

Improving Campus Sustainability: The Authentic Results from Higher Education on Environmental Sustainability, Student Engagement, and Financial Effectiveness

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Abstract

This research study will introduce and educate the reader on sustainability efforts that most effectively and efficiently meet expected outcomes vs. those that fall short of expectations. This study focuses on the variability and success of determined sustainability efforts and the effects these programs have upon implementation. The study will seek to determine the success of various sustainability efforts currently being implemented at institutions of higher-education. The researcher will answer the question: which sustainability programs implemented in higher education institutions have the greatest impact on a scale of environmental sustainability, student engagement and financial effectiveness?

The researcher will conduct the research via descriptive survey with an emphasis on cohort research of the sample (n = 45) by the research outcomes of the *Multifactor Sustainability Assessment* with the sample representing higher education institutions. There will be five general initiatives that will include the following items: transportation, curriculum and student activities, physical operations/facilities management, alternative fuel sources, and consumer actions. Within the five general initiatives, twenty specific initiatives will be surveyed and analyzed to answer the above research question.

Sustainability at the University of Central Oklahoma

In 2001 the University of Central Oklahoma (UCO) faced a bleak future relative to campus infrastructure. HVAC systems had completely crashed in two major campus buildings and the average age of air conditioning and chiller units was over 40 years. Moreover, the State of Oklahoma allocated less than \$1 million per year to the university to provide for all the capital needs of a university of 15,000 students and 2 million square feet of conditioned space.

Interestingly, this overwhelming challenge put UCO on the path to eventually become one of the nation's most honored schools for sustainability. UCO began to solve its infrastructure nightmare by replacing all the ancient units with new, energy efficient systems. The financial savings on utility charges provided more than ample funds to provide a stream of revenue to retire the debt of buying all the new systems. Soon the school completely replaced all lighting systems and every water delivery and restroom fixtures with low energy use and low water use systems, utilizing the same "performance contract" model.

Suddenly UCO was using 25% less water and energy. Waste water streams were reduced. This experience led the university to continue to find ways to create a sustainable environment in a fiscally responsible way. Soon the school elected to use 100% wind generated power from the local utility company. Over the 2 ½ years since switching, the cost of wind power has averaged to be equal to the cost of carbon-based electricity. Again, UCO was responsible to the Earth and to the citizens and students of UCO who entrust their tax and tuition dollars to the most effective use. The carbon footprint reduction at UCO was becoming increasingly noticeable. Students, faculty, staff, and administrators began to coalesce around the idea that a real difference was being made, that the values of the university and the students were being expressed in discernable and tangible ways.

Following these major energy reduction and sustainability projects, the campus erupted with innovative and creative responses to other challenges and opportunities. The university motor pool created a mini-refinery to convert used cooking grease into a high performance bio-diesel for all UCO equipment and vehicles that ran on diesel. A cookie-cutter recycling program leapt to life with paper, cans, plastics, batteries, solvents, fluorescents, cardboard and much more being collected office by office.

The grounds crews began to design tree planting and other landscaping techniques to reduce water usage and to provide maximum shade on buildings to reduce cooling needs. Computerized irrigation systems paid for themselves with water reductions. Low impact gardens were designed by botany and biology faculty to provide on-campus study sites and to meet local ecosystem limits.

UCO, chronically challenged with parking shortages, determined that more paving was not sustainable, instead adding a high demand “bum-a-bike” program and high occupancy vehicle parking lots in the most desirable and closely-accessible parking lots. Instead of adding parking spaces to meet demand, the school has been able to manage demand with these programs and financial support for local mass transit. The costs of these programs are much less than the cost to purchase and tear down houses, construct, and maintain new paved parking.

A multitude of student, faculty and staff suggestions were implemented. In addition to the above, these implemented suggestions included motion sensor light fixtures and the use of a thermal storage tank that would fill and chill water in non-peak times. The local utility providers structured new and reduced rates for the school due to changing use from high-demand peaks to non-peak times. The university committed to meet LEED certification energy saving standards on all new construction in order to minimize future operational costs and carbon footprints.

The administration committed to an acceleration of the “plan to digitize” nearly all previously paper intensive processes. The facilities personnel created a new standard for non-VOC paints to be used. The university even turned to selling on eBay for items previously deemed unusable and destined for warehouses of State surplus or local landfills. Money was both saved and earned for no less effort than previously used to surplus or haul off.

Recently contracts with campus vendors have been re-written, when appropriate, to seek eco-friendly items for purchase or for services like custodial and food. Academic endeavors have led to funded undergraduate research projects in sustainability, the addition of an interdisciplinary Environmental Sciences minor involving four colleges, and the selection of one faculty member for a Fulbright Award in bio-diversity.

The university has been selected for more than a dozen local, national, and international recognitions for its work in sustainability and forever changed the image of the university for the better. In spite of this success, the school was not satisfied with the effectiveness of some of the projects that had been implemented. Some were financially responsible and others not. Some had high levels of student engagement while others connected no students in any direct manner. Some of the projects had no discernable environmental impact but had high public relations value.

These concerns led the school to seek the best practices around the nation for adoption and adaptation. During this research the school found copious written material. Indeed, it was nearly impossible to open any higher education related publication without reading at least one article on green and sustainable success stories. However, despite finding multitudes of stories, nearly no research had been devoted to determining the effectiveness of the many sustainable programs. It became a goal of the university to understand how other universities would rate the effectiveness of their programs as to environmental sustainability, student engagement, and financial effectiveness. In order to become better

at its own sustainability projects, the university needed to know which programs served which goals effectively.

