Spring 5-10-2024

ISO 14001:2015 ENVIRONMENTAL MANAGEMENT SYSTEM ACCREDITATION FRAMEWORK FOR STEPHEN F. AUSTIN STATE UNIVERSITY, A MEMBER OF THE UNIVERSITY OF TEXAS SYSTEM

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By

Breanna G. Duran, Bachelor of Science in Environmental Science

Presented to the Faculty of the Graduate School of
Stephen F. Austin State University
In Partial Fulfillment
of the Requirements

For the Degree of
Master of Science

STEPHEN F. AUSTIN STATE UNIVERSITY
May 2024

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ABSTRACT

The International Organization of Standardization is a worldwide federation of membered bodies. The mission of ISO is to achieve the balance between the environment, society, and the economy. These are essential to meet the needs of the present without compromising the ability of future generations to meet their needs. The ISO 14001:2015 Environmental Management System accreditation allows any business or organization, no matter the type, size or product to showcase its commitment toward environmental stewardship. This accreditation requires the development and successful implementation of an Environmental Management System (EMS). The EMS is set out to continually improve a company's environmental performance. Since 2016, Stephen F. Austin State University, a member of the University of Texas System has had an EMS that is applied toward daily operations. This thesis compares the university's EMS to the requirements of ISO 14001:2015 accreditation framework to determine if this accreditation is feasible. This will be accomplished by conducting interviews, performing a Cost Benefit Analysis of electricity and gasoline usage, and reviewing and recommending revisions that can be made to the current EMS to better align with ISO 14001:2015.

ACKNOWLEDGEMENTS

Funding for this project comes from the Environmental Health, Safety, & Risk Management Department at Stephen F. Austin State University. I would like to thank my committee members for providing their guidance throughout this research. I would also like to thank each of my supervisors: Dr. Jeremy Higgins, Gregory Moore, Travis Vanscoder, and Erik Santes with the Environmental Health, Safety, & Risk Management department for allowing me to expand my knowledge in the EHS field.

This thesis is dedicated to my grandparents for the sacrifices each of them made for their families to prosper. I would also like to dedicate my work to my parents, Adolfo Duran Jr. and Miriam Hernandez Duran, as well as my brother, Adolfo Dominic Duran, for their constant love and support. I want to also thank my dogs, Atticus and Tiernan, for making my days brighter. I could not have done this without my family's support.

Above all, I thank God for making this opportunity possible and allowing me to accomplish what I have thus far.

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INTRODUCTION

The International Organization of Standardization (ISO) is a worldwide federation of membered bodies. ISO was created to ensure products and services are safe, reliable, and of good quality (ISO, 2023). Part of ISO's mission to achieve the balance between the environment, society, and the economy is essential to meet the needs of the present without compromising the ability of future generations to meet their needs (ISO, 2015). ISO 14001 is just one member of the family of ISO standards. ISO 14001:2015 Environmental Management Systems evaluates and improves organizational environmental performance, "by setting up measurable environmental targets and performing a regular review on their effectiveness" (Salim, et al., 2017). Since the creation of the ISO 14001, over 500,000 certifications have been issued in 180 countries around the world (ISO, 2015). The growth of the number of certified organizations worldwide has increased at an average rate of 10% this year, seems to confirm the popularity of ISO 14001 (Boiral et al., 2015; ISO, 2015).

The American continent falls behind ranking in ninth out of 20 for the number of publications related to ISO 14001:2015 (Neves et al, 2017). Although the American continent lacks in this aspect, the United States leads in the most ISO 14001:2015 certifications among all countries in the American continents (Neves, et al., 2017; ISO, 2015) with a total of 4,891 ISO 14001:2015 certificates as of 2022 (ISO Survey, 2022).

This demonstrates that although ISO 14001 certification is not as popular in the American continents compared to other countries, accreditation is still occurring.

Stephen F. Austin State University (SFA) has an Environmental Management System (EMS) which is a major component of ISO 14001: standard. The EMS aims in protecting the environment and promoting environmental stewardship among SFAs faculty, staff, students, and visitors (SFA EMS, 2023). The Environmental Health, Safety, and Risk Management (EHSRM) department at SFA holds responsibility for promulgating EHSRM policies and procedures, to ensure that the university complies with federal, state, and local guidelines through a variety of training and inspection programs (SFA EMS, 2023). The process of obtaining this accreditation and maintaining it would reaffirm SFAs commitment toward environmental stewardship.

This study will utilize the review and revision of SFAs EMS, interviews conducted, and the Economic Analysis performed on electricity and gasoline usage on campus to analyze SFAs current EMS to deem what improvements or modifications can be made to ensure the accreditation process runs smoothly, based on the option that SFA would like to obtain ISO 14001:2015 accreditation.

OBJECTIVES

The overall objective of this study was to provide an accreditation framework to SFA on becoming ISO 14001: 2015 Environmental Management System (ISO 14001:2015) certified based on SFAs EMS. This framework was used for the interviews conducted and economic analysis performed on two chosen environmental indicators, electricity and gasoline consumption. This provided SFA with the opportunity of becoming ISO 14001:2015 accredited based on a system that is already in place and practiced daily. Specifically, the study aimed to:

- Coordinate and conduct interviews with professionals in the ISO 14001:2015 field and companies currently ISO 14001:2015 certified;
- Perform an economic analysis on the following environmental performances: electricity and gasoline; and
- Review SFAs current EMS to deem what objectives were achieved thus far and recommend modifications to be made.

LITERATURE REVIEW

International Organization of Standardization (ISO)

Background

The International Organization of Standardization (ISO) is an independent, non-governmental international organization with a total of 25,297 international standards and 179 national standard members that represent ISO in their country (ISO, 2023). ISO publishes international standards that range from managing a process, making a product, or delivering a service. ISO standards are implemented by membered bodies on a voluntary basis. ISO member countries generate some 98% of the world gross national income (GNI) and represent around 97% of the world's population (ISO, 2015).

14000 Series

The 14000 series enables organizations to move beyond regulatory compliance and take a proactive approach toward environmental management (SafetyCulture, 2023). The standards within the 14000 series are developed by the ISO Technical Committee and other subcommittees. The TC is a committee within ISO that focuses on standards within the field of environmental management (ISO, 2024).

