expensive than the smaller lights, with the two cheapest at $121.13 annually for small round lights and $147.68 for square ceiling lights in the Cardio room (Table 1). This motivated us to focus our attention on

improving the efficiency of these large bulbs first, because they represent the most potential for improvement in the gym's light fixtures. This helped us determine the order in which we would rank the three lighting options we were presented by the lighting vendor.

Our other point of interest for improving efficiency was in the air handlers. We looked at energy bills from before and after the installation of three new air handlers to see how much energy they saved so we could recommend quick replacement of the remaining three. Surprisingly, analyzing the energy usage of the building did not provide us with clear results. Although the energy bill should have been less when only three were running and when three old and three new were running (as opposed to six old running), these trends were not discernible. The new air handlers were put in at the end of February, but the electricity bill from the previous June ($35,783.40) is almost identical to March of this year ($35,941.86), which would suggest that the new air handlers have not improved efficiency (Table 6). Because this is completely unexpected and improbable, further studies are needed to determine why the results do not reflect reduced energy usage and cost. A possible reason for this could be that the Los Angeles Department of Water and Power (LADWP) who charges UCLA for the utilities, does not actually charge based on consumption, but rather by estimates from previous utility bills. This would require a better understanding of which meters correspond to which devices to truly see where the largest energy consumption comes from and why there has not been a change after the air handler installation.

Reducing Usage

Our main goal for reducing usage was to look into certain electronics in the gym and determine if they were actually needed. The best way to reduce their usage would be to get rid of them altogether, if we found that the demand for them was low. We assessed computer usage near Collins Court and participant opinion of lighting and televisions in the Weight/Cardio rooms to see if there were areas where we could cut back usage.

Through observing gym-goers using the computers, we found that computer use is infrequent and almost wholly unrelated to gym use. During 10 hours of observations, our team recorded only 11 people use the computers. The most common use was checking email (4), followed by checking Facebook (2), while only person used the computer for its intended purpose which it to enroll in a recreation classes (Images 1-3). This computer data clearly supports the idea that very few people use the computers, and if they do, it is most likely for

something not related to the gym. We deemed the computers fairly unimportant to gym operations in light of this data. To supplement this information, we used kill-a-watt meters to check the energy usage of the computers, and these showed that the regular computers used 3.78 kWhrs in one week and touchscreen used 6.31 kWhrs (Table 2). Because these represent such low sources of energy usages, they probably will not be removed, but we suggest not replacing them if they break due to low participant use.

From our massive survey effort asking about lighting, televisions, and eco-friendly treadmills in the Cardio/Weight rooms, we were able to see where we could reduce usage without disrupting the gym operations. The results for lighting did not influence us to make lighting protocol changes. 70% of users said lighting in the Weight room was just right, but almost the same amount said it was too bright (16%) as those that said it was too dim (14%) (Table 3). The overwhelming support for the current lighting situation combined with the opposing views of brightness and darkness provide no clear action, so we chose to focus more on lighting efficiency instead of implementing changes. This overwhelming neutrality in the level of lighting in the Weight room was probably due to the fact that participants could not actually look at the Weight room because our survey was done in the lobby, which probably led them to choose the most neutral answer choice.

The responses regarding televisions are a bit more useful, as they suggest that many gym users do not care for the TVs. The same amount that watch the TVs frequently (11%) did not even know that there were TVs in the Weight room. The majority of users said they watched them sometimes or never (77%), which is convincing evidence to think that participants do not particularly care for the TVs. Furthermore, most users said the amount of TVs was either adequate (61%) or more than enough (24%), while just 14% thought there were not enough (Table 3). These results suggest that removing some televisions would not negatively impact many gym users. However, like the computers, the kill-a-watt study showed that they use about 6 kWhrs only (Table 2), so these also may not be removed and simply just not replaced if they break or become outdated.

Finally, the remaining user survey questions focused on the use of eco-friendly treadmills, which represent a possible energy reduction from the normal treadmills. Conventional treadmills, according to our kill-a-watt study, use about 33.19 kWhrs each per week. The eco-friendly treadmills are human-powered, and are a viable replacement for the normal ones if they prove popular enough. While most of those surveyed did not enjoy the eco-friendly treadmills,

64% having never used them, 26% having used sometimes, and only 10% admitting to using them frequently, it turns out most also did not know about the exercise benefits of the treadmills (Table 3). The eco-friendly treadmills burn 30% more calories than the conventional ones. When informed of this, a combined 72.5% of those that run on treadmills but have never used the eco-friendly treadmills said they would use them. Even better, a combined 54.3% of those that don't even run on treadmills said they might or would definitely use the eco-friendly treadmills (Table 4). This shows that simple outreach may help the effort to reduce energy usage. While gym users may choose to use the eco-friendly treadmills simply to burn more calories, they will create an opportunity for us to let them know they are also saving energy.

This survey data on the eco-friendly treadmills was further supplemented by the Energy Grand Challenges team, who actually did a week of outreach and moved the treadmills to a strategic location to increase usage. After this intervention, they observed the use of eco-friendly treadmills from 4-6 pm (one of the busiest times) increase from 17% to 37% (Image 4). They also recorded an average of one more person per treadmill per day using the eco-friendly treadmills. Overall, the outreach and relocation of the eco-friendly treadmills increased their use in ratio to the use of conventional treadmills from about 1:5 before, to 1:2 after. This means that after the intervention, they observed 1 minute of eco-friendly treadmill usage for every 2 minutes of conventional treadmill usage. Both the surveys and this observational data show a need for increased outreach for eco-friendly treadmills which could raise participant interest enough to allow replacement of the conventional treadmills and improve sustainability.