Study Rationale

As environmental sustainability is becoming an increasingly important issue for the world, the role of institutions of higher education in relation to environmental sustainability initiatives is becoming more and more prevalent. If it is the role of colleges and universities to educate members of society, then they must be actively instrumental in the sustainability movement.¹ As colleges and universities across the world begin to meet the ever increasing environmental expectations and demands, it is imperative that research in regards to the different initiatives being implemented is documented and reported. Wright believes that with the education of students comes the increased importance for the institution to practice what is being taught.² Of all of the sustainability initiatives being implemented in the higher education world it is primary to note the effect these initiatives have on environmental impact, student engagement, and financial savings of the institution.

These three variables are listed as some of the most important sustainability factors in regards to institutions of higher education today. Institutions of higher learning can address these issues by being the example they were designed to be. Hansen recognizes institutions of higher learning as necessary examples that show what is possible, while pointing the way for others.³ The student who passes through the halls must not only be taught the importance of environmental sustainability, but she must also recognize her university as being an example to model. Words without actions fall short of their true power. If the next generation of citizens is expected to be educated, truly educated, it is imperative that the educational institutions that teach them are prepared to provide the words and actions that align with a future vision for environmental sustainability. This study sought to determine those initiatives that can impact the environment, increase cost savings, and provide learning opportunities that every institution, faculty, staff, and student values.

With the continual rise of energy costs, many schools are looking for initiatives or best practices to implement in order to reduce energy consumption. These activities have also been paired with the greening trend that has infiltrated business and leaked into the field of higher education in an effort to lower institutions' carbon footprints. David Simon, CEO of Evergreen Energy Solutions highlighted these changes saying that, "[e]nergy costs are projected to rise as much as 12 percent in 2008, and a facility's 'carbon-print' has become an issue of increasing importance."⁴ These changes, coupled with the growth of student engagement and transformative learning in education, have developed a trifecta that will encompass a new emphasis on developing initiatives that reduce an institution's environmental impact, increase student engagement, and produce financial returns.

¹ Almut Beringer, Leslie Malone, and Tara Wright, "Sustainability in Higher Education," *International Journal of Sustainability in Higher Education* 9, no.1, September (2006): 48-66.

² Lisa Pike, Tim Shannon, Kay Larimore, April McGee, Martin Taylor, and Gary Lamoreaux, "Science Education and Sustainability Initiatives: A Campus Recycling Case Study Shows the Importance of Opportunity", *International Journal of Sustainability in Higher Education* 4, no. 3 (2003): 218-219.

³ Alexandra Wright, Tarah Shannon, "Giving 'Teeth' to an Environmental Policy: a Delphi Study at Dalhousie University", *Journal of Cleaner Production* 14, no. 9-11 (2006): 3-5.

⁴ Jim Hensen, "The 800 Pound Gorilla: The Threat and Taming of Global Climate Change", *Facilities Manager*, April (2008):27-28.

Environmental impact

The environmental impact scale in this study is reserved for those initiatives that create significant, tangible results that can be proven to reduce an institution's carbon footprint and reduce or avoid energy use. The measurement and reporting of proven initiatives will guide the next wave of environmental friendly institutions. This wave looks to today's leaders for guidance in establishing both meaningful and realizable sustainable goals. For example, the Environmental Protection Agency (EPA) has developed the ENERGY STAR program that institutions can adopt or reference which outlines initiatives and practices proven to reduce an organization's carbon-footprint. According to EPA estimates, this program in 2007 alone has helped, "avoid greenhouse gas emissions equivalent to those from 27 million cars."⁵ At the most fundamental level the environmental impact should be the most important goal of all sustainability efforts.

Student engagement

Kelly Dougherty, senior project and proposal manager for GreenGrid Green Roofs based in Chicago, stated in a recent article that in addition to environmental impact, "[o]ther important benefits of implementing an energy program should be emphasized as well, including an opportunity to educate students on environmental issues and contributing to the sustainability of the campus."⁶ In our focused research, the student engagement variable scale is reserved for those initiatives that educate and engage students in activities that foster environmental literacy. Serving as a conduit for development, higher education institutions are situated in a unique position to engage students in a transformative learning process. When students are actively engaged in their education, recent research has shown significant increases in performance occur against specific criteria. A study conducted at Oberlin College in Oberlin, Ohio, exhibited this concept in relation to sustainable and green efforts in student development. The study's researchers found that when students were actively engaged and aware of their specific energy consumption within dormitories and competed against each other for reducing individual consumption, it resulted in a "32 percent overall reduction in electricity use in these dormitories... The winning dormitory reduced electricity consumption by 56 percent."⁷ Students exposed to and engaged in environmental literacy are more likely to transpose this education to sustainable action in their personal lives.

Financial Effectiveness

This variable scale is reserved for those initiatives that produce financial returns, cost savings, or cost avoidances. With limited financial resources, institutions of higher education must act as stewards' when investing state, endowment, or university monies. A good example of this action would be the partnership between the University of Central Oklahoma and Johnson Controls Inc. This partnership generated cost avoidance of more than \$850,000 annually which was then reinvested in environmentally sustainable retrofits, upgrades, and renovations.⁸ Another example, that further clarifies this point, is found in the "Queens Building at De Montfort University in Leicester, England... where an innovative passive ventilation system reduced the mechanical budget by 23 percent; that money was then applied to

⁵ David Simon, "Fast Payback", *American School and University, Mind Shifts*, June 2008: 27-28.

⁶ ENERGY STAR, "About ENERGY STAR," *ENERGY STAR*, http://www.energystar.gov/index.cfm?c=about.ab_index.

⁷ Kelly Dougherty, "Energy Efficiency Programs," *College Planning and Management*, June 2008:18.

⁸ John Petersen, Vladislav Shunturov, Kathryn Janda, Gavin Platt, and Kate Weinberger, "Dormitory Residents Reduce Electricity Consumption When Exposed to Real-Time Visual Feedback and Incentives," *IJ of S in HE* 8, no. 1 (2007): 26-27.

the construction of additional space.”⁹ Dougherty recognizes that while many of these initiatives can generate financial savings, these efforts should be viewed as investments in our world’s future.¹⁰ It is the investment in the world’s future that aligns with higher education’s purpose of education, research, and service.