It is important to note that ISO 14000 does not impose specific performance targets, nor does it replace environmental regulations; rather, it proposes a framework for effective environmental management (Edwards, et al., 1999). The ISO developed the 14000 series of standards in 1996 (ASQ, n.d.). Organizations worldwide in both the public and private sectors, are beginning to embrace the ISO 14000 guidelines (Edwards, et al., 1999).

There are a total of nine standards that make up the ISO 14000 series. This study focuses on the first standard, ISO 14001:2015 – Environmental Management Systems - Requirements with Guidance for Use (Chavan and Naik, 2012). The aim of ISO 14001 is supplementing environmental protection and the prevention of pollution in accordance with socio-economic needs (Chavan and Naik, 2012).

ISO 14001:2015 – Environmental Management Systems

The ISO 14001:2015 standard sets out the requirements for an environmental management system (ISO, 2015). It is designed for any organization no matter the sector, providing assurance to management, employees, and customers that environmental impact is being measured and improved (ISO, 2024). ISO 14001:2015 is the only standard, that must be audited, within the ISO 14000 series, that grants environmental quality certification to organizations (Neves, et al., 2017). Per the ISO website, the benefits of becoming ISO 14001:2015 accredited are: enhanced environmental performance, regulatory compliance, cost savings, operational excellence, risk management, and stakeholder and customer trust (ISO, 2021). In addition, ISO 14001:2015 utilizes the plan-do-check-act (PDCA) model. The PDCA provides continuous improvement and fixes the increase in challenging (environmental) targets (Sartor, et al., 2019). This model is partially what allows ISO 14001:2015 to stand out against the remaining eight standards that make up the ISO 14000 family. It is stated that ISO 14001:2015 is the most sought-after environmental certification today (Sartor et. al., 2019).

Since the formation of the ISO 14000 series in 1996, ISO 14001 has been revised twice. The latest version, published in 2015, has the following revisions compared to its predecessor (ISO, 2015):

- Strategic Environmental Management: Understanding the organization's context has been incorporated to identify and leverage opportunities for the benefit of both the organization and the environment. Once environmental goals are identified as a priority, actions to mitigate adverse risk or exploit beneficial opportunities are integrated in the operational planning of the environmental management system.
- Leadership: Assigning specific responsibilities for those in leadership roles to promote environmental management within the organization.
- Protecting the Environment: Including prevention of pollution, sustainable resource use, climate change mitigation and adaptation, protection of biodiversity and ecosystems, etc.
- Environmental Performance: Emphasis with regard to continual improvement, from improving the management system to improving environmental performance.
- Lifecycle Perspective: Organizations need to extend their control and influence on the environmental impacts associated with product design and development to address each stage of the life cycle.

- Communication: Communicating consistent and reliable information and establishing mechanisms for persons working under the organization's control to make suggestions on improving the environmental management system, with equal emphasis on external and internal communications.
- Outsourced Processes: Organizations need to control or influence outsourced processes.
- Documentation: The organization will retain the flexibility to determine when ‘procedures’ are needed to ensure effective process control.
- These updates, along with a new format, are intended to facilitate reading analysis and new interpretation and provide integration with other management systems (Neves, et al., 2017).

To answer the threats and negative impacts the environment faces, organizations across the globe have begun the implementation of an EMS to work toward the ISO 14001:2015 certification. An EMS is a living document that showcases environmental stewardship by following the three main principles of the ISO 14001 family (Chavan and Naik, 2012):

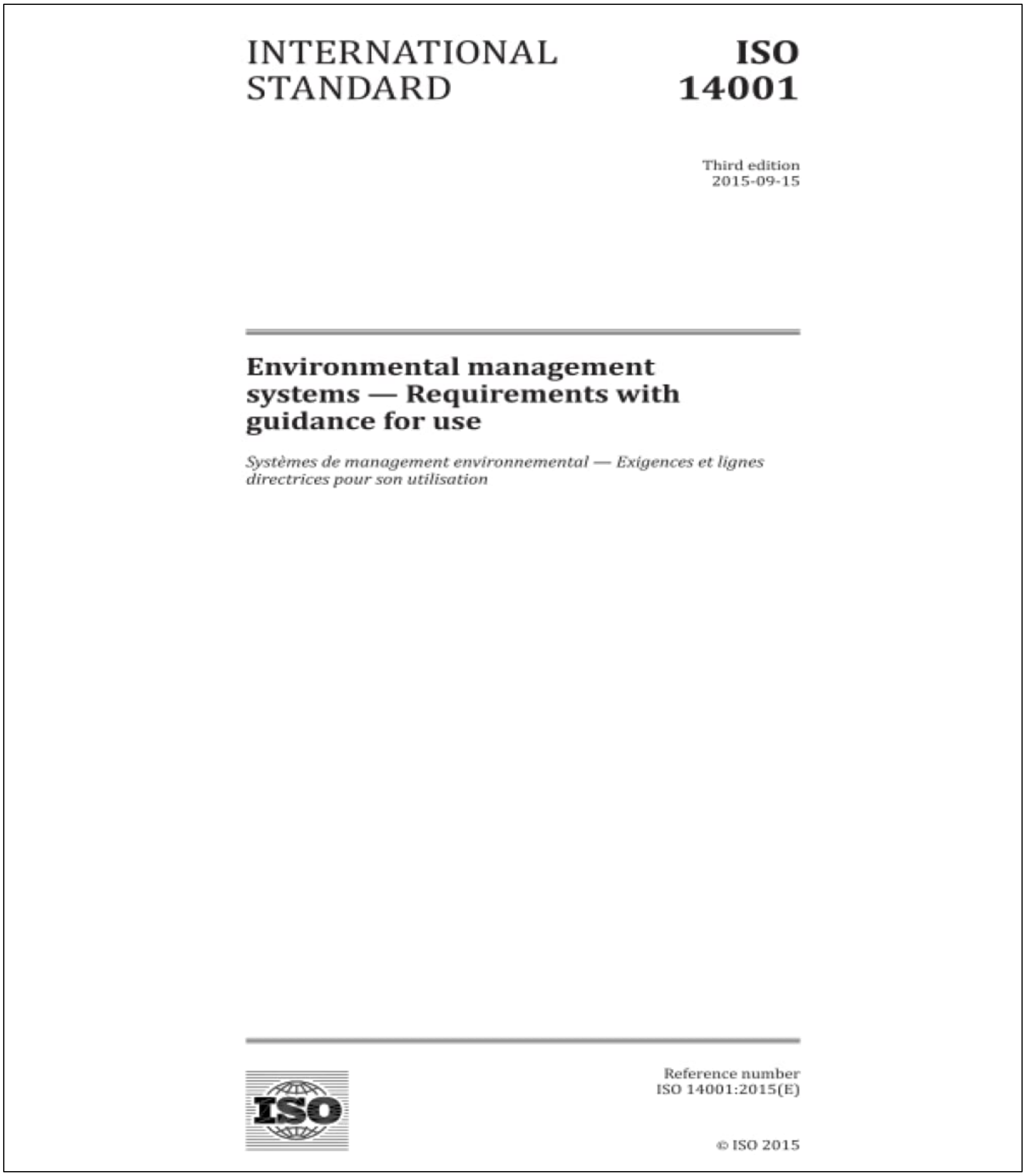
- Prevention of environmental pollution
- Compliance with environmental regulations
- Continuous improvement of environmental performance