Changing Behavior

Our motive behind staff surveys was to assess if the maximum amount of energy was being saved by simply having lights off when they are not needed. Specifically, for the FITWELL desk staff who is in charge of the Weight/Cardio rooms, our main point of the survey was to prove that the weight room had more lighting than necessary, and the staff could therefore adhere to an adjusted lighting protocol to save energy. These were the same questions asked about lighting in the Weight room and televisions in the Cardio room as in the participant survey. However, we were only able to obtain 7 responses from staff members and their responses were all rather neutral, so we were not able to come to any conclusions. Our Front Desk staff survey was aimed more towards seeing if the staff knew the lighting protocol for when lights should be on/off in the racquetball courts and the upstairs recreational rooms (Pyramid, Gold, and Blue).

Survey results showed that 59% of the staff claimed they did not know the protocol for the racquetball courts, and 72% claimed they did not know the protocol for the Pyramid, Blue, and Gold rooms (Table 5). When asked if following the lighting guidelines was difficult, 21% responded that it was somewhat difficult which coincides with the fact that the written responses of those who claimed to know the lighting protocol were all different. Not only do most staff members not know the protocol, but those who do all have different ideas about what that protocol is. This data shows that changing behavior is a huge area of improvement in terms of immediate energy savings simply by keeping lights off more often.

Challenges and Difficulties

The component of the project that involved the most changes from our original strategy was our staff and participant surveys. The survey for the employees was difficult to conduct, and initially yielded barely any responses despite us constantly reminding the employees to complete it. Their overall uncooperativeness was detrimental to the participant survey as well, because we had initially wanted to implement changes and perform the participant survey again, but we realized the staff would not give us reliable data. Furthermore, the participant survey was conducted outside of the rooms in question, which influenced how people would answer the questions if they could not remember particular room conditions. This was particularly problematic for the questions that asked about lighting in the Weight room because participants could not actually see the current lighting. Because of this, we think the results may not have given the most accurate answers to our questions. It should have either taken place in the actual Cardio/Weight rooms or the goal behind it, which was to adjust lighting protocol, should have been reconsidered once we realized we would not have the cooperation of the Wooden staff for any complicated adjustments in lighting procedure.

Related to the participant surveys, a side goal was to spread awareness of and further study the eco-friendly treadmills. However, this proved to be another challenge because we ran out of time to study them any further than what we had learned from the surveys. Luckily, this challenge was solved when we heard of a Energy Grand Challenges team on campus that was focusing on the eco-friendly treadmills. We were able to contact the leader of that team and share the data they had received from their study to supplement our own.

Given the chance to adjust our methodology, it would be best to adjust the survey location as well as answer choices by eliminating a middle road answer such as “just right” or “normal” that would force respondents to consider the question more critically.

Finally, an unexpected challenge came from the discovery that the new air handlers had no clear effect on the energy bill from Wooden. Because we were unable to figure out which specific meters on the bill corresponded to which electrical source, there was no way to tell what was consuming the unexplained energy. Further understanding of the meters might explain why we saw no decrease in energy usage after the installation of three new air handlers.

Recommendations

Based on our results, our team along with our stakeholder, Rich Mylin, has developed various recommendations for the Wooden staff and management.

Our first recommendation is based on the three options for lighting replacement to more efficient models in Pardee, Yates, and the Cardio/Weight rooms as well as the hallway lighting. While we think all three changes are excellent options, in the case that facilities must prioritize certain projects, we ranked the three recommendations. We think that the best first choice would be retrofitting Pardee’s large metal halides lamps, which are currently the only fixtures providing lighting in the room. A metal-halide lamp is an electric lamp that produces light by an electric arc through a gaseous mixture of vaporized mercury and metal halides. This project has the second shortest payback and saves less money overall than the LED replacement. However, we think this is the best investment since currently Pardee’s lighting color and glare is difficult to look at which is a problem for volleyball players or other athletes who frequently use that room. Our second recommendation would be the retrofitting of the Cardio/Weight room metal halides. Once again we based this more off how much these rooms are used and their projected improvements on visibility. Lastly, we think the LED replacement would be the third choice as it would take a very long time (there are over 500 lights to replace) and hallway lights are less vital to the gym-users experience.

Our other major recommendation is for training for student staff members to include stronger guidelines on how to manage the lights throughout the Wooden Center. The responses from the Front Desk staff clearly show that there is confusion over when to turn lights on and off in various areas of the gym. Ensuring that staff is turning lights off at all times not only saves energy but also sets a standard of sustainability for all staff operations.

We also have recommendations based on our participant survey results which indicate that the majority of patrons believe there are too many televisions or that they do not use the televisions located in the Cardio/Weight rooms. However, our kill-a-watt data also indicated that these electronics actually do not take up a huge amount of energy to run at about 60-65W. Therefore, our recommendation is to simply put less of a priority on maintaining or adding televisions. For example, if one breaks, rather than spending budget money on replacing it, Wooden should allocate those funds elsewhere. We recommend similar procedure for the computers – while they do not take up much wattage, especially when asleep, due to their infrequent use they should not be a priority in terms of budgeting funds and maintenance.