Green General Initiatives

Transportation on campuses across the United States has become one of the leading areas to decrease emissions and increase sustainability efforts. In this research these initiatives involve activities or programs centered on the alleviation, reduction, and avoidance of vehicle emissions on or around the university campus; including, but not limited to travel to and from campus. Universities are exploring a range of environmentally appealing solutions to alleviate congestion and improve safety for all campus users.¹¹ Toor concluded that within the area of transportation, universities can save money, reduce environmental impact, and improve town-gown relations.¹² There are many programs and initiatives that can influence environmental sustainability outcomes within the area of green transportation. This, partnered with the movement of faculty, staff, and students on and to a university campus, makes transportation a staple target for sustainable initiatives.

As students graduate and become leaders of tomorrow they will disperse from the world of higher education into their specific career. In doing so, they will take with them the green practices and approaches they were involved with at their institution.¹³ By this theory, the value of curriculum, rooted in environmental literacy initiatives, is imperative to the success of the next generation’s ability to make decisions that are conducive to the health of the environment. These initiatives involve activities or programs designed to educate and engage the student in regards to environmental literacy and action. When general academic programs or specific courses strive to teach environmental literacy through the practice of service learning, the potential for the student to continue their involvement in the future is increased dramatically. Today’s students have been identified as perhaps the most environmentally conscious generation.¹⁴ The current generation of students in college is the future generation of decision makers in business, government and communities. By creating opportunities on campus, both in and out of the classroom, institutions of higher education are generating the “bio-fuel” that will energize the next generation to continue the sustainability movement.

Physical operations and facilities management are areas of environmental sustainability that proffer many opportunities in financial savings and emissions reduction. Effectively and efficiently managed, operations and facilities can prove to foster substantial impacts at universities and colleges who strive to be stewards of their resources and environment. There are entire publications, journals and articles dedicated to the lucrative management of facilities and operations at universities and colleges such as: American School & University, College Planning & Management, Facilities Manager, and International Journal for Sustainability in Higher Education. From focusing on certifying new

⁹ William Browning, “Successful Strategies for Planning a Green Building.” *Planning for Higher Education* 31, no. 3 (2003): 112.

¹⁰ Johnson Controls, *Case Study: University of Central Oklahoma*, (2007): 1.

¹¹ Dougherty, *Energy Efficient Program* 18.

¹² Francois Poinatte and Will Toor, “Finding a New Way: Campus Transportation for the 21st Century,” http://ecenter.colorado.edu/about_us/will.html

¹³ Will Toor, “The Road Less Traveled: Sustainable Transportation for Campus,” *Planning for Higher Education*, March-May (2003): 137-140.

¹⁴ Carlos Balsas, “Sustainable Transportation Planning for College Campuses,” *Transport Policy* 10, no. 1 (2003): 35-40

construction to retrofitting old facilities, there are opportunities for financial savings, reductions in emissions, and student learning opportunities. These opportunities, which are easier to take advantage of than to ignore, can assume the guise of energy management, campus beautification, resource conservation, and the earning of sustainable program certifications (e.g. - LEED), on campuses.^{15 16 17} By taking green actions, an institution can practice what it teaches, embrace financial savings, and decrease emissions; while becoming an example to the students it forges into the leaders of the future. It is imperative that the administration and decision makers are aware of these opportunities and take full advantage of the value found in each.

The use and creation of alternative fuel sources proves to be an area in environmental sustainability where innovation and creativity are dominant characteristics. According to the North Carolina Solar Center, "It is evident there is a growing need to rely more on alternative energy sources and less on limited conventional energy sources that often are detrimental to the environment."¹⁸ When best practices of alternative fuel sources are shared with other institutions, a bridge can be built that provides cost savings, positive environmental impact, and learning opportunities for all involved partner institutions. These initiatives involve activities or programs centered on the procurement and utilization of alternative fuel and energy sources designed to decrease the university's carbon footprint. Alternative fuel sources have been identified as follows: solar energy, wind power, low-impact hydroelectricity, bio-fuels/gas, bio-mass, and geothermal energy.¹⁹ There are numerous agencies and departments that research the emission reduction of the alternative fuel sources such as the United States Department of Energy and the National Renewable Energy Laboratory. Alternative energy is a valuable resource utilized by universities and colleges to impact the communities they cohabitate with and world in which they live.

Consumer actions are defined as those sustainability initiatives that involve activities or programs centered on relations with outside parties designed to foster environmentally sustainable practices for all parties involved. Specific consumer actions include, but are not limited to: vendor contracts, partnerships, reverse auctions, and on campus recycling initiatives. The University's of Oregon, Florida, Central Oklahoma, and California- Santa Barbara are among programs that employ sustainable procurement as a green practice. These universities recognize environmentally responsible purchasing practices as a major initiative that can produce cost savings and positive environmental impact. To identify a few, these positive outcomes can arise through performance contracting, reduction in disposal costs, consortium purchasing power, and waste prevention.²⁰ The University of California- Santa Barbara recognizes universities as having the purchasing power and capacity to shift markets and drive technology toward a more sustainable model. Partnerships among universities, their vendors, and their consumers can pave the way for a cleaner future.

Study sample

The target population for this research study was identified as active members of the broader higher education community participating in green sustainability initiatives. This list included various universities and colleges from assorted backgrounds who are at different junctures in their green

¹⁵ Tod Stevens, "Simple Strategies," *American School and University, Mindshifts*, June 2008: 23-25.

¹⁶ Ray Michan, "To LEED or Not to LEED? That is the Question," *College Planning and Management*, April (2008): 32-36.

