2018 Soka University Sustainability Report

The University Sustainability Committee completed its eighth year in May of 2018 with a number of sustainability contributions to the campus community and infrastructure. Sustainability is extremely important to the students, faculty and staff at the University. Soka strives to be a leader in sustainability and innovation and is constantly evaluating new technologies and processes to promote sustainability. Past projects for sustainability include the use of energy efficient equipment including heating and air conditioning systems, motor controls, lighting upgrades, solar panels, use of green chemicals, improvement in pest control and water saving projects such as scheduling controls, irrigation controllers, improved sprinklers or drip irrigation and the increased use of drought tolerant plants. Working hand in hand, students, faculty and staff have accomplished a significant amount of progress. The University, with the leadership of the Sustainability Committee, will continue its progress to become more sustainable and environmentally responsible by monitoring technology and adapting appropriate sustainability projects when it becomes feasible.

This report provides prior activities and accomplishments that have occurred on campus relating to environmental responsibility, energy management, and landscaping sustainability. This document provides the new Sustainability Committee members an understanding of past activities and serves as a foundation for future initiatives, recommendations, and projects to continue progress toward the University's values to be environmentally responsible and to successfully co-exist with nature.

1.0 2018 Sustainability Activities

1.1 STARS Silver

In June 2018, SUA resubmitted its Sustainability Tracking Assessment and Rating System (STARS) report and earned its first silver rating. SUA made progress from a Bronze rating in 2017 to a Silver rating in 2018. Students, faculty, and members from various areas of campus worked to complete the resubmission. STARS is a program of the Association for the Advancement of Sustainability in Higher Education (AASHE). The STARS program provides a clear framework for colleges and universities to measure their sustainability performance. STARS credits include four categories: Academics, Engagement, Operations, and Planning & Administration.

1.2 LED Lighting Project

Facilities Services has been constantly monitoring rebates for LED lighting. Most of the lighting on campus was converted to LED wherever feasible. One of the last areas which were not converted to LED is the fluorescent tube lights around campus. Recently Southern California Edison and Lockheed Martin began the LCR (Local Capacity Requirements) program. This program provides rebates to preferred customers that go beyond the standard rebate programs. Soka University is fortunate to be in an area that was recently opened up to the LCR program. The University recently received approval for the project and installation of the new lights will begin on July 18th 2018. The total cost of the project is $111,199. $78,453 which represents 71% of the total project cost was funded through a rebate from Southern California Edison. The remaining $32,676 cost of the project represents a 4 month payback with an annual projected savings of $74,676.

1.3 New Building Construction

STEM and RHB projects

The Facilities Services Chief of Operations was engaged in a Total Cost of Ownership (TCO) American National Standards Institute (ANSI) writing project with APPA (Leadership in Educational Facilities) since 2016. Principles from these TCO standards were applied to these projects so that any higher first costs are offset with reduced operating and replacement costs and all "Value Engineering" (V.E.) design or product substitutions were made without compromise to quality. The LEED Gold and the Southern California Edison (S.C.E.) Savings by Design initiatives were also part of this new building program. The building commissioning process also includes optional staff training for optimum operation of the sophisticated laboratory systems. Some of these following highlights extend from last year's report.

- **Standardization** – The mechanical, electrical, plumbing, security, door access and signage systems were kept the same or similar to other systems on campus for improved maintenance efficiency.
- **Upsizing Residence Hall Generator** – The new emergency generator servicing the residence hall was upsized in order to support future residence hall construction.
- **Plumbing Recommendations** – Selected American Standard plumbing fixtures for increased availability and cost savings.
- **HVAC Variable Refrigerant Flow (VRF)** – VRF will be installed in the new residence hall buildings for improved energy efficiency over the existing heat pump technology for an estimated energy savings of 35%.
- **Stainless Steel Exhaust** – Selected stainless steel over galvanized steel for use in the fume hood exhaust system which will at least double the life-cycle.
- **Research Freezers** – Collaborating with other research institutions to obtain data on best practices for temperature control and alarm features.
- **Central Plant Capacity Increase** – Installed an ArcticChill Turbocor chiller in the central plant which will result in lower life-cycle maintenance and utility costs.
- **Total Cost of Ownership Asset Management** – The Archibus Computerized Maintenance Management System (CMMS) data base will be updated to reflect the life-cycle costing components for all maintainable assets for the new facilities. This is being supported through the application of an Archibus software module that allows for asset data transfer from the project Building Information System (BIM) plans and specifications.

1.4 Earth Week 2018

The Soka Student Union (SSU) Student Sustainability Committee successfully organized a week-long event to celebrate Earth Week in April 2018. The list of events for Earth Week included documentary screening, lunch time talks, a clothing swap, and a faculty sustainability panel. Students participated in faculty-led discussions about a range of sustainability topics, such as alternative energy source, sustainable mobility, sustainable development, and campus sustainability. On the last day of Earth Week, SUA students participated in the LA river cleanup organized by Friends of Los Angeles River (FOLAR), a non-profit organization committed to restore LA river's natural habitat.

Earth Week 2018 was the second time the SSU Student Sustainability Committee organized a weeklong event dedicated to sustainability. The event was organized with support from the office of Student Activities, the student body, faculty, and staff. This event provided several opportunities for dialogue and discussion about sustainability.

1.5 Student Sustainability Educator

In May 2018, the office of Student Affairs created a new student position "Student Sustainability Educator." This position will serve to foster a culture of care for both people and planet among SUA students. The Student Sustainability Educator will organize events and activities to create sustainability awareness in campus community.

2.0 Accomplishments from Prior Years

2.1 Environment

2.1.1 Expanded Student Initiated Food Waste Diversion Program

During the 2012-2013 School year, Soka the committed initiated food diversion program for excess biodegradable food waste in the kitchen area. This program diverted food and other biodegradable waste from the landfill for use in composting. The waste was collected from leftover food and food waste generated during preparation. The diversion program resulted in less frequent trash pickups and reduced waste going to the landfill.