From our participant survey results as well at the Grand Challenges Team findings, our recommendation for the eco-friendly treadmills would be to implement a permanent sign or display informing patrons of the benefits of using them. Our responses indicate that the fact that they burn 30% more calories is persuasive to many users, and the Grand Challenges team recorded an increase in use following an informational campaign in Wooden. Since our kill-a-watt data shows that treadmills are not huge energy sucks in the gym, rather than replace all of them with eco-friendly versions, for now Wooden should simply work on advertising the existing eco-friendly versions more to users.

While our utility bill analysis did not provide much information on savings from the new air handlers, our recommendation to Wooden is that they do a comprehensive investigation of each one of their meters to ensure that they are correctly measuring and tracking energy use. Just from our analysis we cannot be sure why exactly there was no change in energy use and savings, and it is important to determine whether it is an internal or external issue. If Wooden can determine exactly how energy is being used and billed, then they will be better able to analyze the impact of more efficient air handlers and how they can save energy.

If there were to be a follow up team, we recommend that they continue pursuing the air handler issue since these machines do take up a huge amount of energy. Based on our other data, the small electronics and lighting really do not have significant impacts on energy consumption when compared to these enormous air handlers. If Wooden really wants to make a strong reduction in their energy use, they will have to evaluate their larger building operations.

Also, since the team spent so much time in Wooden, we noted other areas that future teams could explore to improve overall sustainability in the building. In particular, there is a notable lack of recycling bins in the facility, which struck us as odd since so many patrons use

plastic water bottles while working out. We peeked into one of the trashcans and saw it full to the top with plastic water bottles, which have become a pollutant of global concern due to the fact that most people fail to recycle them. This is an area of huge potential for a future Action Research Team.

Additional Projects

Solar Panels

During our midterm presentation at the end of Winter quarter, our team was intrigued when Chief Sustainability Officer, Nurit Katz, suggested that we consider applying for TGIF to get solar panels on the Wooden Center. Our ART project was very applicable because we were already doing an energy audit of the Wooden Center, so we could easily assess the energy usage and present data demonstrating the possible benefits of renewable energy. The team leaders, Maddie and Denita, decided to take on this challenge and met with Nurit to discuss what they would need to fill out for the TGIF major fund application. They also met with the TGIF Coordinator, Patty Zimmerman, and received additional information about the solar panel installation on Ackerman Union several years ago. With these details and the help of the team, they managed to submit the application only a month after the idea was presented to them. After a hearing with the TGIF Coordinators, we were very excited to hear that we had received $88,000 to begin the project. In addition to these funds, Rich Mylin had also agreed to have UCLA Recreation match the funding for up to $100,000. With these funds finally secured, we hope to begin preliminary planning to get the ball rolling as soon as possible.

The project outline not only included the installation of solar panels, but also included outreach programs to ensure that students know about our efforts. We want to show that UCLA is taking steps towards becoming more sustainable and meeting its carbon neutrality goals, as well as inspire students to pursue their own student-initiated projects. Some of our ideas include a kickstart fundraiser to raise additional money for solar panels and a solar cooker contest to engage students with the idea of renewable energy. We also plan to install a direct monitoring system in Wooden once the panels are installed to display a live feed of the amount of energy and carbon saved with the use of solar energy. Ultimately, we hope to move one step closer to reducing our dependence on fossil fuels and genuinely improving UCLA's environmental consciousness.

Earth Day Fair

As a sustainability research team on campus, we decided to participate in E3's annual Earth Day Fair to share our research with students and raise awareness about sustainability efforts. We wanted to find something that would engage students and really get them excited about sustainable solutions, so we decided to rent a bike-powered blender. We contacted the company that provides bikes for Ecochella, an annual bike-powered sustainability festival that happens every Spring Quarter here at UCLA. The company is called Rock the Bike and they were able to send us one bike-powered blender. Before that we had also applied for a TGIF mini fund to pay for the bike and supplies for smoothies. On the day of the Earth Day Fair, we set up the bike and attracted students by having them blend their own smoothies on the bike. The event was a huge success because we were able to attract hundreds of students who loved the idea of a bike-powered blender and of course, free food. It mostly gave us the opportunity to explain our research in the Wooden Center and tell students about possible efforts to install bikes that can return energy to the grid. The wave of positive feedback and involvement really showed that students do support these efforts and that we can make a lasting impact if we continue to raise awareness about environmental issues.

Conclusion

Overall, our team's project was multi-faceted and largely successful. Our three main components, improving efficiency, reducing usage, and changing behavior, all helped us learn more about how energy is being used at the John Wooden Center and what we can do to make it more sustainable. In terms of efficiency we demonstrated that replacing the old, high wattage lights would save considerable costs and energy with a short payback period. We also discovered that utility bills should be looked at more closely to better understand areas for improvement. With reducing usage, our surveys and observational studies showed that the television and computers are rather unnecessary, but do not consume a huge amount of energy. The surveys also documented gym-user interest in eco-friendly treadmills which could be a future improvement with further outreach. Finally, we uncovered that changing protocol definitely requires more organization on the part of student staff because they do not seem to follow any uniform lighting protocol.

Our future outlook deals first and foremost with the additional solar panel side project. The installation will require research and planning that will incorporate our project conclusions

to improve sustainability at the Wooden Center for years to come. Our success in encouraging student involvement and interest in eco-friendly bikes at the Earth Day Fair would also be a possible addition of renewable energy. In the future, the Wooden Center could install bikes that return energy to the grid and truly allow students to directly participate in achieving UCLA's carbon neutrality goals.

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Appendix

Participant Survey

Wooden Participant Survey

Please answer each question as accurately as possible.