¹⁷ Amy Milshtein, "Its Not Easy Being Green," *College Planning and Management*, April (2008): 38-42

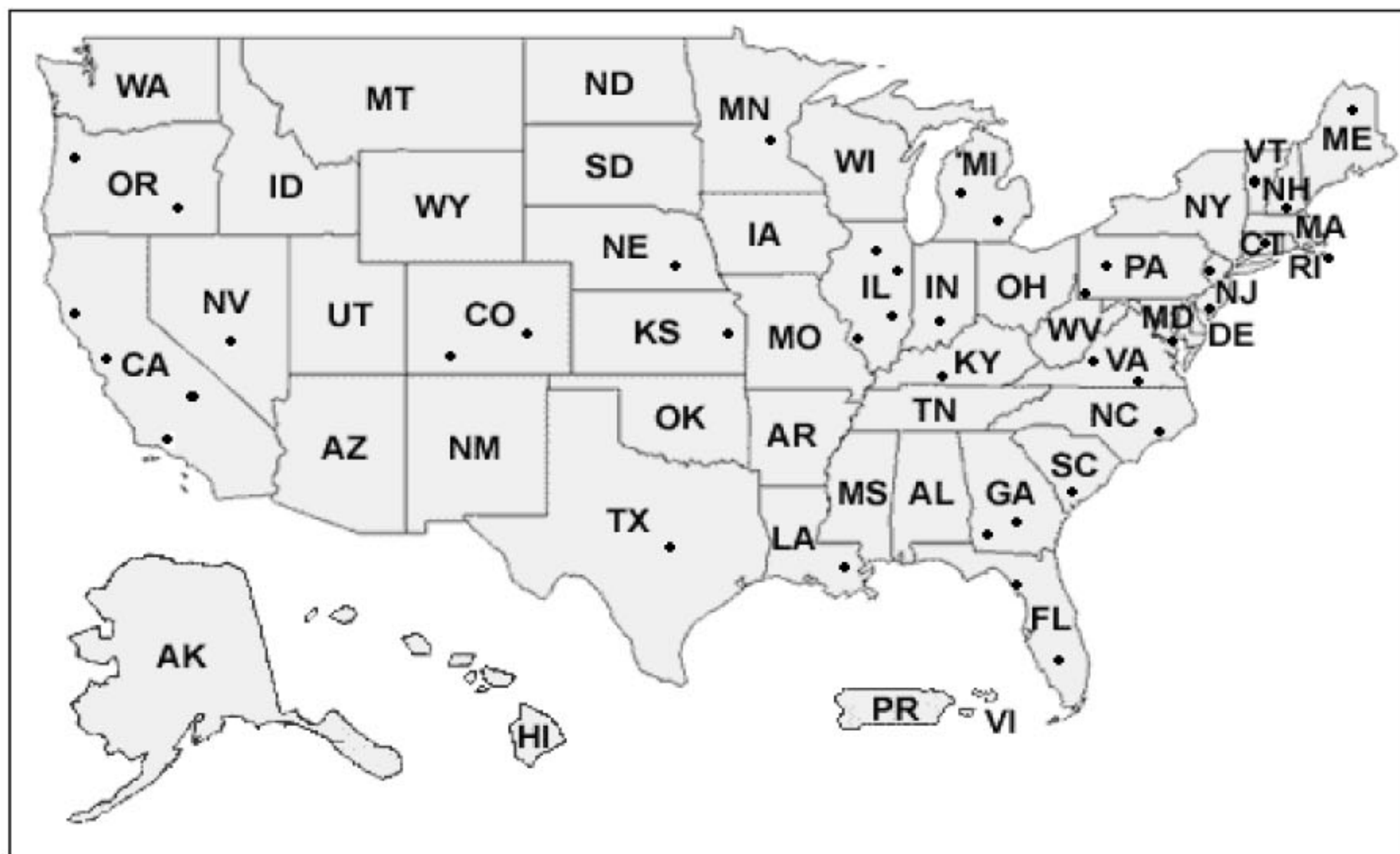
¹⁸ John Paul Weesner, "Look to the Landscape," *College Planning and Management*, April (2008): 52-56.

¹⁹ North Carolina Solar Center, "Overview of Renewable Energy Technologies," September (2001): 1-2

²⁰ Environmental Protection Agency, "Green Power Defined," <http://www.epa.gov/greenpower/gpmarket/index.htm>

sustainability journey. The sample was targeted across the United States as those institutions who are members of the Association for the Advancement of Sustainability in Higher Education (AASHE). Many of the institutions selected are also participants in the Sustainability Tracking, Assessment, and Rating System (STARS) and are also co-signers of the American College and University Presidents Climate Commitment. This resulted in an actual sample of $n = 45$ participating institutions. The sample was representative of institutions who are currently aware of the value of green initiatives and are striving to increase the number and quality of programs at their institutions.

Table 1.0 *Geographic Location of Surveyed Institutions in Regards to Green Praxis.*



Methodology

The Multifactor Sustainability Assessment (MSA), developed by the University of Central Oklahoma (2008), was the methodological instrument for this study. It was developed to be the key research instrument for the following reasons: there was not another instrument available that met the criteria of the research study that provided the respondent the opportunity to select their involvement in general and specific green initiatives while simultaneously scoring their perceptions of the initiatives success in relation to the three variables studied.

The MSA consists of 42 quantitative survey items. The synthesis of the MSA is as follows: eight demographic items and five general initiative items. Within the general initiative items there are five to seven specific initiative items ranked in accordance to their effectiveness. The initiative's effectiveness is

ranked on a Likert Scale by the following variables: environmental impact, financial impact, and student engagement. The Likert Scale was based on a 1 to 10 spectrum, where 1 is the lowest value and 10 is the greatest value of impact or effectiveness. The five general initiatives are as follows: transportation, curriculum and student activities, physical operations/facilities management, alternative fuel sources, and consumer actions. The general and specific initiative items were marked with yes or no radio buttons identifying that the respondent does participate in the general initiative, or they do not. The demographic items sought to determine the size of the institution, length sustainability program has been implemented, employment of full-time sustainability coordinator, formally documented goals, and degree classification type.