This year, with the help of the students, the program was expanded to have students and patrons of the cafeteria to presort bio-degradable waste in collection criteria prior to placing washable items on the dish conveyor. Most students are diligent about separating food and biodegradable waste into a separate trash can so that more food is diverted away from the landfill.

2.1.2 Waste Receptacle Signage

There are many different recycling receptacles that are being used around campus. The customer satisfaction report identified that some of the recycling around campus was confusing. The Facility Services Department worked with the Sustainability Committee to provide proper labeling and signage on the receptacles.

2.1.3 Green Chemical Training

The Custodial Staff received special training and certifications from Diversey ™, the green cleaning chemical supplier, relating to the dispensing and use of cleaning chemicals for bathrooms, offices, classrooms, and other rooms. Each participating employee received a completion certificate. Proper dispensing from specialized dispensing equipment in the cleaning closets assures the use of the correct quantity and dilution of cleaning compounds to reduce unnecessary waste of chemicals. Proper cleaning techniques promote proper techniques for disinfecting surface areas, basins, toilet bowls, and floors. Proper use of glass cleaner prevents streaking.

2.1.4 Solid Waste Management and Disposal

Last year, the University started reporting solid waste disposal volumes with the help of the International Environmental Alliance (IEA), a company that helps the University manage the disposal of solid waste, hazardous waste, and universal waste. The key statistic that is used is to determine the percentage of waste that the University is "diverting" from the landfill. During the last fiscal year, diversion rates ranged between 15% and 20%. Through improvement in practices, current diversion rates are exceeding 50%. This improved diversion percentage relates to diverting more cardboard and useable paper, reporting the reuse of green waste (grass clippings, leaves, branches), and the initiation of a student program for redeeming bottles (proceeds go the charity).

Other significant achievements relating to the University's waste management program working with IEA include the following:

- Reduced the number of haul trips for the compactor and the associated expenses (such as

haul fees & fuel surcharges) by 50%. Annual savings from prior years is averaging $5,000.

- Reduced the costs relating to the University's disposal waste streams by utilizing IEA's economies of scale to drive down the cost of disposing waste through its subcontractors as opposed to the University dealing directly with these waste disposal contractors. As an example at Soka, IEA was able to reduce Soka's "universal waste" costs by 40% using its own subcontractors passing IEA's discounts to Soka.

- Increased recyclable commodity revenue (Paper, Old Corrugated Cardboard) by over 20%. IEA aggregated all the data relating to the University's waste streams into one environmental statistical report. Though every stream is not utilized every month, by capturing all data as used, the University receives an accurate waste diversion percentage. Waste stream data being captured consists of Non-hazardous Waste, Hazardous Waste, Universal Waste, E-Waste and Yard Waste (grass clippings, branches, etc.), Old Corrugated Cardboard (OCC), and Paper.

2.1.5 Universal Waste Recycling

Universal Waste is an Environmental Protection Agency (EPA) category of waste materials not designated as "hazardous waste", but they contain materials that need to be prevented from free release into the environment. Universal waste includes batteries, pesticides, mercury containing equipment (including many thermostats), and lamps (including compact fluorescent). IEA provides proper certification of Universal Waste as opposed to traditional haulers who have placed these same items on the hazardous manifest resulting in higher disposal charges. IEA is tracking the disposal of this type of waste and disposal information will be provided in their overall monthly report depicting the type and amount of the different categories disposed.

2.1.6 Hand Dryers

Two high usage paper towel dispensers were replaced by energy efficient "Jet Towel" hot air units resulting in an annual projected savings of $2,496 and 1.45 tons in CO2 emissions from the paper manufacturing process. This savings amount does not include the labor costs for restocking the units with paper nor the $30.00 per year in additional energy costs to run the blowers.

2.1.7 Green Chemicals

Green chemicals are used in all cleaning programs employed at the University.

2.1.8 Faucets and Drinking Water Fountains

The entire campus is equipped with reverse osmosis water filtration units for the faucets (both hot and cold water) and drinking water from the fountains. Additionally, all plumbing fixtures are equipped with low flow aerators.

2.1.9 Electronic Waste Recycling (eCycling)

Electronic Waste Recycling (eCycling) is recycling or reusing electronic equipment or components rather than adding them to the waste stream. ECycle products include but are not limited to computers, peripherals, cell phones, telephones, televisions, DVD players, and other electronics. This type of waste will be recycled using SIMS Metal Management (in partnership with IES) to recycle electronic equipment. SIMS is the world's largest recycler of electronic waste and is

traded on the New York Stock Exchange. All eCycle products will be processed at the SIMS processing plant in California. Scheduled "Electronic Waste Days" will occur at strategic times.

2.1.10 Rodenticide Use

Background

During the fall of 2011, the University had an infestation of rodents on campus necessitating an emergency response to increase the number of bait stations on campus. Other remedial measures where made including the additions of door brushes to keep rodents out of the dorms and instructions to students close windows and to remove food waste to reduce the access of the rodents to the buildings. These measures were effective and the University currently does not have a significant rodent problem.

During the October 21, 2011 meeting held by the Sustainability Committee, issues questioning the University's practices with respect to the used of rodenticides for rodent control were brought up. The University was requested to conduct an analysis of the rodenticides for subsequent review.

Review Process

To acquire the needed information to determine the current state of the situation and to seek potential solutions if a problem was encountered. The University contacted the two exterminator companies that the University is using for its rodent control program. Robert Lawson referred an ecologist named Lisa Lyren from the U.S. Geological Survey who is an expert on Bobcats residing in the Woods Canyons Wilderness Park. We also received information from Susan Anon, field ecologist, with the Irvine Ranch Conservancy. Information was also obtained off the EPA's website relating to the use of rodenticides.

Analysis and Findings

The University currently uses Difthialone – a "second generation" anticoagulant that interferes with blood clotting resulting in death from excessive bleeding. This rodenticide is listed on the EPA's list of 10 rodenticides that measures have been taken to reduce the risks to humans, pets, and wildlife. One of these measures is to make sure that the rodenticides are sold in bait stations (not loose) within 50 ft. of the buildings.