* Required

How would you describe the amount of lighting in the weight room right now? *

- Way too bright
- A bit too bright
- Just right
- A bit too dark
- Way too dark
- I don't use the weight room

How often do you watch the TVs in the weight room? *

- Frequently
- Sometimes
- Never
- There's TVs in the weight room?
- I don't use the weight room

How would you describe the number of TVs in the treadmill room? *

- More than enough
- Adequate
- Not enough
- I don't use the cardio room

How often do you use the EcoMills in the treadmill room? *

- Frequently
- Sometimes
- Never
- I don't run on treadmills

If you knew the EcoMills burn 30% more calories, would you use them more often? *

- Definitely yes
- Maybe
- Probably not
- Definitely no
- I don't run on treadmills

Submit

Front Desk Staff Survey

Wooden Center Front Desk Staff Survey

We are an Action Research Team working with Recreation to improve the energy efficiency of the John Wooden Center. Your response will give us insight into how energy is used and help us make improvements to reduce energy usage.

* Required

1. Are you aware of the current lighting guidelines for the racquetball courts? *
(i.e. when the lights should be turned on or off)

- ○ Yes
- ○ No

2. If you answered yes to question 1, briefly describe the guidelines.

3. Are you aware of the current lighting guidelines for the Pyramid, Blue, and Gold Rooms? *
(i.e. when the lights should be turned on or off)

- ○ Yes
- ○ No

4. If you answered yes to question 3, briefly describe the guidelines.

5. How easy is it to follow the current lighting guidelines? *

- ○ Very Easy
- ○ Somewhat Easy
- ○ Normal
- ○ Somewhat Difficult
- ○ Very Difficult

6. If you answered difficult to question 5, briefly describe why.

How often do you observe people using the computers by Collins Court? *

- ○ Almost Never
- ○ Sometimes
- ○ Frequently

Submit

Never submit passwords through Google Forms.

Fitwell Desk Staff Survey

Wooden Center FITWELL Desk Staff Survey

We are an Action Research Team working with Recreation to improve the energy efficiency of the John Wooden Center. Your response will give us insight into how energy is used and help us make improvements to reduce energy usage.

* Required

How would you describe the amount of lighting in the weight room in the morning? *

- Way too bright
- A bit too bright
- Just right
- A bit too dark
- Way too dark

How would you describe the amount of lighting in the weight room in the afternoon? *

- Way too bright
- A bit too bright
- Just right
- A bit too dark
- Way too dark

How would you describe the amount of lighting in the weight room at night? *

- Way too bright
- A bit too bright
- Just right
- A bit too dark
- Way too dark

How would you describe the number of TVs in the cardio room? *

- More than enough
- Adequate
- Not enough

Submit

Wooden Utility Bill

Wooden Center Utilities

Ledger Year 1415 (July-April) / Billing Jun 14-March 15

JOB	LEDGER MONTH	Utility	METER	PERCENT	BILUNITS	BILLDATE	RUNDATE	TOTRATE	1,415.00
July Ledger for June Billing									
T5819	201407	CHW	10-26	100	66236	6/30/2014	7/29/2014	0.1819	12,048.33
T5819	201407	CHW	10-29	100	66625	6/30/2014	7/29/2014	0.1819	12,119.09
T5819	201407	ELE	2-147	100	59190	6/30/2014	7/29/2014	0.1	5,919.00
T5819	201407	ELE	4-164C	100	24000	6/30/2014	7/29/2014	0.1	2,400.00
T5819	201407	ELE	4-164D	100	253440	6/30/2014	7/29/2014	0.1	25,344.00
T5819	201407	ELE	4-164E	-100	-7680	6/30/2014	7/29/2014	0.1	(768.00)
T5819	201407	ELE	4-164F	-100	-9504	6/30/2014	7/29/2014	0.1	(950.40)
T5819	201407	ELE	4-164G	-100	-4020	6/30/2014	7/29/2014	0.1	(402.00)
T5819	201407	STM	2-629	100	278800	6/30/2014	7/29/2014	0.0163	4,544.44
T5819	201407	STM	2-737	100	48100	6/30/2014	7/29/2014	0.0163	784.03
T5819	201407	WAT	2-562	26	0	6/30/2014	7/29/2014	6.79432	-
T5819	201407	WAT	2-563	26	0	6/30/2014	7/29/2014	6.79432	-
T5819	201407	WAT	4-164I	100	487.76	6/30/2014	7/29/2014	6.79432	3,314.00
T5819	201407 Total								64,352.49
August Ledger for July Billing									
T5819	201408	CHW	10-26	100	73276	7/31/2014	8/27/2014	0.1819	13,328.90
T5819	201408	CHW	10-29	100	39195	7/31/2014	8/27/2014	0.1819	7,129.57
T5819	201408	ELE	2-147	100	59406	7/31/2014	8/27/2014	0.1	5,940.60
T5819	201408	ELE	4-164C	100	22000	7/31/2014	8/27/2014	0.1	2,200.00
T5819	201408	ELE	4-164D	100	222336	7/31/2014	8/27/2014	0.1	22,233.60
T5819	201408	ELE	4-164E	-100	-7680	7/31/2014	8/27/2014	0.1	(768.00)
T5819	201408	ELE	4-164F	-100	-14544	7/31/2014	8/27/2014	0.1	(1,454.40)
T5819	201408	ELE	4-164G	-100	-5640	7/31/2014	8/27/2014	0.1	(564.00)
T5819	201408	STM	2-629	100	276900	7/31/2014	8/27/2014	0.0163	4,513.47
T5819	201408	STM	2-737	100	50600	7/31/2014	8/27/2014	0.0163	824.78
T5819	201408	WAT	2-562	26	0	7/31/2014	8/27/2014	7.40321	-
T5819	201408	WAT	2-563	26	0	7/31/2014	8/27/2014	7.40321	-
T5819	201408	WAT	4-164I	100	464.98	7/31/2014	8/27/2014	7.40321	3,442.34
T5819	201408 Total								56,826.86
September Ledger for August Billing									
T5819	201409	CHW	10-26	100	71890	8/31/2014	9/26/2014	0.1819	13,076.79
T5819	201409	CHW	10-29	100	87200	8/31/2014	9/26/2014	0.1819	15,861.68
T5819	201409	ELE	2-147	100	62706	8/31/2014	9/26/2014	0.1	6,270.60
T5819	201409	ELE	4-164C	100	14800	8/31/2014	9/26/2014	0.1	1,480.00
T5819	201409	ELE	4-164D	100	249984	8/31/2014	9/26/2014	0.1	24,998.40
T5819	201409	ELE	4-164E	-100	-90432	8/31/2014	9/26/2014	0.1	(9,043.20)
T5819	201409	ELE	4-164F	-100	-9744	8/31/2014	9/26/2014	0.1	(974.40)
T5819	201409	ELE	4-164G	-100	-4180	8/31/2014	9/26/2014	0.1	(418.00)
T5819	201409	STM	2-629	100	289000	8/31/2014	9/26/2014	0.0163	4,710.70
T5819	201409	STM	2-737	100	0	8/31/2014	9/26/2014	0.0163	-
T5819	201409	WAT	2-562	26	0	8/31/2014	9/26/2014	7.2945	-
T5819	201409	WAT	2-563	26	0	8/31/2014	9/26/2014	7.2945	-
T5819	201409	WAT	4-164I	100	168.84	8/31/2014	9/26/2014	7.2945	1,231.60
T5819	201409 Total								57,194.17