The MSA was designed as an interactive website instrument (<http://administration.ucok.edu/msa/>). The MSA website was sent to nearly 100 institutions of higher education in the United States. Data collection for the report took place from May through July 2008 and analysis of the data took place in July 2008. The MSA website informed the respondent of the purpose and scope of the research study. A section was created that identified, defined, and gave examples of green general initiatives that institutions are implementing; and a section that defined the three variables. At each institution, the MSA was completed by the sustainability coordinator or their equivalent along with any individual they deemed necessary. The respondent was telephoned and emailed by the researchers in order to ensure the correct contact person had been identified and to attain a higher percentage of participation. As in much research where the respondent is self-reporting the variation affects data validity, reliability and trustworthiness. The researchers are cognizant of the subjectivity that results from the self-reporting style utilized by the MSA and in turn bases this as the reason for not ranking the participating institutions accordingly. The MSA sought to identify what green initiatives and programs are being implemented at the sample institutions and at the same time allow the institutions the opportunity to score these initiatives in juxtaposition to the three variables of this study.

The survey items were analyzed using Microsoft Excel. Each item was analyzed individually and in comparison to the other participants' responses. Once each item was compared to the other responses, the "yes" responses were compared to three variables' scores in regards to the Likert scale. This allowed the researcher the opportunity to analyze the responses in regards to each of the items and each items efficiency and effectiveness as green sustainability initiatives.

Findings

The results of the research study were analyzed through the demographic responses, five general initiatives, and twenty specific initiatives. The survey highlighted the subjects' responses to each of the queries on the instrument. Each initiative's mean is noted as low, moderate, or high in the following manner: low represents those means < 5.00 ; moderate represents those means < 7.00 ; high represents those means > 6.99 . Many of the standard deviations are volatile and represent a broad range of responses from the sample. This situation was considered when interpreting and analyzing the data. Additional attachments have been included for reference for complete analysis of general initiative and demographic findings.

Table 2.0 *General Descriptive Statistical Analysis from Institutes of Higher Learning in regards to Sustainability Initiatives*

<u>Item</u>	<u>n</u>	<u>*EI-</u> <u>M</u>	<u>EI-</u> <u>SD</u>	<u>EI-</u> <u>Interp</u>	<u>*SE-</u> <u>M</u>	<u>SE-SD</u>	<u>SE-Interp</u>	<u>*FE-</u> <u>M</u>	<u>FE-SD</u>	<u>FE-</u> <u>Interp</u>
<i>Transportation General Initiative (TGI)</i>										
Bicycle Programs	23	5.17	2.35	mod	6.52	2.20	mod	4.57	2.17	low
Community/Bus Trans.	34	7.16	2.38	high	7.58	2.02	high	6.20	2.23	mod
Parking Programs	19	5.15	2.82	mod	3.57	2.56	low	4.66	2.41	low
<i>Curriculum, Student Activities, and Environmental Literacy General Initiative (CSEGI)</i>										
Minors	14	6.53	2.39	mod	7.90	1.94	high	5.76	2.45	mod
Bachelors	16	7.12	2.05	high	8.00	2.37	high	6.86	2.08	mod
Masters	8	8.25	1.19	high	8.87	0.78	high	7.25	1.39	high
Service learning	30	6.81	1.43	mod	8.15	1.85	high	5.78	1.58	mod
Community Engage.	24	6.96	1.81	mod	8.12	1.69	high	5.71	2.26	mod
<i>Physical Operations/Facilities Management General Initiative(POFMGI)</i>										
Lighting	40	7.87	1.58	high	4.50	2.55	low	7.88	1.63	high
Grounds/Green Plant.	36	7.26	1.63	high	4.87	2.31	low	5.88	2.1	mod
Certification	32	8.09	1.25	high	5.76	2.55	mod	6.89	1.72	mod
H2O Grounds	27	7.92	1.41	high	4.27	2.35	low	6.82	1.87	mod
H2O Facilities	34	7.00	1.84	high	4.39	2.14	low	6.72	2.12	mod
<i>Alternative Fuels and Energy Source General Initiative (AFSGI)</i>										
Bio fuels	20	5.90	2.45	mod	5.80	2.82	mod	5.42	2.13	mod
Energy Conservation	16	7.13	2.03	high	6.09	2.73	mod	4.50	2.70	low
Bio Mass	2	9.50	0.18	high	9.50	0.18	high	9.00	0.35	high
Other- Cogeneration	5	8.20	0.75	high	2.00	0.89	low	8.20	2.23	high
<i>Consumer Actions General Initiative (CAGI)</i>										
Recycling	29	7.86	1.45	high	7.14	1.61	high	6.46	1.90	mod
Vendor Agreements	20	6.75	1.70	mod	4.37	2.53	low	6.37	1.69	mod
Reverse Auction	10	7.70	2.28	high	3.70	2.72	low	6.60	2.69	mod

* EI= Environmental Impact; SE= Student Engagement; FE= Financial Effectiveness

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Table 2.1 *Descriptive Analysis of the Top Twenty Specific Initiatives Scored across each Evaluation Scale.*