A discussion with Lisa Lyren indicated that anti-coagulants and especially anticoagulants are having an adverse effect on bobcat populations in the Woods Canyons Wilderness Park and that anticoagulants have been found in dead bobcats' blood. Some of these bobcats have the mange, which is linked with the presence of anticoagulants.

Recommendations and Actions

A discussion with Western Exterminators resulted in their recommending an alternate product called Terad 3 that contains a rodenticide called cholecalciferol, which saturates the rodent with Vitamin D3 and is toxic to rodents. The claim is that this product has minimal effect on non-targeted wildlife. As a new product, there is little information about this product with the exception of an article about its use for gopher control in Pacific Northwest Forest. The article indicates that "risks to target wildlife" may exist.

Based on the forgoing information, the University recommended using Terad 3 during a trial period to monitor its effectiveness and to continue reviewing the literature on its effects on non-targeted wildlife. As of September of 2012, the Terad 3 product has been effective in controlling rodents on campus.

2.1.11 Use of Barn Owls to Control Rodents

Barn owls are one of the most common raptors in Southern California. Their primary prey includes wood rats, roof rats, voles, gophers, and pocket mice. The use of barn owls to control these types of prey animals is an environmentally feasible way to control them with respect to intrusion on the Soka campus from the wilderness area surrounding the campus. Barn owls live primarily in sycamore and oak tree cavities, cliffs, and bluffs. The owl boxes, which provide living and nesting areas, average about 12 feet above the ground.

To control rodents and other prey described above, the University contracted with a company to provide eight nesting boxes around the perimeter of the campus. Boxes were hung 12 to 20 feet off the ground in five Peruvian Pepper Trees, one Coast Life Oak, one Pine Tree, and one Sycamore tree. The contracted company visits the boxes semi-annually to inspect the owls, to perform research duties, and to instruct the University about any maintenance or replacement of the boxes.

The use of owls to control rodents will supplement the bait boxes currently used around the site to control rodents. Last year, the University switched the bait it was using in these traps from an anti-coagulant (Difthialone) to a Vitamin D (Terad 3) product to reduce the detrimental effect the poison could possibly have on non-targeted wildlife such as bobcats and owls.

2.1.12 Multifold Towels

The Custodial Department, to reduce cost and to promote environmental responsibility, changed its multifold restroom towels from recycled white to recycled brown towels. Though both use recycled paper and are environmentally accredited, the switch to brown towels resulted in a cost reduction of 32.8% or annual dollar savings of $2,938.

2.1.13 Toilet Tissue

The Custodial Department changed its Eucalyptus brand of toilet tissue to an EPA compliant brand of toilet tissue resulting in a cost reduction of 26.8% or annual dollar savings of $2,622.

2.1.14 Locked Toilet Tissue Dispensers

After conducting a review of excessive use and pilferage of toilet tissue at various locations, the University installed “side by side” toilet dispensers with locks to prevent removal of entire rolls of toilet paper. This measure significantly reduced the amount of toilet tissue consumed.

2.1.15 Reusable Tupperware Containers

Another important topic that has come up in committee discussions is Tupperware in the cafeteria (reusable containers as a replacement to throw away cardboard boxes). The objective is to reduce the University's waste stream and to save the cafeteria from continually purchasing unsustainable brown boxes. Students enjoy the freedom to take out their food; however, many find it a hassle to wash their own Tupperware and the Committee does not want to encourage students to take away the plates and cutlery! Last year the Tupperware Campaign was very successful, so the program for the next year will be brought back. However, next time, higher quality Tupperware containers will be used. The University is able to purchase higher quality containers with the help of the Sustainability Committee and the Dining Department.

2.1.16 One-Touch Soap Dispensers

The soap dispensers around campus were changed from pump dispensers to a one-touch system which automatically dispenses foam soap. The dispensers were provided for free from Unisource, and will cut down on soap usage,

2.1.17 Bioswales

To wash run-off water through rocks and native plants, new buildings are designed with bioswales.

2.1.18 Eco Floor Project

The Sustainability Department initiated and planned the "Eco Floor" project. For this his project, students will creatively change the layout of the rooms in one floor of a resident hall to be more sustainable. This could involve using low flush toilets, balcony gardens, clotheslines, etc. The specifics of the hall will be up to the group of students who choose to design it. The focus of this project is to create a more sustainable living space on campus, and act as a testing ground for new green technologies to be implemented in the rest of the school.

2.1.19 Recycling

SUA was working with the International Environmental Alliance to divert waste from the landfill. Cardboard, Mixed Paper, E-Waste, Food Waste and Green Waste are all recycled. Last year's recycling effort resulted in the

recycling of 244 tons of waste. Fifty-five percent of all waste generated at SUA is being diverted from the landfills which is the equivalent of saving 4,155 trees, or eliminating the use of 489 barrels of oil.

2.2.0 Energy

During the year, FSP re-examined the campus and its energy program with a view to continuing the process of reducing the energy costs. This section describes past energy related programs and projects that have been completed over to date.

2.2.1 STEM Battery Technology

In 2016, Soka installed one of the first battery storage systems on campus. The pilot program working with STEM and Southern California Edison significantly cut peak demand electricity charges at Soka. The program will provide a minimum annual savings of $31,875. In addition, in 2017 Soka increased its battery storage capacity to support the library which will result in an additional annual savings of over $15,000.

2.2.2 Energy Dashboard Project

Within the last year, electricity sub-meters were installed at each building on campus. Prior to the installation, one Edison meter was used to track electricity consumption for the entire campus. Sub-metering allows the University to obtain better visibility with respect to determining the effectiveness of energy conservation and management on campus. The system allows tracking of real time energy consumption and this helps in benchmarking and management of systems and equipment.

An additional web interface tool was installed to allow students, faculty and staff to access, review, graph, and track electricity usage by building. Students are currently using the system as a component of energy research projects. Energy use competitions among the students at the Residence Halls are anticipated for the next year.