Wooden Center Utilities

Ledger Year 1415 (July-April) / Billing Jun 14-March 15

October Ledger for September Billing									
T5819	**201410**	CHW	10-26	100	69689	9/30/2014	**10/30/2014**	0.1819	12,676.43
T5819	**201410**	CHW	10-29	100	17605	9/30/2014	**10/30/2014**	0.1819	3,202.53
T5819	**201410**	ELE	2-147	100	57460	9/30/2014	**10/30/2014**	0.1	5,746.00
T5819	**201410**	ELE	4-164C	100	18000	9/30/2014	**10/30/2014**	0.1	1,800.00
T5819	**201410**	ELE	4-164D	100	206784	9/30/2014	**10/30/2014**	0.1	20,678.40
T5819	**201410**	ELE	4-164E	-100	-54336	9/30/2014	**10/30/2014**	0.1	(5,433.60)
T5819	**201410**	ELE	4-164F	-100	-5088	9/30/2014	**10/30/2014**	0.1	(508.80)
T5819	**201410**	ELE	4-164G	-100	-2400	9/30/2014	**10/30/2014**	0.1	(240.00)
T5819	**201410**	STM	2-629	100	286200	9/30/2014	**10/30/2014**	0.0163	4,665.06
T5819	**201410**	STM	2-737	100	21900	9/30/2014	**10/30/2014**	0.0163	356.97
T5819	**201410**	WAT	2-562	26	0	9/30/2014	**10/30/2014**	7.32298	-
T5819	**201410**	WAT	2-563	26	0	9/30/2014	**10/30/2014**	7.32298	-
T5819	**201410**	WAT	4-164I	100	384.58	9/30/2014	**10/30/2014**	7.32298	2,816.27
T5819	**201410 Total**								**45,759.26**
November Ledger for October Billing									
T5819	**201411**	CHW	10-26	100	73468	10/31/2014	**11/25/2014**	0.1819	13,363.83
T5819	**201411**	CHW	10-29	100	13224	10/31/2014	**11/25/2014**	0.1819	2,405.45
T5819	**201411**	ELE	2-147	100	67718	10/31/2014	**11/25/2014**	0.1	6,771.80
T5819	**201411**	ELE	4-164C	100	22800	10/31/2014	**11/25/2014**	0.1	2,280.00
T5819	**201411**	ELE	4-164D	100	314496	10/31/2014	**11/25/2014**	0.1	31,449.60
T5819	**201411**	ELE	4-164E	-100	-74880	10/31/2014	**11/25/2014**	0.1	(7,488.00)
T5819	**201411**	ELE	4-164F	-100	-6240	10/31/2014	**11/25/2014**	0.1	(624.00)
T5819	**201411**	ELE	4-164G	-100	-3660	10/31/2014	**11/25/2014**	0.1	(366.00)
T5819	**201411**	STM	2-629	100	316300	10/31/2014	**11/25/2014**	0.0163	5,155.69
T5819	**201411**	STM	2-737	100	40200	10/31/2014	**11/25/2014**	0.0163	655.26
T5819	**201411**	WAT	2-562	26	0	10/31/2014	**11/25/2014**	7.02994	-
T5819	**201411**	WAT	2-563	26	0	10/31/2014	**11/25/2014**	7.02994	-
T5819	**201411**	WAT	4-164I	100	684.74	10/31/2014	**11/25/2014**	7.02994	4,813.68
T5819	**201411 Total**								**58,417.31**
December Ledger for November Billing									
T5819	**201412**	CHW	10-26	100	64019	11/30/2014	**12/18/2014**	0.1819	11,645.06
T5819	**201412**	CHW	10-29	100	53132	11/30/2014	**12/18/2014**	0.1819	9,664.71
T5819	**201412**	ELE	2-147	100	56323	11/30/2014	**12/18/2014**	0.1	5,632.30
T5819	**201412**	ELE	4-164C	100	17600	11/30/2014	**12/18/2014**	0.1	1,760.00
T5819	**201412**	ELE	4-164D	100	251136	11/30/2014	**12/18/2014**	0.1	25,113.60
T5819	**201412**	ELE	4-164E	-100	-43008	11/30/2014	**12/18/2014**	0.1	(4,300.80)
T5819	**201412**	ELE	4-164F	-100	-4464	11/30/2014	**12/18/2014**	0.1	(446.40)
T5819	**201412**	ELE	4-164G	-100	-2360	11/30/2014	**12/18/2014**	0.1	(236.00)
T5819	**201412**	STM	2-629	100	349700	11/30/2014	**12/18/2014**	0.0163	5,700.11
T5819	**201412**	STM	2-737	100	41900	11/30/2014	**12/18/2014**	0.0163	682.97
T5819	**201412**	WAT	2-562	26	0	11/30/2014	**12/18/2014**	7.40959	-
T5819	**201412**	WAT	2-563	26	0	11/30/2014	**12/18/2014**	7.40959	-
T5819	**201412**	WAT	4-164I	100	455.5	11/30/2014	**12/18/2014**	7.40959	3,375.81
T5819	**201412 Total**								**58,591.36**