The extent of the EMS solely depends on what is reasonably achievable and feasible for the organization itself. ISO 14001:2015 recommends tools and methods when implementing and maintaining an EMS based on the “Environmental management systems – Requirements with guidance for use” guideline text.

Environmental management systems – Requirements with guidance for use Standard Book

The contents of this booklet include a high-level structure for organizations aiming to implement an EMS that contributes to the environmental pillar of sustainability (ISO, 2023). The topics range from understanding the context of the organization and the scope of an environmental management system needed to addressing nonconformity and continual improvement. In addition to assessing conformity, it also discusses the documented information that must be maintained/retained to successfully manage an EMS.

This booklet is a total of 35 pages that is divided into nine chapters and two annexes, and the front is shown in figure 1. The chapters are expected to relay what is expected to be implemented and practiced at an organization to become and remain ISO 14001:2015 compliant. To become ISO 14001:2015 accredited, an organization must have a copy of ISO 14001:2015 whether in a hard copy, electronic copy, or other external source (ISO, 2023). A copy of the 2015 version is available upon request at the EHSRM office at SFA. The requirements in this booklet can be used in whole or in part and is only meant to be used to assess conformity. As stated, conformity to ISO 14001:2015 can differ from one organization to another due to the context of the organization (ISO, 2023).


INTERNATIONAL STANDARD

ISO 14001

Third edition
2015-09-15

Environmental management systems — Requirements with guidance for use

Systèmes de management environnemental — Exigences et lignes directrices pour son utilisation

Reference number
ISO 14001:2015(E)

© ISO 2015

Figure 1. ISO 14001:2015(E) Environmental management systems – Requirements with guidance for use Standard, Third edition (ISO, 2015).

ISO 14001:2015 at the University Level

This certification showcases an organization's commitment to developing and implementing an environmental policy. ISO 14001:2015 certification applies to any business or organization – regardless of type, size, or product (ISO, 2015). As of 2024, there has only been one university and one department within a university that have become ISO 14001:2015 accredited. The University of Missouri-Rolla became the first and only university in the United States to earn the "green seal" of approval from ISO (Missouri University of Science and Technology, 2001). Also, the Environmental Health and Safety department at the University of South Carolina became ISO 14001:2015 certified in 2002 with a complete revision following the new ISO 14001:2015 standard.

Although ISO 14001:2015 accreditation is uncommon in higher education, accreditation is growing prominence in the UK higher education (Simkin and Nolan, 2004). An EMS methodology is expected to spread to more universities in the coming years (Simkin and Nolan, 2004). Luckily, SFA already has an EMS that is applied to operations daily. Per Lee (2018), an EMS can benefit an organization, in this case a university, by improving environmental performances of goals set out in the EMS, provide a better understanding of environmental impacts of business activities, and improve public perception and participation of the organization. As discussed in the methodology section of this research, the interviews conducted with SFA personnel support the previous statement.

Environmental Management System (EMS)

An EMS is considered an organizational framework designed to meet regulatory standards in a systematic and cost-effective manner (EPA, 2023; SafetyCulture, 2023). An EMS seeks to show the importance of using national or international certifications for evidence-based management and good sustainable development of a university (Gomes,Caetano, et. al., 2022). Sustainable development is simply defined by The United Nations (n.d.) as, "A shared blueprint for peace and prosperity for people and the planet, now and into the future." Due to SFA voluntarily creating and implementing an EMS and participating in an Environmental Compliance Audit in 2011, the next step in the ISO 14001:2015 accreditation process would be to have SFAs EMS audited by a third party to provide the following regarding ISO 14001:2015:

- Identify areas of non-compliance;
- Recommend and take corrective actions; and
- Address areas of potential violation

Plan-Do-Check-Act (PDCA) Model

The underlying basis for an EMS is the PDCA model (figure 2). The PDCA model teaches organizations to plan an action, do it, check to see how it conforms to the plan, and act on what has been learned (Johnson, 2002). This model allows for continual improvement within an organization based on repetitive motions that are constantly analyzed to determine what can be modified to meet the requirements of the organization. The PDCA model can be successfully used in any type of business (Jagusiak-Kocik, 2017). Also, the PDCA is intended to ensure the organization's environmental objectives are being met and improved where required.

The breakdown of the PDCA model is (Jagusiak-Kocik, 2017; Johnson, 2002):

- Plan - is associated with identifying and analyzing the problem(s). This allows an action plan to be formed to address the problem(s) in the next step;
- Do - Develop a plan that addresses the problem(s) and implement them at the organization. It is vital to have the support and understanding from all levels of employees that will be affected by the plan formed;
- Check - Check whether the solutions developed address the problem(s) identified. This step will answer whether the goal was achieved. This step is often viewed as the most critical step in the model as it requires an organization to re-evaluate the plan. If the implementation of solutions proved to not be appropriate, one shall return to step 1, plan. If the implementation proved beneficial, the next and final step of the model is; and
- Act - Once the plan implemented proved to address the problem(s), they are considered the norm and lead to standardization and monitoring of activities at the organization. Also, what is found that does not work during the Check step should be acted upon and improved and the cycle repeats.