2.2.3 Installation of Tankless Hot Water Heaters

All hot water storage tanks are insulated. The new buildings just recently have installed tankless water heaters. "Insta hot" tankless water heaters have been used as a replacement for older water heaters containing a tank. These older water heaters will be replaced where feasible. These tankless hot water heaters are more energy efficient.

2.2.4 Central Plant Upgrade

In anticipation of the new STEM (Science, Technology, Engineering and Math) building the central plant was upgraded with a new Turbcor© chiller. This chiller is designed to run more efficiently during partial load conditions. The addition of this third chiller to the central plant will allow the central plant to run extremely efficiently under all load conditions. Although the Turbocor©

chiller is initially slightly more expensive than a traditional chiller, the increased energy efficiency results in a lower total cost of ownership.

2.2.5 Summer Housing Repairs and Utility Efficiencies

During each summer, Building Maintenance Services completes repairs for the Housing Units when they are unoccupied and also shuts down energy consuming equipment when rooms or buildings are not used to conserve energy during the summer.

2.2.6 Chilled Water – Thermal Savings

The underground chilled water pipe loop used for air conditioning (HVAC) is used as a thermal storage unit. The pipe is 22" in diameter and is one mile long containing 95,000 gallons of water between the supply and return points. During the off-peak times, the water is chilled to 36 degrees and used during the on-peak hours. This action keeps electrical consumption below the higher demand penalties reducing the higher electrical rates for the summer months. Estimated annual savings from this creative central plant operations results in a cost avoidance of $80,000 per year.

2.2.7 Variable Speed Drives

A variable speed drive is a piece of equipment that regulates the hertz output and rotational force, or torque output, of an electric motor. At Soka University, variable speed drives have been placed on most of the 98 electric motors on campus.

For the electric motors relating to the 44 air handlers on campus, the use of variable air volume systems (VAV) has significantly reduced energy consumption. For example, a 20% reduction in fan blower speed is correlated with a 50% corresponding reduction in energy. These drives are connected to the University's energy management system (EMS) and are regulated according to the temperature needs and static pressure of the buildings. All air-handling units are multi-zoned providing specific coordinated air delivery as dictated by the energy management system.

Variable frequency drives were installed in the central plant. Variable frequency drives control motor speed and torque by varying motor input frequency and voltage in order to reduce electricity consumption. Three variable frequency drives were installed on 30hp chill water pumps and 75hp condenser water pumps. These drives are expected to decrease electricity consumption by approximately 15%. The variable frequency drives were installed using rebate money from Southern California Edison.

2.2.8 Thermostatic Valves

To optimally manage water temperature throughout the closed loop system air conditioning and heating system. The University has installed 2 and 3 way thermostatic valves. These valves are opened by a temperature-activated thermostat that slowly reacts to temperature changes in the water flowing into the valve. The 3-way valves are used for either "mixing" or "diverting" water to achieve the optimal water temperature. 2-way valves only allow flow to occur when the fluid temperature increases to the operating point. The positioning and use of these valves within the closed loop system contributes to optimal water temperatures necessary for minimizing the

consumption of energy to cool or heat water.

2.2.9 Boilers

The University has 31 boilers on the campus used to heat potable water and water used within HVAC systems. All of the University's boilers are high efficiency rated. All boilers rely on local and the overall Energy Management System (EMS) to manage temperature settings for the heating systems. All heating is fueled from natural gas as opposed to the use of electricity.

2.2.10 Water Treatment (HVAC Systems)

Water treatment is used to optimize the efficiency of heating and cooling by cleaning, and de-scaling pipes, reducing energy and operating costs. The water treatment programs include chemicals to treat the water in order to maintain clean conditions for mechanical cooling and heat transfer. FSP carefully checks all water treatment systems daily to prevent, pipe and vessel damage, scaling and corroding of hot water boiler tubes, condenser and cooler tubes within the chillers and bacteria in cooling tower preventing any chances of Legionnaire's disease. Increased energy consumption and poor cooling and heat transfer performance is a common result of inefficient water treatment.

2.2.11 Windows

All windows in the buildings have shades and double pane glass therefore they prevent unwanted heat or cold when they are closed. Additionally, windows may be opened thereby allowing the use of fresh air when the weather permits this. The energy management system automatically makes the appropriate temperature adjustments when windows are open.

2.2.12 Chillers and Cooling Tower

The University's central plant has two high efficiency 600-ton chillers. Chiller number one is a "soft" start chiller that saves energy. Chiller number two is controlled by a variable frequency drive to save energy. The chilled water loop, discussed earlier, is pumped by primary and secondary pumps from the central plant with the outer buildings utilizing booster pumps with variable frequency drives to promote energy efficiency. The main cooling tower has two energy efficient "two speed" pump motors.

2.2.13 Swimming Pool Cover

The swimming pool has a cover that reduces electrical, natural gas, water evaporation and chemical costs saving over $55,000 each year.

2.2.14 Boiler and Water Heater Upgrades

Twelve boilers have been installed in the Library, Gandhi Building, Founders Hall, Student Center, Gym, and Reception Center. These boilers are responsible for the heating systems in the buildings. The new boilers are much more energy efficient resulting in a significant natural gas savings. SUA received energy efficiency rebates from Southern California Edison to help offset the cost of the new equipment.

Water heaters were replaced in student buildings 305, 310, 380 and 385. Newer models are much more efficient and result in lower electricity or natural gas expenditures.

2.2.15 Smart Pump Controls for Swimming Pool Pumps

The school swimming pool has two 50 horsepower pumps. A "smart pump control" was installed in 2010 to optimize pump and electricity usage. An energy rebate was received from Southern California Edison amounting to $13K to defray the cost of the unit ($24K) and the resulting annual savings is $14K at current usage and electricity rate levels.