Wooden Center Utilities
Ledger Year 1415 (July-April) / Billing Jun 14-March 15

January Ledger for December Billing

T5819	**201501**	CHW	10-26	100	85862	12/31/2014	**1/28/2015**	0.1819	15,618.30
T5819	**201501**	CHW	10-29	100	48267	12/31/2014	**1/28/2015**	0.1819	8,779.77
T5819	**201501**	ELE	2-147	100	67881	12/31/2014	**1/28/2015**	0.1	6,788.10
T5819	**201501**	ELE	4-164C	100	20000	12/31/2014	**1/28/2015**	0.1	2,000.00
T5819	**201501**	ELE	4-164D	100	213696	12/31/2014	**1/28/2015**	0.1	21,369.60
T5819	**201501**	ELE	4-164E	-100	-23808	12/31/2014	**1/28/2015**	0.1	(2,380.80)
T5819	**201501**	ELE	4-164F	-100	-4128	12/31/2014	**1/28/2015**	0.1	(412.80)
T5819	**201501**	ELE	4-164G	-100	-2040	12/31/2014	**1/28/2015**	0.1	(204.00)
T5819	**201501**	STM	2-629	100	365900	12/31/2014	**1/28/2015**	0.0163	5,964.17
T5819	**201501**	STM	2-737	100	59400	12/31/2014	**1/28/2015**	0.0163	968.22
T5819	**201501**	WAT	2-562	26	0	12/31/2014	**1/28/2015**	7.00927	-
T5819	**201501**	WAT	4-164I	100	497.14	12/31/2014	**1/28/2015**	7.00927	3,484.59
T5819	**201501 Total**								**61,975.15**

February Ledger for January Billing

T5819	**201502**	CHW	10-26	100	71550	1/31/2015	**2/25/2015 14:31**	0.18190007	13,014.95
T5819	**201502**	CHW	10-29	100	55599	1/31/2015	**2/25/2015 14:31**	0.181900034	10,113.46
T5819	**201502**	ELE	2-147	100	61062	1/31/2015	**2/25/2015 14:31**	0.1	6,106.20
T5819	**201502**	ELE	4-164C	100	19200	1/31/2015	**2/25/2015 14:31**	0.1	1,920.00
T5819	**201502**	ELE	4-164D	100	182592	1/31/2015	**2/25/2015 14:31**	0.1	18,259.20
T5819	**201502**	ELE	4-164E	-100	-31296	1/31/2015	**2/25/2015 14:31**	0.1	(3,129.60)
T5819	**201502**	ELE	4-164F	-100	-3216	1/31/2015	**2/25/2015 14:31**	0.1	(321.60)
T5819	**201502**	ELE	4-164G	-100	-1600	1/31/2015	**2/25/2015 14:31**	0.1	(160.00)
T5819	**201502**	STM	2-629	100	386500	1/31/2015	**2/25/2015 14:31**	0.016299793	6,299.87
T5819	**201502**	STM	2-737	100	54700	1/31/2015	**2/25/2015 14:31**	0.016299817	891.60
T5819	**201502**	WAT	4-164I	100	605.68	1/31/2015	**2/25/2015 14:31**	6.988723418	4,232.93
T5819	**201502 Total**								**57,227.01**