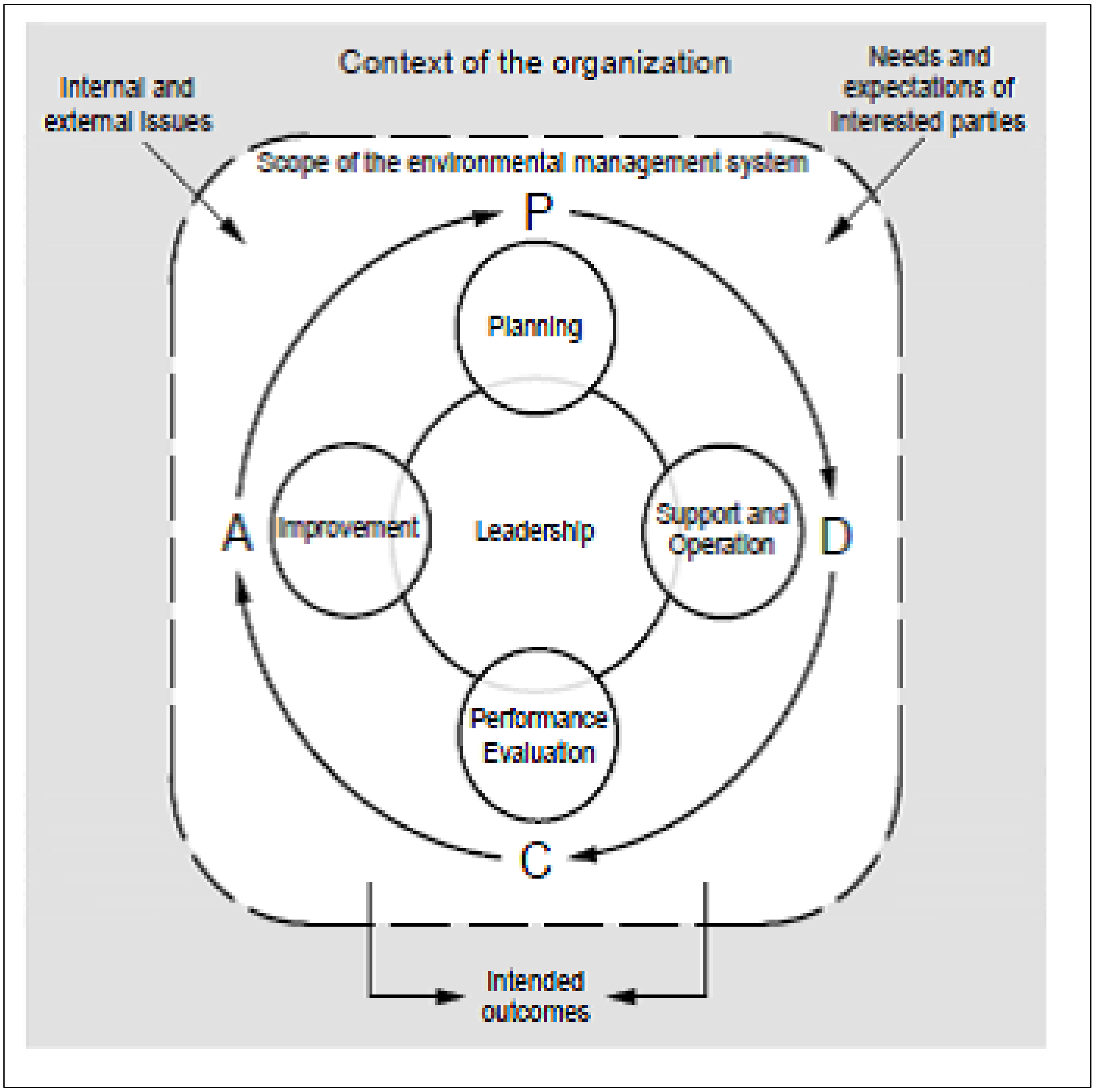


Figure 2. Plan-Do-Check-Act model (ISO, 2023).

The application of the PDCA cycle to SFA's EMS would allow for accountability across all personnel involved. It would allow for continual improvement in how all individuals address environmental management, whether in the laboratories or outdoors. The PDCA is a never-ending cycle, improvement is not seen as the end and does not bring satisfaction based on current operations (Jagusiak-Kocik, 2017). The PDCA model offers the ability of an operation to continually evaluate and change operations where improvements can be made. If SFA decides to become ISO 14001:2015 accredited, the PDCA model would need to be adopted into SFA operations. The PDCA would assist in ensuring SFA's EMS objectives are continually evaluated and improved where needed.

Stephen F. Austin State University's Environmental Management System

The Environmental Management System (EMS) at SFA was designed to provide a framework for environmental management and the implementation of environmental policies and procedures at SFA (SFA EMS, 2023). The EMS is supported by the Environmental Management policy number 05-507 (appendix b) in SFA's Handbook of Operating Procedures. SFA's EMS is geared toward the protection of the environment while also looking for ways to minimize the environmental impact of campus activities. In 2011, SFA was one of the 53 institutions that took part in the Environmental Protection Agency (EPA) Region 6 and Texas Commission on Environmental Quality (TCEQ) Environmental Compliance Audit Program. The purpose of the program was to identify areas of non-compliance related to environmental regulations, take corrective actions to address potential violations, and disclose such findings and corrective actions to the EPA and TCEQ (SFA EMS, 2023). The audit was conducted by HRP Associates Inc., and 273 potential violations and areas of non-compliance were identified. Corrective actions were immediately implemented, and areas of non-compliance were corrected (SFA EMS, 2023). The audit is available for review at the EHSRM department. The EMS was fully implemented in March of 2016 and the most up-to-date version is January of 2023. The EMS applies to all facilities and departments under SFA jurisdiction, and the Environmental Safety Officer is responsible for implementing the EMS. The Environmental Safety Officer identifies the relevant regulatory program area(s), requirements to maintain compliance, best management practices, and communicates this information to appropriate personnel (SFA EMS, 2023). Figure 3, a schematic chart, represents the chain of command when it comes to the management and oversight of the EMS. Per ISO, the main factor of a successful EMS is the commitment from all levels and functions of the organization, led by top management (ISO, 2015). The commitment of the ISO 14001:2015 accreditation is expected from the Environmental Safety Officer and Director of EHSRM due to these two individuals overseeing the EMS implementation at SFA. I conducted interviews with these two individuals to discuss their commitment level of ISO 14001:2015 accreditation if SFA were to one day pursue accreditation. Also, the dedication from all personnel to practice environmental stewardship, attend trainings, and practice safety is vital in a successful EMS at SFA. The EMS also dives into emergency preparedness and response as well as environmental planning, pollution prevention, and sustainability.