2.2.16 Lighting

FSP uses a three number criteria for analyzing lighting including lighting efficacy (efficiency), color accuracy, color temperature (from orange to yellow to white to blue), compatibility with existing fixtures foot candle readings, diming ability, energy credit incentives, disposal costs, life cost, specific use visibility, and the need for direct or indirect lighting. Some or all of these criteria are used for the various lighting applications on campus. The key is to find lighting that first meets visual criteria and requirements for a specific application. Then, the lighting candidates are reviewed with the objective to minimize the total cost of the lighting including energy consumption over a certain period of time. FSP tests various types of lighting to insure that relevant criteria and in some cases, legal requirements are met. During the past two years, the following measures were taken with respect to lighting:

- **LED Lighting.** Lighting was installed in the dining area, bookstore, and game room were substituted with LED's. Changes from incandescent to LED lighting resulted in a 76% reduction in energy use (e.g. 75 watt to 18 watt fixtures) which, is approximately $2.1K per year.

- **Residence Hall Lighting.** Residence hall lighting was programmed to be at half lighting during daylight hours. All exterior lighting is controlled by photocells. Where warranted, occupancy sensors are used to control the lighting. Offices and classrooms use T8 fixtures, the most efficient retrofit alternative at this time. The more efficient T5 fixtures require change out of the lighting troffers that results in a prohibitively high initial investment resulting payback period.

- **LED's Installed in Tree Well Lights.** Tree well lights were replaced at substantial savings. New Light-emitting Diode (LED) lights (13 Watts each) were installed as a replacement for the older halide lights which also required ballasts (total wattage per unit was 90 watts). Unit cost savings for the replacement is $320 per unit. The result is an 87% decrease in energy costs per unit.

- **Cafeteria Lighting.** Installed new fluorescent lighting in the cafeteria to add more foot-candles to the open area. The old lamps were 75 watts each and the new lights are 36 watts each. The result is a 52% decrease in energy costs per unit.

- **Elevator Lights**. Elevator lights were exchanged from 50 watt bulbs to 4 watt LED's. The result is a 92% decrease in energy costs per unit. Calculated savings for the elevators amounted to $7,543 per year with a payback of 3 months.

- **LED's Installed in Dome Third Floor of Founders Hall.** Incandescent lights (60 Watts Each) inside Founders Hall were changed to 7 Watt LED's. The result is a decrease of 83% in energy costs per unit.

- **Pauling and Founders Hall Lighting Project**. 150-Watt incandescent lights were replaced with 36-Watt compact fluorescent lamps (261 lamps). The lamps were located in the Art Gallery in Founders Hall and Room 216 in Pauling Hall. Edison rebated the cost of the lamps ($14,274). The result is a decrease of 76% in energy costs per unit. Estimated savings in energy per year amount to $11,000 per year.

- **LED Lighting Upgrades in 2015**

SUA has upgraded lighting around campus to (Light-Emitting Diode) LED lighting wherever feasible. LED lights use significantly less electricity, are not hazardous, and last longer than other forms of lighting. Past LED lighting projects have included outdoor tree lighting and walkway lighting, as well as many small projects around campus where efficiency improvements and lighting run times made LED technology economically feasible. LED lights have improved greatly over the past few years. They have become more reliable, more efficient, and improved significantly in design and aesthetics. Increased production also lowered the cost of LED lights, making their use much more cost effective.

During 2014, SUA worked with Southern California Edison to identify projects and obtain rebates for many new lighting projects around campus. During that year, increased competition combined with better production techniques has significantly lowered the cost of purchasing LED lights. During the most recent rebate cycle, SUA was able to identify projects where nearly the entire cost of the light bulbs was covered by the money received from the rebate. SUA received $53,475 in lighting rebates from Southern California Edison, while only paying a very small amount to pay for the tax associated with the lights. The change to LED lighting is estimated to decrease electricity usage by an average of 72% for the lighting projects completed this year. This will provide an estimated annual savings of $64,747 due to reduced electricity usage.

LED lighting will significantly reduce electricity consumption, costs associated with purchasing new lights, and also the labor associated with changing burned out lights and ballasts. LED lights also provide greater color rendering when compared to traditional forms of lighting, and turn on instantly without the need to warm up. The chart below shows the lighting projects that were performed within the last year along the reduction in energy usage based on the type of lights used.

Quantity	Current Light	Current Wattage	New Light	New Wattage	% Electricity Saved	Kw Saved Per Light	Estimated Run Time	Annual KwH Savings
800	Incandescent A-19	60	LED A-19	8.5	86%	51.5	7,300	300,760
1,750	4-Pin CFL	17	LED A-19	9	47%	8	6,570	91,980
110	Halogen PAR-38	80	LED BR-40	17.5	78%	62.5	4,380	30,113
370	CFL BR-40	26	LED BR-40	17.5	33%	8.5	3,650	11,479

290	Incandescent MR-16	50	LED Mr-16	7	86%	43	5,110	63,722

Annual Energy Usage Reduction	**72%**	**498,053**
Annual Electricity Cost Reduction		**$64,747**

2.2.17 Photovoltaic Energy Supply

The Performing Arts Center has photovoltaic panels generating up to 10,000-kilowatt hours of power per month (or $1.4K per month in electricity savings). This represents about 15% of the building's total electrical energy needs. The historical production record of electricity is measured and accessible by anyone via the following web link:

http://live.deckmonitoring.com/?id=soka_university

With respect to retrofits, net present value savings using photovoltaic power generation does not justify the capital expense. Other institutions have photovoltaic systems that are producing paybacks between 5 and 13 years. The technology is continuing to improve and the University may invest in these systems at that time.

2.3.18 Energy Conservation

During each year, the University maintenance staff turns back time schedules for air conditioning and heating. No significant complaints were received. Electricity usage savings have averaged $10K per month during peak load periods.

2.2.19 Implementation of Electrical Sub-metering on Campus

The University implemented sub-metering to identify when and where energy is used by building in order to implement energy conservation measures and programs. Electrical sub-meters were installed for each building on campus. The type of energy data provided by these meters goes significantly beyond the capability of the master utility meter that was used at the main service entrance.