<u>Rank</u>	<u>Specific Initiative</u>	<u>Sample</u> <i>n</i>	<u>Environmental</u> <u>Impact (rank)</u> <i>M</i>	<u>Student</u> <u>Engagement</u> <u>(rank)</u> <i>M</i>	<u>Financial</u> <u>Effectiveness</u> <u>(rank)</u> <i>M</i>	<u>Score</u>	<u>Grade</u>
1	Bio Mass	2	9.50*	9.50*	9.00*	28.00	A
2	Masters	8	8.25(1)	8.87(1)	7.25(3)	24.37	A
3	Bachelors	16	7.12	8.00(4)	6.86(5*)	21.98	A
4	Recycling	29	7.86	7.14	6.46	21.46	A
5	Community/Bus Trans.	34	7.16	7.58	6.20	20.94	B
6	Community Engage.	24	6.96	8.12(3)	5.71	20.79	B
7	Service learning	30	6.81	8.15(2)	5.78	20.74	B
8	Certification	32	8.09(3)	5.76	6.89(4)	20.74	B
9	Lighting	40	7.87(5)	4.50	7.88(2)	20.25	B
10	Minors	14	6.53	7.90(5)	5.76	20.19	B
11	H2O Grounds	27	7.92(4)	4.27	6.82	19.01	C
12	Other- Cogeneration	5	8.20(2)	2.00	8.20(1)	18.40	C
13	H2O Facilities	34	7.00	4.39	6.72(5)	18.11	C
14	Grounds/Green Plant.	36	7.26	4.87	5.88	18.01	C
15	Reverse Auction	10	7.70	3.70	6.60	18.00	C
16	Energy Conservation	16	7.13	6.09	4.50	17.72	C
17	Vendor Agreements	20	6.75	4.37	6.37	17.49	D
18	Bio fuels	20	5.90	5.80	5.42	17.12	D
19	Bicycle Programs	23	5.17	6.52	4.57	16.26	D
20	Parking Programs	19	5.15	3.57	4.66	13.38	F

*Bio Mass is discounted for having a sample size of 2 institutions.

5* this is discounted for being so closely related to the Master's offering

Discussion

Top Twenty Specific Initiative Analysis and Grade Assignment

Table 3.2 identifies the top twenty specific initiatives with the highest overall average total score across the three evaluated scales. The researchers have designated that an average *M* score of 7 or above (for an average total *M* score of 21 or better) on each of the scales will give that associated specific initiative an A performance grade. Average *M* scores between 6.66 to 6.99 (for an average total *M* score between 20 to 20.99) across all three scales result in a B performance grade for the associated specific initiative. An average *M* score of between 5.83 to 6.65 (for an average total *M* of 17.5 to 19.99) resulted in a C performance grade for the associated specific initiative. The researchers have designated that an average *M* score between 5.33 and 5.82 (for an average total *M* score between 16-17.49) on each of the scales will give that associated specific initiative a D performance grade. Average *M* scores of 5.32 or below (for an average total *M* score of 15.99 or worse) across all three scales result in an F performance grade for the associated specific initiative.

Four of the specific initiatives received A performance grades. But, of those four only one initiative, recycling, had a sample size well over half of the participants engaging in these activities. This indicates that the reporting institutions broadly feel they receive the most benefit across the three measured scales from recycling initiatives, with recycling having an average total score of 21.46. These initiatives are likely to have been skewed upwards in point value because they are well known across a broad spectrum of individuals. Everyone is aware of the positive impact of recycling. It allows for the proper disposal of certain wastes while creating the opportunity for the reuse of many of our old or trashed materials. Recycling, while obviously not the most environmentally impacting, is considered the “poster initiative” for green campuses across the U.S. Recycling is one of those initiatives that everyone knows, and everyone recognizes as a continual fixture on the sustainability front. Although Bio Mass received an almost perfect average total score, this finding should be discounted because only 2 (4.4 percent) of responding institutions reporting engaging in this activity.

Six specific initiatives received a B performance grade. Lighting initiatives with a total average *M* score of 20.25 had a sample size of 40 (90 percent). With such a high sample and corresponding total average score, institutions should look seriously into lighting initiatives as a way to receive sustainable benefit across the three measured scales. Also, another important note is that the average mean of these initiatives were likely negatively impacted by such a large sample size within almost all of the initiatives in this grade category.

The remaining initiatives did not perform well collectively across all three scales. Particularly, Parking initiatives received the lowest average total score of 13.38. Of the top twenty scoring specific initiatives, this was the only initiative within the top twenty to receive an F performance grade. As such, institutions should note that most other institutions find little benefit from these initiatives and would likely benefit from looking into or investing in other sustainability efforts.

Top Five Specific Initiatives for Environmental Impact

The first observation that must be addressed is the fact that the Bio Mass initiative was consistently marked as the top performer on all three scales. This rank is quickly undermined when considering the sample was made up of only two institutions. Bio Mass programs are arguably relevant on all scales but no major inferences can be drawn from such a small sample. But it is important to note Bio Mass as an innovative form of green initiatives. Providing a Masters Degree in Environmental Sustainability was the next highest scoring specific initiative. This initiative also had a very high mean with a low standard deviation. Therefore, this initiative received the researcher’s number one ranking in the environmental impact category. It could easily be argued that lighting initiatives, our fifth ranking initiative on this scale, currently produce a larger impact on the environment than providing a diploma to a student, but respondents likely evaluated the long term impact of that student’s education in regards to future elevation or prevention of environmentally hazardous activities. In this case, it is important to recognize the value placed on the investment of educating the future generation of decision makers. Respondents were more likely to give greater value to initiatives that might not necessarily translate into a

current environmental impact, but would likely have large impacts in the future, while being innovative or cutting edge, as recognized by the sample size.

Cogeneration activities received the second highest score for environmental impact. Interestingly, this specific initiative was not on the survey, but many universities listed this initiative as an alternative activity they were doing that had a significant impact on this scale. The score is further validated by a high mean of 8.20 coupled with a very small standard deviation of .75. Co-generation is gaining ground in many universities across the US. This is most likely attributable to the value, control, pride, and message that are sent by the university to the community, students, faculty, and staff. This activity was more likely highlighted by administrators or sustainability coordinators at the respective institutions than by other university representatives.