March Ledger for February Billing

T5819	**201503**	CHW	10-26	100	70863	2/28/2015	**3/31/2015**	0.1819	12,889.98
T5819	**201503**	CHW	10-29	100	52787	2/28/2015	**3/31/2015**	0.1819	9,601.96
T5819	**201503**	ELE	2-147	100	57188	2/28/2015	**3/31/2015**	0.1	5,718.80
T5819	**201503**	ELE	4-164C	100	17600	2/28/2015	**3/31/2015**	0.1	1,760.00
T5819	**201503**	ELE	4-164D	100	171072	2/28/2015	**3/31/2015**	0.1	17,107.20
T5819	**201503**	ELE	4-164E	-100	-32832	2/28/2015	**3/31/2015**	0.1	(3,283.20)
T5819	**201503**	ELE	4-164F	-100	-3168	2/28/2015	**3/31/2015**	0.1	(316.80)
T5819	**201503**	ELE	4-164G	-100	-1600	2/28/2015	**3/31/2015**	0.1	(160.00)
T5819	**201503**	STM	2-629	100	412000	2/28/2015	**3/31/2015**	0.0162998	6,715.52
T5819	**201503**	STM	2-737	100	70900	2/28/2015	**3/31/2015**	0.0162998	1,155.66
T5819	**201503**	WAT	4-164I	100	546.72	2/28/2015	**3/31/2015**	6.9803911	3,816.32
T5819	**201503 Total**								**55,005.43**

Wooden Center Utilities
Ledger Year 1415 (July-April) / Billing Jun 14-March 15

April Ledger for March Billing

T5819	**201504**	CHW	10-26	100	62130	3/31/2015	**4/30/2015**	0.1555	9,661 22
T5819	**201504**	CHW	10-29	100	55396	3/31/2015	**4/30/2015**	0.1555	8,614 08
T5819	**201504**	ELE	2-147	100	60679	3/31/2015	**4/30/2015**	0.1015	6,158 92
T5819	**201504**	ELE	4-164C	100	19600	3/31/2015	**4/30/2015**	0.1015	1,989 40
T5819	**201504**	ELE	4-164D	100	232704	3/31/2015	**4/30/2015**	0.1015	23,619 46
T5819	**201504**	ELE	4-164E	-100	-36096	3/31/2015	**4/30/2015**	0.1015	(3,663 74)
T5819	**201504**	ELE	4-164F	-100	-3168	3/31/2015	**4/30/2015**	0.1015	(321 55)
T5819	**201504**	ELE	4-164G	-100	-1860	3/31/2015	**4/30/2015**	0.1015	(188 79)
T5819	**201504**	STM	2-629	100	407100	3/31/2015	**4/30/2015**	0.0111015	4,519 42
T5819	**201504**	STM	2-737	100	74500	3/31/2015	**4/30/2015**	0.0111015	827 06
T5819	**201504**	WAT	4-164I	100	503	3/31/2015	**4/30/2015**	7.0254783	3,539 72
T5819	**201504 Total**								**54,755.18**

Computer Observations

Name	Date:	Time of Day	Touchscreens	Regular
Maddie	2/26/2015	3:30pm - 4:30pm	0	1
Maddie	2/27/2015	9:00am - 10:00am	0	0
Natalie	2/24/2015	11:00am - 12:00pm	0	0
Natalie	2/25/2015	10:00am - 11:00am	0	2
Denita	2/23/2015	6:30pm - 7:30pm	0	2
Denita	2/25/2015	6:30pm - 7:30pm	0	3
KellyAnne	2/24/2015	3:00pm - 4:00pm	0	3
KellyAnne	2/26/2015	10:30am - 11:30am	0	0
Danna	2/23/2015	12:00pm - 1:00pm	0	0
Danna	2/28/2015	1:30pm - 2:30pm	0	0

Lighting Replacement Cost Analysis

PowerLux® Elite High Bay Retrofit System Proposal for:							
UCLA GYM (Pardee & Yates) RETROFIT ANALYSIS							
					Existing	**Proposed**	
Cost per KWH:					**MH**	**New Elite**	
$0.12			**Lamp Type:**		Metal Halide	Ceramic MH	
Daily Usage:			**Lamp Wattage:**		400	210	
12	**Hours**		**System Wattage:**		460	225	Reduced 51%
Days per Year:			**Kelvin**		4000	4200	
365	**Days**		**CRI**		65	90	Exellent color
Annual Usage:			**Lumen (mean):**		22300	20800	
4,380	**Hours**		**Efficacy Lumen/Watt**		56	99	77% Higher
			Lumen Maint. @ Rated Life		40%	70%	30% Higher
	Average Lamp Life (Hours)				7,500	30,000	4 Times Long
	Annual Nos of Lamp				0.584	0.000	
	Cost per Lamp				$14.18	$106.00	
	Lamp Disposal Cost				$0.00	$0.00	
	Labor for Changing Lamp				$15.00	$15.00	
	Average Ballast Life (Hours)				17,520	80,000	New ballast
	Annual Nos of Ballast				0.250	0.000	built to last
	Cost per Ballast				$164.54	$180.00	
	Labor for Changing ballast				$15.00	$15.00	
	Annual Operating Cost				$241.78	$118.26	
	Annual Relamping Cost				$17.04	$0.00	
	AnnualBallast Changing Cost				$44.89	$0.00	
	Total Annual Cost of Ownership				**$303.70**	**$118.26**	
Total Quantity Installed:			**36**	***Kits***	***Each Unit savings***	***Total Savings***	
Your ASquareLite Estimated Savings:							
1st Year Operating Cost Savings					*$123.52*	*$4,447*	
1st Year Total Savings					*$185.44*	*$6,676*	
2nd Year Total Savings					*$370.88*	*$13,352*	
5 Years Savings					*$927.21*	*$33,380*	
10 Years Savings					*$1,854.42*	*$66,759*	
Material Cost				***$300.82***	***x 36 =***	***$10,829.52***	
Less Rebate				***$0.00***	***x 36 =***	***$0.00***	
Labor				***$15.00***	***x 36 =***	***$540.00***	
				$315.82		***$11,369.52***	
Payback Time:					***20.7***	***Months***	
Features:							
Long Rated Life and High lumen maintenance							
Long life new generation ballast to reduce maintenance costs							
Easy retrofit with Compact Point Light Source giving better lighting							
Save energy with new light without purchasing new fixtures							
PowerLux® Corporation 1260-E Liberty Way, Vista, CA 92081 Tel: 760-727-2360 Fax: 760-434-4766							
			For more information, contact:		*Ken Lau, PowerLux 760-727-2360*		
5/13/15					*Glinda Shipley, All-Phase Electric Supply, 562-243-7632*		