Sub-meters provide detailed and accurate interval data snapshots of energy use and demand for each building. This information will provide the information for accurate and reliable:

- Load profiling
- Cost Benchmarking
- Cost Allocation
- Measurement and Verification
- Energy Conservation and Cost Reduction
- Green building initiatives and government mandates

The data will be made available web enabling faculty, staff, and students to review the data. It is planned to have students use this information to compete with each other with respect to the

energy costs of their residence halls.

2.2.20 Automation Controls

The automation controls which run the central plant were upgraded. The central plant runs the air conditioning for the Student Center, Library, Founders Building, Gymnasium, Pauling Building, Gandhi Building, Maathai Hall and the Performing Arts Center. The new automation controls will help the central plant run more efficiently. The energy dashboard system that shows the performance of the system was also upgraded.

2.2.21 Energy Dashboard Project

Within the last year, electricity sub-meters were installed at each building on campus. Prior to the installation, one Edison meter was used to track electricity consumption for the entire campus. Sub-metering allows the University to obtain better visibility with respect to determining the effectiveness of energy conservation and management on campus.

Traditional utility bill analysis uses information that is simply too dated (bills arrive 30 to 45 days after usage) and too aggregated (bills are for an entire month of usage and not at 15 minute intervals segmented by building. Sub-metering addresses this information gap, providing real-time detailed visibility of energy use that can be used to manage utility operations.

The following is a list of the major benefits of sub-metering on campus:

- Identification of unnecessary equipment running at night, off shift, or during the weekend
- Ability to get information back to the facility department energy management system operators the same day and to provide operators with feedback the next day about the effectiveness of implemented adjustments or changes.
- Comparison and benchmarking of usage across similar buildings over time.
- Detection of utility bill errors by comparing sub-meter usage with the actual utility bill
- Better management of electricity usage when buildings face peak usage pricing from the utility at certain times of the day.
- The energy dashboard is a web interface tool for students, faculty, and staff to easily access, review, graph, and track electricity usage by building.

The dashboard includes various educational items associated with the analytical data such as comparing savings to the number of cars off roads, trees saved, dollars saved, utility energy, energy trends, carbon footprint benefits, green tips, and consumption. The dashboard provides live tracking of the square footage cost of each building.

2.3 Landscaping Environmental Accomplishments from Prior Years

2.3.1 Irrigation

Landscaping Services is focused on sustainability, irrigation, and water conservation primarily due to the prolonged drought effecting Southern California. This focus resulted in taking the necessary steps to reduce irrigation to a point where the University received no penalties for overages in water consumption. This was achieved by a combination of vigilant maintenance and

water monitoring practices along with the use of improved water saving technologies. Campus irrigation inspections are performed weekly on campus and any issues are quickly resolved.

Landscaping Services changed much of the irrigation around campus to drip irrigation. In areas that still need overhead watering, Landscaping Services upgraded irrigation nozzles to the newest technologies in order to reduce water consumption and increase the uniformity of irrigation. These two adopted technologies are explained below:

The MP (Matched Precipitation) Rotator features a unique, multi-trajectory rotating stream delivery system that achieves water-conserving results. Rather than simply "spray" water onto landscapes, MP Rotators deliver multiple streams of water at a steady rate. This slower application rate allows water to gently soak into the soil and achieves an even distribution throughout the area being irrigated. This increased efficiency results in 30% less water use when compared to traditional sprays and significantly reduces wasteful runoff.

The second technology, the HE-VAN (High Efficiency Variable Arc) nozzle is adjustable from 0 to 360 degrees and has a high efficiency variable arc spray. The nozzle is designed to handle reclaimed/dirty water without clogging. With its large water droplets, high distribution uniformity, and low scheduling coefficient, the HE-VAN nozzle shortens watering times and reduces wasted water from unnecessary overwatering. The HE-VAN nozzle shortens sprinkler run times by up to 30%, which corresponds with up to a 30% water savings.

2.3.2 Turf Conversion

Landscaping Services continued the installation of drought tolerant plants by installing these plants in place of 32,685 square feet of grass. Landscaping Services worked with Moulton Niguel Water District to obtain $24,513 in funding to completely pay for this turf conversion. The turf conversion to drought tolerant plants will significantly reduce the water consumption when compared to grass.

Before: **After:**

2.3.3 Conversion to Electric Powered Equipment

Landscaping Services converted small gas powered equipment to electric equipment to reduce its impact on the environment. The electric powered equipment eliminates engine fumes and their impact on landscapers, students, faculty and staff who are near the equipment. The newer equipment is much quieter and eliminated complaints about gas-powered equipment near the residence halls.

2.3.4 Reduced Use of Chemicals and Synthetic Fertilizers

Landscaping Services reduced the use of chemicals and synthetic fertilizers in the gardens and only used them when absolutely necessary when there was no natural or manual way of dealing with the problem. Fertilization is performed on an as needed basis after collecting data from soil tests verses following the manufactures' recommendations.

2.3.5 Irrigation Controllers

All irrigation controllers were replaced with smart controllers that take daily evapotranspiration rates from each immediate watering area. This information is combined with a database of each watering area containing soil type, slope angle, slope face direction, plant type, sprinkler type, sprinkler water output to calculate the watering days, the time of watering on these days, and the amount of watering to keep the plants alive and healthy. This upgraded water conservation system will save the University a significant amount of money by receiving additional rebates from the Moulton Niguel Water District as well as the Municipal Water District. Rebates will be compiled and reported to the University.

2.3.6 Participation with Students and Staff

Landscaping Services is always looking for ways to interact with students and staff at the University to encompass the culture and community this beautiful place has within**.** Landscaping Services continues to participate in car washes for the Alternative Spring Break (ASB), participating in teaching students gardening techniques, and the participation at the Student Instructional Garden classes.

2.3.7 Student Instructional Garden (SIG)

In addition to participating in events with the staff and students, Landscaping Services provided professional advice and lends a helping hand when called upon by the student workers. Landscaping Services assisted SIG by purchasing vegetables to plant and providing labor to assist with weeding and planting.