Due to the importance of all employees being committed to addressing and implementing the EMS, the EMS organization chart was created to illustrate the hierarchy of the EMS at SFA which can be seen in figure 3. The importance of establishing this hierarchy of organization and oversight is because for SFA to become ISO 14001:2015 accredited, a successful EMS is necessary. A successful EMS is dependent on securing institutional commitment (Simkins and Nolan, 2004).

Dependent on the review of SFA's current EMS and interviews conducted with SFA personnel the researcher will determine what modifications, if any, would need to be made to align the current version of SFAs EMS to the ISO 14001:2015 standard. The EMS can be viewed on the SFA EHSRM website https://www.sfasu.edu/docs/safety/environmental-management-system.pdf and appendix a of this paper.

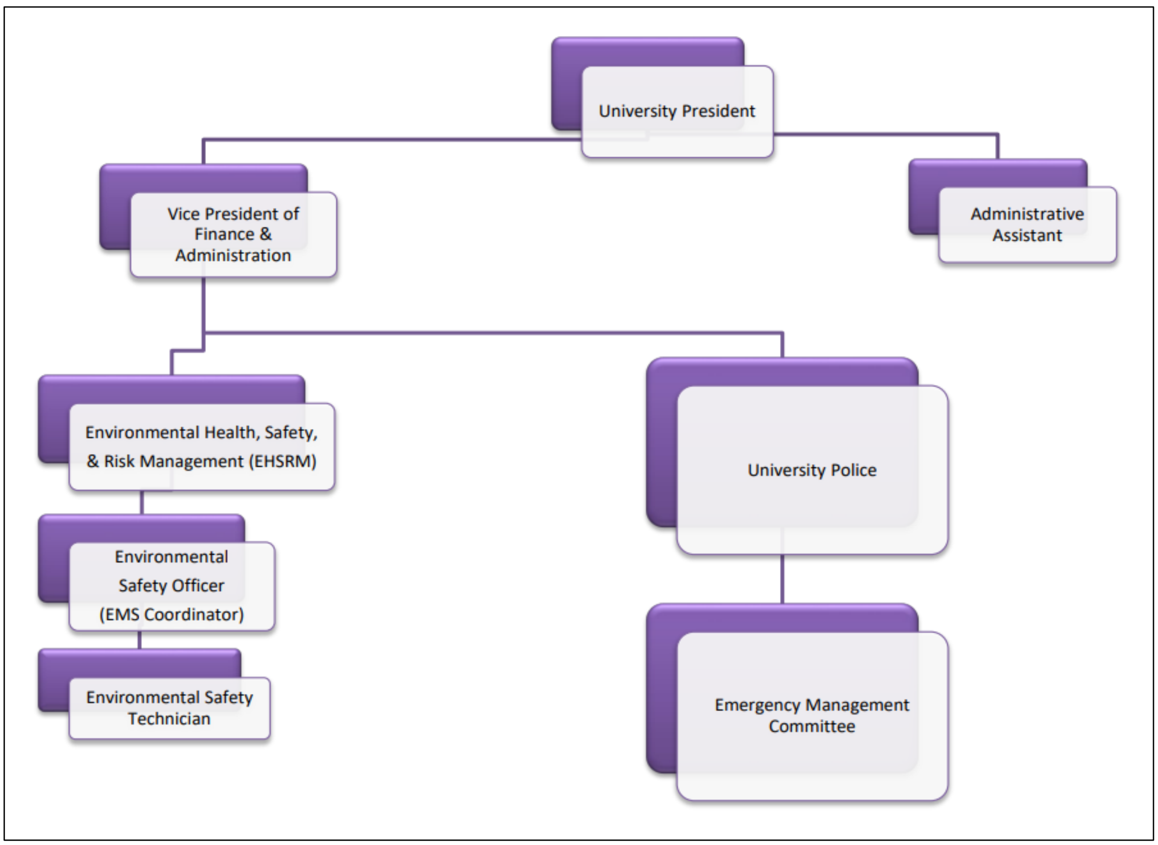


Figure 3. EMS Organization and Oversight at SFA (Environmental Management System for SFA, 2023).

Training

The EHSRM department coordinates with departmental supervisors to ensure that all SFA personnel receive required environmental and safety training in accordance with applicable regulatory requirements as appropriate for their position (SFA EMS, 2023). There are a total of 19 training programs offered across at least five departments. The frequency and delivery method for the trainings vary based on the training program and regulatory requirement. The departmental supervisor is responsible for consulting with EHSRM to determine which environmental training their employees are required to take (SFA EMS, 2023). All environmental training records are kept at the EHSRM department.

A goal for the university is to facilitate employee and student awareness of environmental issues through education and training for further protection of the surrounding environment (SFA EMS, 2023). This is accomplished by the environmental training program in the EMS. Training serves the purpose of teaching people the company policies and everyday procedures (Sammalisto, 2007). The EHSRM department follows an environmental compliance calendar that outlines dates requirements are to be met and trainings are one of these requirements.

Communication

Communication serves the purpose of changing the attitudes of individuals and creating increased awareness about environmental issues (Sammalisto, 2007). Communication is a simple and cost-effective tool SFA can utilize to make aware the goals and objectives of the EMS at SFA and the role each department will play. The Environmental Safety Officer is responsible for communicating the EMS to appropriate upper management, department Director, Chair, Dean, Supervisor, and/or University Leadership (SFA EMS, 2023). The EHSRM department also communicates through the EHSRM website.

Commitment

Commitment from all levels of an organization, especially top management, is vital to a successful EMS. The interviews conducted with SFA personnel will emphasize the commitment from top management when it comes to the EMS at SFA and potential ISO 14001:2015 accreditation. It is the goal of the interviews to re-affirm commitments that have been put in place since the creation of SFAs EMS.