Green Certification activities scored the third highest on this scale. Obviously certification processes like LEED have a real impact on the environment. Standards for these certifications are created by governing bodies that test outcomes and assure that abiding by the certified guidelines are less harmful than staying with old policies and procedures. Also, one would think that certification processes would rank higher on this scale mainly for the reason that it involves some type of action that would incorporate all the specific initiatives or ones that are very similar. LEED certification is a set of standards that typically entail nearly all of the research items found in this study. Due to this context, it was expected for LEED to rank in the top five in regards to environmental impact.

H2O Grounds initiatives were the fourth highest ranking general initiative on this scale. These initiatives provide for better irrigation throughout campuses that foster growth of foliage that offset a portion of a campus's carbon emissions. Moreover, the growth that occurs creates a more aesthetic atmosphere that likely generates a more environmentally friendly setting around which those filling out the survey work. These initiatives also foster more efficient utilization of resources. The researchers believe the aesthetics fostered by the investment in green H2O ground initiatives proffers an intrinsic as well as an extrinsic value to the university that likely impacted the respondent's responses.

Lighting was the fifth highest ranking general initiative on the environmental impact scale. Lighting initiatives have continually been found to be one of the many "low-hanging fruits" of the environmental sustainability world. Lighting is something that can proffer huge environmental impacts, while at the same providing a learning environment that is more conducive to the faculty, staff, and students.

Top Five Specific Initiatives for Student Engagement

Offering a Masters Degree in Environmental Sustainability was rated the highest initiative on the student engagement scale. The higher the degree, it is assumed the greater the intensity and thoroughness of material to be covered. But, not only does academic course work increase as the level of degree increases, but so do discussions and real world application. Projects and activities are integrated into the curriculum and students are thus more engaged in the discipline. The finishing of a Master's thesis or Doctoral dissertation in the field of environmental sustainability will be a piece of knowledge that will impact not only today, but the future. The projects completed by these students can typically be valuable to the current communities and next generation of researchers.

Service Learning initiatives were rated second on this scale. Service Learning is specifically designed to be more engaging than traditional coursework. Students are required to engage in activities outside of the classroom and are evaluated on their experience and ability to relate that associated experience to the coursework presented in the classroom. Service learning is a teaching method that seeks to ground the learner in theory, while at the same time providing hands-on learning opportunities in a community. This experience is strengthened by the learner-facilitator relationship and continual reflection with their peers, facilitators, and community counterparts. This initiative is rooted in the perspective that service learning provides the learner with truly reflective experiences that can transform their learning to a more educated and well rounded perspective.

Similarly, Community Engagement is the third highest initiative on the student engagement scale. Community engagement can happen in many ways. Two of the most common ways community

engagement can occur in reference to this study is through service learning courses and co-curricular initiatives. Service learning was mentioned previously. Co-curricular initiatives provide students with opportunities that are not directly rooted in curriculum or teaching, and may or may not have some form of reflective component. It is thought that participation in community engagement during collegiate years could have an effect of the student's future participation with their community post-graduation.

The following the three highest scores were, fourth providing a Bachelors Degree in Environmental Sustainability and fifth providing a Minor in Environmental Sustainability. Community engagement was likely ranked higher than the Bachelors degree and Minor offering because it requires action from students outside of the classroom. It would be considered different from service learning because it is not internally focused but mainly aimed at helping others. The Bachelors and Minor offering likely scored higher than the other specific initiatives primarily because they are highly student involved. Few other specific initiatives covered in the Multifactor Sustainability Assessment were student focused or interactive, rather they are designed to be implemented and managed by faculty, staff, and administrators.

Top Five Specific Initiatives for Financial Effectiveness

Cogeneration, specifically within the lens of financial effectiveness, provides cost savings to participating institutions. Anytime a university can produce its own electricity based on its own needs and aligned with usage at its own discretion, it will allow for a positive impact financially. Cogeneration is a great way to provide a campus with some of its energy needs, but may be difficult to meet all energy needs. As mentioned earlier, cogeneration was not on the survey, but many of the participating institutions mentioned and gave substantial weight to these initiatives. Thus, in further research more data needs to be retained on these efforts and to assure the impact of these activities are representative of a larger population.

Lighting initiatives were the second highest scoring activities on this scale. These initiatives lead to the most effective and efficient use of a particular energy outlay. These activities lower cost in two ways. First, they lower the actual costs of lighting on campus by lowering the amount of energy used in the process therefore lowering the monthly bill. And second, because the institution is using less energy, the cost of energy goes down by basic rules of economic demand. McIntosh et al. referenced lighting as being an example of a "low hanging fruit" capable of being implemented with little to no effort²¹. Seeing as though lighting has shown up on the financial and environmental scales, it may be one of the most implementable initiatives of all. The high scores on this scale were likely the evaluations given my administrators at the respective institutions that responded to the MSA.

Offering a Masters Degree in Environmental Sustainability was the third highest scoring initiative on this scale. Not far behind it, but behind the fourth scoring initiative was offering a Bachelors Degree in Environmental Sustainability. These initiatives were likely seen not as relevant cost avoidances for universities in the present or even for particular universities at all, but as investments in society's future on a financial scale. The costs of educating future leaders in these areas are seen as minimal in comparison to their potential benefits.

Green Certification initiatives were the fourth highest scoring on this scale. Initial investments for complying with these policies are higher than building with traditional materials and practices. But, over the lifespan of a campus or building, the benefits of compliance are realized through the reduction of resource utilization as well as lowering the institutions carbon footprint. In context of the performance contracting efforts mentioned previously, the guidelines of LEED provide a framework to upfront costs with long term cost savings or at least avoidance.