2.3.8 Performing Arts Center Green Roof

The University's commitment to environment is exemplified from the construction of the new Performing Arts Center on campus. During the building's design phase, the University sought to develop a high performance environmentally sound "green" building. After the construction of the building, the United States Green Building Council (USGBC) awarded the LEED (Leadership in Energy & Environmental Design) "Gold" certification for the Performing Arts Center. A part of this certification related to the installation and use of photovoltaic panels around the roof perimeter. The Landscaping Department inspects the roof and stays up to date on all irrigation issues. Weeding is performed on the roof as needed.

2.3.9 Student Instructional Garden

One of the ways we have been actualizing the 'coexistence of nature and humanity' is through the set-up of the Soka Instructional Garden (SIG) this year. One of the objectives of the garden was for students to learn how green waste from landscaping on campus can be decomposed through composting processes. The success of this project required coordination with the Facilities and Landscaping Departments to deliver leaves, grass, shredded paper and sometimes food scraps for example. In the Sustainability Committee meeting, we have been discussing how to improve our coordination as well as the facilities available at the Soka Instructional Garden. As the processes becomes more efficient, students will be able work with larger volumes and ultimately organically recycle many green waste streams on campus. The benefits are: reduction in land-fill waste, reduction in trucking of green waste off campus, and without a doubt, the creation of fresh compost (natural soil amendment).

The Student Instructional Garden (SIG) was a significant point of interest this past year for students and faculty. Landscaping Services partnered with different professors on campus and student groups to make the garden what it is today. There are many different types of row crops and raised planter beds alike. Landscaping Services designed and installed the garden in early October, 2012 and since the installation, the crops have flourished.

Landscaping Services participated in various activities at the garden including an inaugural tour for students and faculty, composting activities and educating the students with knowledge vital to the survival of the garden.

Kale Plants **Broccoli, Sugar Pod Peas, and Kale**

Composting Bins Installed at the Student Instructional Garden

2.3.10 Plant Installation

July, 2012, was a busy month on campus with the installation of the new Gandhi Courtyard area as well as the installation of the Catalina Cherry trees and Catalina Ironwood trees around campus. These plants are indigenous to California and which is a result of the Sustainability Committees recommendation to use native plants where feasible. In two weeks, Landscaping Services removed over 400 Olive trees and installed 320 Catalina Cherry trees and 95 Catalina Ironwood trees. The Olive trees had a disease called *Xylella fastidiosa* that is a fatal disease to the tree. The trees that were installed are doing well and are growing at a good rate. Additionally, more California Poppies were planted last year to contribute to the emphasis on native plants.

Catalina Cherry Trees Mixed with Native California Poppies, Fescue Grass, and Lavender

2.3.11 Working with Students in Landscaping Activities

In the past year Landscaping Services worked closely with the Sustainability Committee and many different groups on campus to teach and train them in environmentally responsible landscaping and gardening practices. Landscaping Services worked with the Alternative Spring Break, ASB group to help teach them how to do basic gardening practices for the home they helped construct during the spring break in Detroit, MI. Landscaping Services also helped ASB by participating with their car wash held in February, 2013. Landscaping Services also worked closely with professors and student workers at the Student Instructional Garden to ensure the plants are receiving their proper watering needs and that the students or professors have their questions answered. The landscaping clinic with the students taught them how to plant plants properly, properly use equipment such as hand pruners, shovels, rakes, etc. Basic hand pruning of branches from trees was also taught.

Students Involved with ASB Planting Lavender **Truck Getting Washed at the ASB Car Wash**

2.3.12 Irrigation

Irrigation System Upgrade

Most of the 775 plastic valves comprising the irrigation system were replaced with brass valves. Landscaping Services is now reviewing various alternatives relating to the implementation of "smart" controllers to reduce water consumption. The new controller systems are satellite based that also allow the user to communicate with the system using smart phones or computers. The controllers review the evapotranspiration of the water when it rains and when the irrigation comes on. The system will only water the plant material if all of the water has evaporated from the soil. As an example, if a certain station doesn't need to be turned on because it is in a shady area, and there is another station in a sunny area, the system will skip or modify the amount of time each of these stations needs to be watered. All of the controllers are able to be controlled by using a web based interface that allows the user to program the timers, modify stations, add/subtract time from stations, shut off the whole controller (extremely helpful when it rains), and instantly turn on stations from the click of a button. This retrofit is budgeted for the 2014 year. The system is a necessity for the cost effective management of the irrigation system using new technology and will result in a significant reduction in the water costs for irrigation.

Drip Irrigation

Drip irrigation and valves were replaced in various areas around campus. The current plastic valves are being replaced with higher quality brass valves. This will help to cut down on future leaks, and is especially important because the water district has recently tightened the rules on water variances due to water leaks.

Appendix A

Campus Grass

Committee member, Robert Lawson wrote the following article for SUA today about the campus grass including the environmental aspects of the grass and its function on campus:

Soka University of America (SUA), like many universities, is a place where one can find grass. A lot of grass. Over 25% of our landscaping is grass. Grass is where we play sports, host events, and just hang out. Grass fulfills much of our fire prevention plans, helps cool us, and keeps our slopes intact. Grass helps us be a good neighbor with our wilderness park. Grass is permeable and helps us collect rain. Grass keeps our campus looking neat and is integral to our look. So grass has a lot going on at Soka.

Grass adds to the bucolic look of a Tuscany hillside, as laid out in the 1990's Soka master plan designed by SWA. Our campus totals about 103 acres; of those, 57 are landscaped, 15.5 acres of which are grass. Thus grass is 27% of our landscaping. Our grass can be grouped as mowed lawn (5 acres), sports turf (7 acres), and bunch grass (3.5 acres).