Economic Analysis

Economic Analysis looks at the measurement of the benefit of a new or improved system relative to the existing system (UNT, 2024). This paper looks at the upgrade to electricity and gasoline consumption at SFA. An economic analysis is at the center of each EMS due to the evaluation of costs and benefits that aid in allocation of resources (Edomah, 2018). An economic analysis may aid in deciding which projects can be funded to aid, if necessary, in the objectives set forth by the objectives in a company’s EMS.

The objective of performing an economic analysis for this thesis is to compare the costs with potential savings associated with upgrading to LED lighting and newer modeled fleets. It is said that the adoption of ISO 14001:2015 has been found to have a positive impact on waste reduction and waste management (Boiral et. al., 2017). A limitation that can be faced when performing an economic analysis is that while some potential savings can be converted to monetary value, other benefits cannot easily be converted to monetary value (UNT, 2024). This is due to not being able to account for all variables that may impact the outcome, such as costs and involvement. It is imperative that other aspects, including the two chosen for this thesis, such as water and sewage consumption be assessed in future research.

Environmental Indicators

Boiral et al., (2017) state that the positive impact that the environmental indicators energy and resource consumption equaled 92% of the papers reviewed. The goal of the economic analysis was to look at potential upgrades for electricity and gasoline consumption that may lead to a reduction in cost as well as more environmentally focused improvements. Per the implementation of the Energy and Water Management Plan, SFA has reduced the total annual utility spending by 51% since the beginning year of FY2008 (SFA Energy and Water Management Plan, 2022).

1. Energy

Electrical consumption peaked in FY2008 and FY2010 requiring SFA to find new ways to reduce consumption. The reliance and combustion of nonrenewable energy sources has raised concern for the environment and human health. SFA established an Energy Conservation Committee with a goal of reducing energy consumption by 30% over a 10-year period, beginning in FY2008 (SFA Energy and Water Management Plan, 2022). Through the phases outlined in the Energy and Water Management plan (see appendix c), the goals for reducing energy consumption were met. As a result, a third phase was commissioned to identify additional facility improvement measures to reduce the consumption and/or costs at

SFA (SFA Energy and Water Management Plan, 2022). One focus of energy efficiency at a university is switching from mercury-containing light fixtures to light emitting diode (LED) fixtures that do not contain mercury. For example, in FY22, SFA underwent a full relighting project of the McGee Business building. A total of 836 fluorescent light fixtures were replaced with LED fixtures and will reduce energy consumption from lighting in that building by approximately 40% (SFA Energy and Water Management Plan, 2022). What also makes LED bulbs the best option in today's world is the amount of wattage LED bulbs possess is lower than fluorescent bulbs. This infers that LED bulbs require a less amount of power needed to operate as compared to fluorescent bulbs.

SFA will continue to upgrade the lighting across campus to LED lighting, as funding becomes available. I will utilize the economic analysis to see if the electrical upgrade would provide sufficient benefits compared to costs due to the efficiency, design, and performance of LED bulbs.

2. Gasoline

Gasoline consumption is inevitable, especially at the university level. Gasoline usage at SFA is due to the operation of motor vehicles. Gasoline consumption across campus is high and the consumption fluctuates by month and department which can be shown in figure 6. The top three departments of gasoline consumption in FY2022 were the Athletics Department, Arthur Temple College of Forestry and Agriculture, and the Physical Plant Department (PPD). The Energy and Water Management plan listed gasoline reduction opportunities for SFA and one of those was the continual update on fleet. An economic analysis will be performed for the cost and benefits of upgrading to more fuel-efficient motor vehicles.

Sustainability

Student Involvement

Universities are inherently different when compared to most private industry companies that typically obtain the ISO 14001:2015 certification. Universities serve multiple missions including education, research, and public services and therefore have the responsibility of educating students (Alshuwaikhat and Abubakar, 2008). The responsibility of educating students on environmental management can be achieved by infusing sustainability into undergraduate and graduate courses (Alshuwaikhat and Abubakar, 2008). The integration of sustainable courses would allow for more environmental consideration across all degree fields studied at SFA. At The University of Glamorgan, students receive environmental awareness training that introduces them to the Environmental Policy Statement and relevant parts (Price, 2005). Per the EMS at SFA, some students are required to take certain environmental training courses, depending on their job tasks. To involve the entire student community, the researcher will ask the interviewees discussed below if requiring students to participate in an environmental awareness orientation before they begin their education career at SFA or annual trainings would be feasible.

There are various ways to involve students in sustainability, which is a backbone for the environmental management system. As universities shape the future professionals, it is essential that student involvement is considered when creating, implementing, and managing an EMS.

Environmental Services Committee

As mentioned above, SFA formed the Environmental Services Committee to call for, review, prioritize and recommend approval for funding awards to SFA campus environmental improvement projects utilizing an Environmental Services Fee (ESF) (SFA PPD, 2023). Services that are funded by the ESF range from recycling, energy efficiency, transportation, or provide matching funds toward environmental projects. Depending on the findings of the economic analysis, the recommendation of upgrades to electrical and/or gasoline consumption being funded by the ESF can be recommended.