PowerLux® Elite High Bay Retrofit System Proposal for:

UCLA GYM (Treadmill & Weight Room) RETROFIT ANALYSIS

Cost per KWH:				Existing MH	Proposed New Elite	
$0.12			Lamp Type:	Metal Halide	Ceramic MH	
Daily Usage:			Lamp Wattage:	250	140	
12	Hours		System Wattage:	298	153	Reduced 51%
Days per Year:			Kelvin	4000	3000	
365	Days		CRI	65	90	Exellent color
Annual Usage:			Lumen (mean):	22300	17600	
4,380	Hours		Efficacy Lumen/Watt	56	95	77% Higher
			Lumen Maint. @ Rated Life	40%	70%	30% Higher
	Average Lamp Life (Hours)			7,500	30,000	4 Times Long
	Annual Nos of Lamp			0.584	0.000	
	Cost per Lamp			$14.18	$57.42	
	Lamp Disposal Cost			$0.00	$0.00	
	Labor for Changing Lamp			$15.00	$15.00	
	Average Ballast Life (Hours)			17,520	80,000	New ballast
	Annual Nos of Ballast			0.250	0.000	built to last
	Cost per Ballast			$164.54	$180.00	
	Labor for Changing ballast			$15.00	$15.00	
	Annual Operating Cost			$156.63	$80.42	
	Annual Relamping Cost			$17.04	$0.00	
	AnnualBallast Changing Cost			$44.89	$0.00	
	Total Annual Cost of Ownership			$218.55	$80.42	

Total Quantity Installed:	45	Kits	Each Unit savings	Total Savings
Your ASquareLite Estimated Savings:				
1st Year Operating Cost Savings			$76.21	$3,430
1st Year Total Savings			$138.14	$6,216
2nd Year Total Savings			$276.28	$12,432
5 Years Savings			$690.69	$31,081
10 Years Savings			$1,381.38	$62,162
Material Cost		$234.25	x 36 =	$10,541.25
Less Rebate		$0.00	x 36 =	$0.00
Labor		$15.00	x 36 =	$675.00
		$249.25		$11,216.25
Payback Time:			22.0	Months

Features:

Long Rated Life and High lumen maintenance

Long life new generation ballast to reduce maintenance costs

Easy retrofit with Compact Point Light Source giving better lighting

Save energy with new light without purchasing new fixtures

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5/13/15 Glinda Shipley, All-Phase Electric Supply, 562-243-7632

PowerLux® LED T8 System Proposal for:

UCLA

Cost per KWH:			Existing Fluorescent	Proposed LED AC T8	
$0.12		Lamp Type:	T8	T8 AC	
Daily Usage:		Lamp Wattage:	32	16	
13.16	Hours	System Wattage:	34	16	Reduced 53%
Days per Year:		Kelvin	4100	4100	
365	Days	CRI	70	80	
Annual Usage:		Lumen (mean):	2915	1680	
4,803	Hours	Efficacy Lumen/Watt	85	100	
		Average Lamp Life (Hours)	7,500	50,000	6.7 Times Lo
		Annual Nos of Lamp	0.640	0.000	
		Cost per Lamp	$1.76	$24.02	
		Lamp Disposal Cost	$2.00	$0.00	
		Labor for Changing Lamp	$15.00	$0.00	
		Average Ballast Life (Hours)	17,520	0	No more ball
		Annual Nos of Ballast	0.274	0.000	Less headach
		Cost per Ballast	$12.17	$0.00	
		Labor for Changing ballast	$15.00	$0.00	
		Annual Operating Cost	$19.60	$9.22	
		Annual Relamping Cost	$12.01	$0.00	
		AnnualBallast Changing Cost	$7.45	$0.00	
		Total Annual Cost of Ownership	$39.06	$9.22	

Total Quantity Installed:	500	Lamps	Each Unit savings	Total Savings
Your ASquareLite Estimated Savings:				
1st Year Operating Cost Savings			$10.38	$5,188
1st Year Total Savings			$29.84	$14,920
2nd Year Total Savings			$59.68	$29,839
5 Years Savings			$149.20	$74,598
10 Years Savings			$298.39	$149,197

Material Cost	$24.02	x 500 =	$12,010.00
Less Rebate	$0.00	x 500 =	$0.00
Labor	$15.00	x 500 =	$7,500.00
	$39.02		$19,510.00
Payback Time:		15.9	Months

Features:

50,000 Hours Rated Life and High lumen maintenance

Eliminate ballast to reduce maintenance costs

Flicker free light and instant restrike for safety and security

Thermally balanced luminaire for sustainable energy saving lighting system

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5/14/15 Glinda Shipley, All-Phase Electric Supply, 562-243-7632