H2O Facilities initiatives were the fifth highest scoring on this scale. The amount of water a university uses within its facilities is structured perfectly for resource and const reduction. Respondents likely utilized and recorded savings that resulted from retrofitted water delivery systems and rest room

²¹ Mary McIntosh, *State of the Campus Environment*. New Jersey: National Wildlife Federation, 2000.

fixtures that save thousands and many times millions of gallons of water usage. Alternatively, timed systems like thermal storage tanks allow for the efficient use of resources by filling and cooling of water in none peak usage times. The majority of the responses from the financial effectiveness scale were likely the biased in favor of university administrator rolled responders.

Conclusions

The University of Central Oklahoma has seen recent success in sustainability recognition and realization, but the overall state of sustainability across the United States is nowhere near where it should be. In response, universities across the nation are increasingly getting involved in sustainable practices and initiatives. These institutions are looking for best practices to follow. Therefore, the Multifactor Sustainability Assessment was developed by UCO and implemented in an attempt to gauge the success of sustainability initiatives currently utilized by some of the most well recognized sustainability leaders across the U.S. in higher education. Most specifically, the impacts of these initiatives were evaluated on their performance on scales of environmental impact, student engagement, and financial effectiveness.

Our initial research has shed light on what other institutions are doing and the perceived benefit they are associating with these initiatives. On the scale of environmental impact, the following initiatives were rated as the most effective: offering a Masters Degree in Environmental Sustainability, engaging in cogeneration activities, participating in green certification activities, utilizing H2O preservation activities on campus grounds, and utilizing efficient lighting initiatives. On the scale of student engagement, the following initiatives were rated the most effective: offering a Masters Degree in Environmental Sustainability, engaging in green service learning projects, engaging in green community service projects, offering a Bachelors Degree in Environmental Sustainability, and offering a Minor in Environmental Sustainability. On the scale of financial effectiveness, the following activities were rated as the most effective: engaging in cogeneration activities, utilizing efficient lighting initiatives, offering a Masters Degree in Environmental Sustainability, participating in green certification activities, and utilizing H2O preservation activities within campus facilities.

More research should be conducted with the focus of identifying successful sustainability initiatives that are currently being utilized by institutions of higher education. This research is small in size and is therefore limited in its ability to provide extensive detail to the adequacies of each initiative. More importantly, more research should be presented in not just a prescriptive manner but descriptive manner so that Universities can reference best practices implementation.

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Attachment 1. General Demographic Statistical Analysis of Institutes of Higher Learning in regards to Environmental Sustainability Initiatives

Size	1,001-4000	4,001-10,000	10,001-30,000	30,000+	Total
#	8	9	19	9	45
%	18%	20%	42%	20%	100%

Full Time Sustainability Coordinator			Designated Sustainability Website		
Yes	19	42%	Yes	35	78%
No	26	58%	No	10	22%
Total	45	100%	Total	45	100%

Designated Sustainability Goals			Private vs. Public		
Yes	35	78%	Private	15	33%
No	10	22%	Public	30	67%
Total	45	100%	Total	45	100%

Duration of Sustainability Practices			Highest Degree Offered		
0-2years	10	22%	Associates	2	4%
3-5years	9	20%	Bachelors	5	11%
6-8years	5	11%	Masters	11	24%
8-10years	4	9%	Doctorate	27	60%
10+years	17	38%	Total	45	100%
Total	45	100%			

Attachment 2. *Descriptive Analysis of the respective scores of the Five General Initiatives across the three Evaluation Scale.*

<u>General Initiative</u>	<u>EI</u> <i>M</i>	<u>SE</u> <i>M</i>	<u>FE</u> <i>M</i>	<u>Score</u>	<u>Grade</u>
Transportation General Initiative (TGI)	5.83	5.89	5.14	16.86	D
Curriculum, Student Activities, and Environmental Literacy General Initiative (CSEGI)	7.13	8.20	6.27	21.60	A
Physical Operations/Facilities Management General Initiative (POFMGI)	7.63	4.76	6.83	19.22	C
Alternative Fuels and Energy Source General Initiative (AFSGI)	7.51	7.13	6.30	20.94	B
Consumer Actions General Initiative (CAGI)	7.44	5.07	4.48	16.99	D

* EI= Environmental Impact; SE= Student Engagement; FE= Financial Effectiveness

Attachment 3. Descriptive Analysis of the top five General Initiatives scored across each Evaluation Scale.

<u>Rank</u>	<u>Environmental Impact Initiative</u>	<u>EI</u>	<u>Rank</u>	<u>Student Engagement Initiative</u> <u>Cont'd</u>	<u>SE</u>
		<i>M</i>			<i>M</i>
1	Physical Operations/Facilities Management	7.63		Consumer Actions General Initiative (CAGI)	5.07
2	Alternative Fuels and Energy Source	7.51	4	Physical Operations/Facilities Management	4.76
	General Initiative (POFMGI)		5	General Initiative (POFMGI)	
3	Consumer Actions General Initiative (CAGI)	7.44		<u>Financial Effectiveness</u>	<u>FE</u>
4	Curriculum, Student Activities, and Environmental Literacy General Initiative (CSEGI)	7.13	1	Physical Operations/Facilities Management	6.83
				General Initiative (POFMGI)	
5	Transportation General Initiative (TGI)	5.83	2	Alternative Fuels and Energy Source	6.30
				General Initiative (AFSGI)	
	<u>Student Engagement Initiative</u>	<u>SE</u>	3	Curriculum, Student Activities, and Environmental Literacy General Initiative (CSEGI)	6.27
1	Curriculum, Student Activities, and Environmental Literacy General Initiative (CSEGI)	8.20		Transportation General Initiative (TGI)	5.14
2	Alternative Fuels and Energy Source	7.13	4		
	General Initiative (AFSGI)		5	Consumer Actions General Initiative (CAGI)	4.48
3	Transportation General Initiative (TGI)	5.89			

* EI= Environmental Impact; SE= Student Engagement; FE= Financial Effectiveness