Mowed Lawn: Looking towards campus entrance (all with turf block)

The mowed lawn is located in our central and back campus. When we think of mowed lawn, most of us envision events and the weekly mowing. But did you know the mowed lawn is also a key component of our fire prevention program? Under the much of the mowed lawn is a grid system, or turf block, which supports a fully loaded fire tanker truck: 48,000 pounds! Much of our mowed lawn is actually a roadway. Along the fire access road to the dorms the turf block is exposed where the grass was removed. The Fire Marshall deemed it too slippery for fire trucks. This grass is also key to meeting the fire suppression codes laid out by the Orange County Fire Authority (OCFA), commonly called "fuel mods" for Zone A. The common name of this grass is tall fescue, *Festuca Arundinacea,* variety "Marathon® IIe". Thus keeping this grass healthy and green is not just for aesthetics!

Mowed Lawn: the Campus Green (all with turf block)

Our track and sports field have sports turf. This turf must hold up to heavy foot traffic and large events. The common name of this grass is Bermuda grass, *Cynodon dactylon*, variety Tifway® III. Bermuda grass also has a reputation of being invasive, but a tough grass is needed for a tough job. The sports field was leveled with dirt from the new parking structure, which will increase the height by about 6 feet. This required that the existing turf be removed first.

Sports Turf: Track & sports fields

Bunch grass is found all around campus on slopes, borders, and along the Millennium Trail. Most of us have some sort of story about seeing bobcats, snakes, coyotes, deer, or heron. They are most likely looking to catch a small mammal in the grass, as are the birds of prey: kites, hawks, and owls. This is no surprise as 85% of our campus borders a wilderness park. Bunch grass provides habitat and food. This grass is also key to meeting the OCFA fire suppression code for Zone B which extends out to the end of the parking areas. The ground landscaping shall not exceed 2 feet tall, must be on a regular irrigation system, and MUST be kept well-watered. We are being good park neighbors and keeping the campus safe from fire with our bunch grass.

Bunch Grass: Great Blue Heron

The grass needs to be watered for many reasons. Soka used 47 million gallons of reclaimed water for all irrigation in a recent year, at a cost $106,000. Approximately 56% was consumed in the 4 hot/dry summer months, and 44% in the remainder in the 8 cool/wet months. How are we water efficient? Grass is a permeable landscaping which helps collect rainwater. Our landscaping irrigation system is climate sensitive and uses drip lines extensively. All Soka irrigation uses locally processed recycled, or reclaimed, water.

Which grass is more water wise? It depends. All things being equal, the mowed lawn requires more water. The bunch grass is more drought tolerant, but the fire suppression requirements keep it watered much like the mowed lawn. The sports turf is hearty and drought resistant, but the more it is used the more it needs to be watered. All grass serves as a cover to the soil to help keep it cool and retain moisture.

The predominant grass in our bunch grass is red fescue, *Festuca rubra 'mulate',* which is a California (CA) native. The bunch grass was started from seed mixes, of which 6 of the 10 species are CA natives. The newest grass, actually a sedge, planted around Mandela Hall, is Berkeley Sedge, *Carex Divulsa*. There is some hoo-hah about the origins of this plant, originally classified as a CA native, but recently it has been identified by taxonomists as *C. tumulicola*, originally from Europe. This now un-Berkeley sedge is considered by many an invasive non-native! The Bermuda grass came to the US from its namesake, but is originally from Africa. The tall fescue is originally from Europe. The original commercial strain, K13, was found on a hillside in Kentucky in 1931 and developed by a professor who heard about it after judging a sorghum syrup competition in a nearby town.

Many on campus may not know about the 1993 Laguna Beach fire. This fire, driven by the Santa Ana winds, swept by the Soka campus and burned much of our neighbor city Laguna Beach all the way to the Pacific Ocean. After a recent inspection of Soka, our OCFA inspector said, "Soka has really done well with the fire mods, and when there has been a concern, Soka has quickly responded. This year all agencies, federal to local, all predict a very active fire season." Our grass helps play a big part in keeping our campus fire safe.

Bunch Grass: Border & slope

A good landscaping grass should keep weeds out. A weed is a plant out of place. Hardy bunch grass only gets an occasional weed. In the past 3 years, the weed-grass Poa, *Poa annua*, has invaded much of our mowed lawn and shows as light green areas. Poa is a prolific seed producer, the seeds can lay dormant for years, and Poa can seed below the mowing height. Grass that is "invaded" by Poa may have to be removed altogether and restarted from seed or replaced with sod. The herbicide Prograss can be applied to Poa without killing the tall fescue. We also use the herbicide Roundup around campus. Poa infested golf courses are the reason Monsanto and Scott teamed up to create a GMO turf that is resistant to Roundup. Simply spray Roundup on the turf, and only remaining plant is the "Roundup ready" turf. Environmentalists argue that not enough is understood about this bioengineered process, and the new turf could escape and become a super-weed.

Mowed lawn and sports turf need to be mowed and fertilized. Mowing increases our carbon footprint in gas, machinery, and the green waste hauled away. To reduce our green waste, the moved lawn is also cut with a mulching mower which leaves the grass mulched on the lawn. All the grass is fertilized for general growth or to keep it green. Annually, we apply over 11,000 pounds of inorganic fertilizer to all grass. By weight, 8% is applied to the bunch grass, and the remainder is split about 50/50 between the sports turf and mowed lawn. As of yet no study has been done to see if our run-off water includes high amounts of this fertilizer.

Many have enjoyed the wild flowers in the bunch grass. The first few years after Soka opened, wildflowers were common and abundant, especially our state flower: CA poppy, *Eschscholzia californica*. Eschscholtz was a botanist who came to California in 1816 on a Russian expedition that stopped at Fort Ross, a former Russian establishment. An earlier seed mix included another local, golden yarrow, *Eriophyllum confertiflorum*, which can be found in patches in the back of campus. Adding more CA native wildflowers around campus in the bunch grass would add color, variety, and diversity.

Bunch Grass: California poppy in bloom

So when you walk campus, look around at the grass again and see if you see something new or in a different way. However, if you simply want to lay down on it on a sunny day… that's just fine.