Energy and Water Management Plan

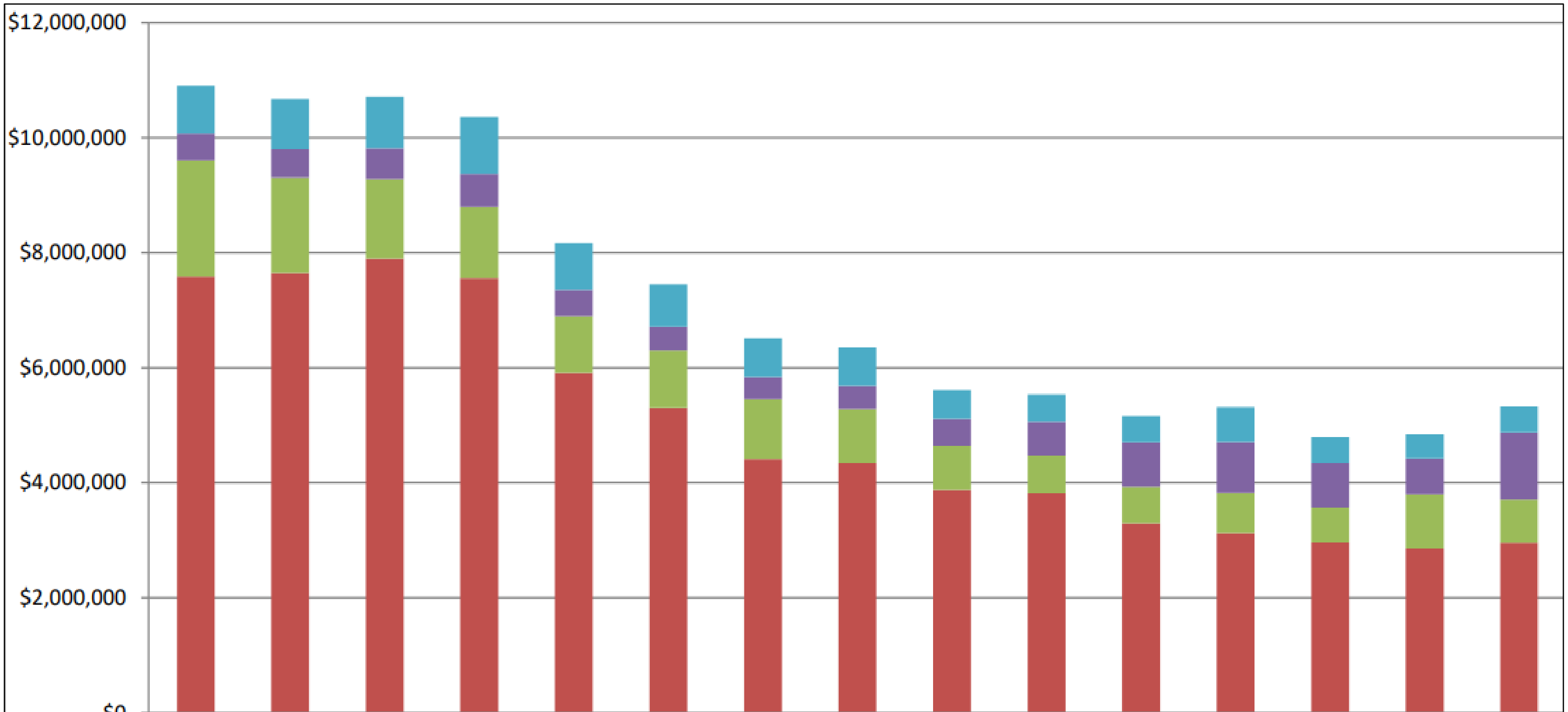
In 2008, SFA began the journey of environmental stewardship, hence the creation of the Energy and Water Management Plan managed by the Physical Plant Department (PPD) at SFA. The Energy and Water Management Plan at SFA was created to reduce the utility consumption and cost at the university through an energy service contractor. The plan will be useful for this research due to the plan addressing Electricity and Gasoline usage which are the two chosen indicators for this research. The goal of the plan was to reduce energy consumption by 30% over a 10-year period beginning in FY2008 (SFA Energy and Water Management Plan, 2022). Siemens Building Technologies Inc. was selected as the contractor to assist SFA in meeting its goal.

The plan began with two phases to address energy consumption. These phases focused on completing necessary conservation measures. SFA reduced the annual utility spending from $10.9 million(M) in fiscal year (FY) 2008 to $6.56M in FY2014 (SFA Energy and Water Management Plan, 2022). Due to the successful implementation of phase one and two, a third phase was commissioned to analyze additional facility improvements for all campus utilities.

Phase three focused on HVAC/Automation upgrades, lighting projects, water sub-metering, etc. This project began in 2015 and was completed in 2016. A fourth phase was prepared and additional building upgrades and irrigation system upgrades for the next round of facility improvements. Phase four has been tabled for future discussions.

Figure 5 depicts the utility costs for four utilities used across SFA campus (sewer, water, gas, and electricity) and the fluctuated cost associated with each utility from FY2008 to FY2022. It is evident that since the implementation of the Energy and Water Management Plan, the costs for the electricity utility consumption had decreased from FY2008 to FY2022. It can be viewed that electricity usage has remained relatively the highest utility cost from FY2008 to FY2022.

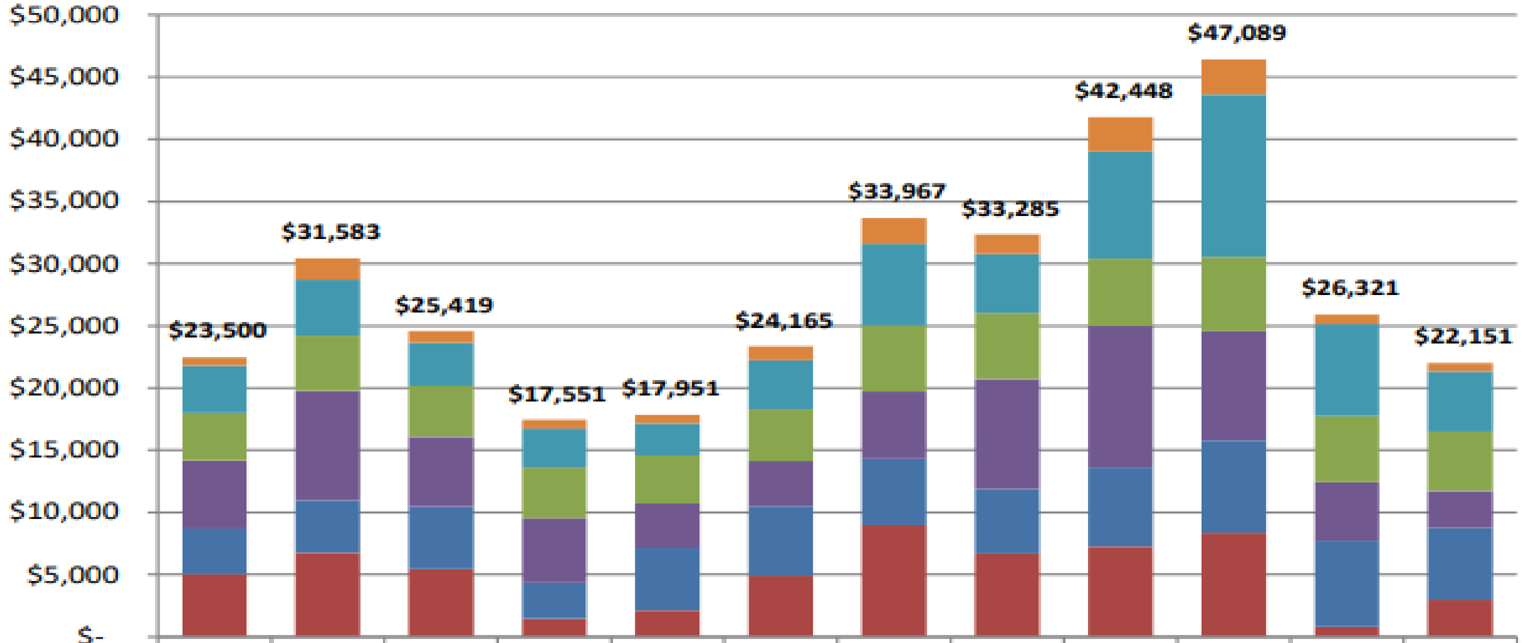
Note: The most up-to-date information is provided in the 2022 version of the Energy and Water Management Plan. The plan can be viewed in appendix c.



	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022
Totals	$10,901,432	$10,672,172	$10,712,074	$10,362,482	$8,172,276	$7,449,719	$6,513,872	$6,354,458	$5,612,966	$5,536,660	$5,158,676	$5,312,531	$4,795,332	$4,624,879	$5,326,716
Sewer	$826,531	$870,556	$896,648	$995,334	$821,619	$737,392	$674,209	$667,997	$506,552	$475,116	$458,607	$605,154	$453,114	$424,203	$451,712
Water	$470,776	$494,881	$534,578	$566,795	$455,621	$411,942	$384,164	$404,487	$459,465	$589,909	$768,042	$884,416	$777,064	$630,452	$1,166,945
Gas*	$2,020,319	$1,660,012	$1,382,633	$1,244,712	$981,181	$996,840	$1,040,235	$937,826	$772,618	$654,560	$635,023	$702,175	$605,065	$932,564	$751,730
Electricity	$7,583,805	$7,646,722	$7,898,215	$7,555,641	$5,913,855	$5,303,544	$4,415,264	$4,344,148	$3,874,331	$3,817,075	$3,297,004	$3,120,785	$2,960,089	$2,861,314	$2,956,329

**Figures exclude LP gas consumed at the Agriculture Center*

Figure 4. Utility Costs – Fiscal Year 2008 to Present for SFA (Energy & Water Management Plan for SFA, 2022).



	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22
Totals	$23,500	$31,583	$25,419	$17,551	$17,951	$24,165	$33,967	$33,285	$42,448	$47,089	$26,321	$22,151
Other	$671	$1,755	$936	$682	$703	$1,113	$2,036	$1,551	$2,796	$2,844	$786	$667
Forestry & Agriculture	$3,788	$4,480	$3,464	$3,118	$2,577	$3,907	$6,626	$4,742	$8,561	$13,025	$7,379	$4,888
University Police	$3,842	$4,452	$4,112	$4,065	$3,876	$4,197	$5,306	$5,336	$5,438	$6,016	$5,316	$4,740
Athletics	$5,492	$8,807	$5,603	$5,219	$3,563	$3,588	$5,384	$8,846	$11,347	$8,752	$4,694	$2,951
Physical Plant	$3,612	$4,175	$5,006	$2,902	$5,015	$5,567	$5,317	$5,174	$6,387	$7,420	$6,911	$5,832
Transportation	$5,076	$6,782	$5,459	$1,452	$2,126	$4,956	$9,002	$6,687	$7,249	$8,370	$826	$2,935

Figure 5. Fiscal Year 2022 Monthly Spend on Gasoline & Diesel Fuel for SFA (Energy & Water Management Plan for SFA, 2022).

ISO 14001:2015 Accreditation

To become ISO 14001:2015 accredited, SFA would need an accreditation body that is recognized by The International Accreditation Forum (IAF) to accredit SFA as ISO 14001:2015. IAF is the global association of accreditation bodies, certification body associations, and other organizations involved in conformity assessment activities (IAF, 2023). There are a total of 97 accreditation bodies that assess against internationally agreed standards (IAF, 2023). In this case, a chosen accreditation body would assess SFA's EMS to ensure it demonstrates competence and performance capability against the ISO 14001:2015 standard. The IAF distributed an online survey across the globe in 2012 to users to determine the driving factor in obtaining certifications and the certification provider used. It was found that out of the 4,191 respondents, less than 200 were in the education sector with only 3% of the respondents being from the U.S... The survey deemed that of the 4,191 respondents, the second highest ISO certification achieved was EMS at 18%. The driving factors of seeking certification varied greatly, but the top three factors were: internal business improvement (47%), customer requirement (32%), and regulatory compliance (13%). Of the responses, 91% stated that they selected an accredited certification body to obtain certification and stated, "it complies with best practices and is competent to deliver a consistently reliable and impartial service" (IAF, 2012). This survey was able to confirm that businesses are experiencing significant benefits and added value on the revenue side. The businesses that participated in the survey also support the use of an accreditation body to certify a business

ISO 14001:2015 compliant. While many respondents deemed that the certification led to a minor increase or no change in sales, obtaining certification that aided in meeting regulatory requirements was important to the customer.

The time frame of accreditation as well as cost is dependent on the size of and environmental management goals of the organization. I expect that since SFA already has an EMS, that is applied on a daily basis, the time frame of accreditation may be shorter than those starting from the ground up.

ISO is not responsible for certifying organizations, instead, external certification bodies issue certifications. To become a certification body, a company must be a member of the American National Standards Institute (ANSI) American National Accreditation Board (ANAB). ANAB accredits companies that provide third party certifications and registration to organizations domiciled in the United States (US) seeking registration of their environmental management systems (Younce, 2007). Figure 7 shows the database used to identify an ANAB certification body. The research filtered the results to identify a certification body in the United States that is authorized to certify an organization as ISO 14001:2015 accredited. Based on the criteria filtered, a total of 25 certification bodies were identified that would be able to certify SFA the "green seal". Essentially, one of the 25 certification bodies listed on the ANSI ANAB database (figure 7) would perform what is called the certification audit. The certification audit is mean to verify an organization's compliance with, in this case, ISO 14001:2015 and give the certification.

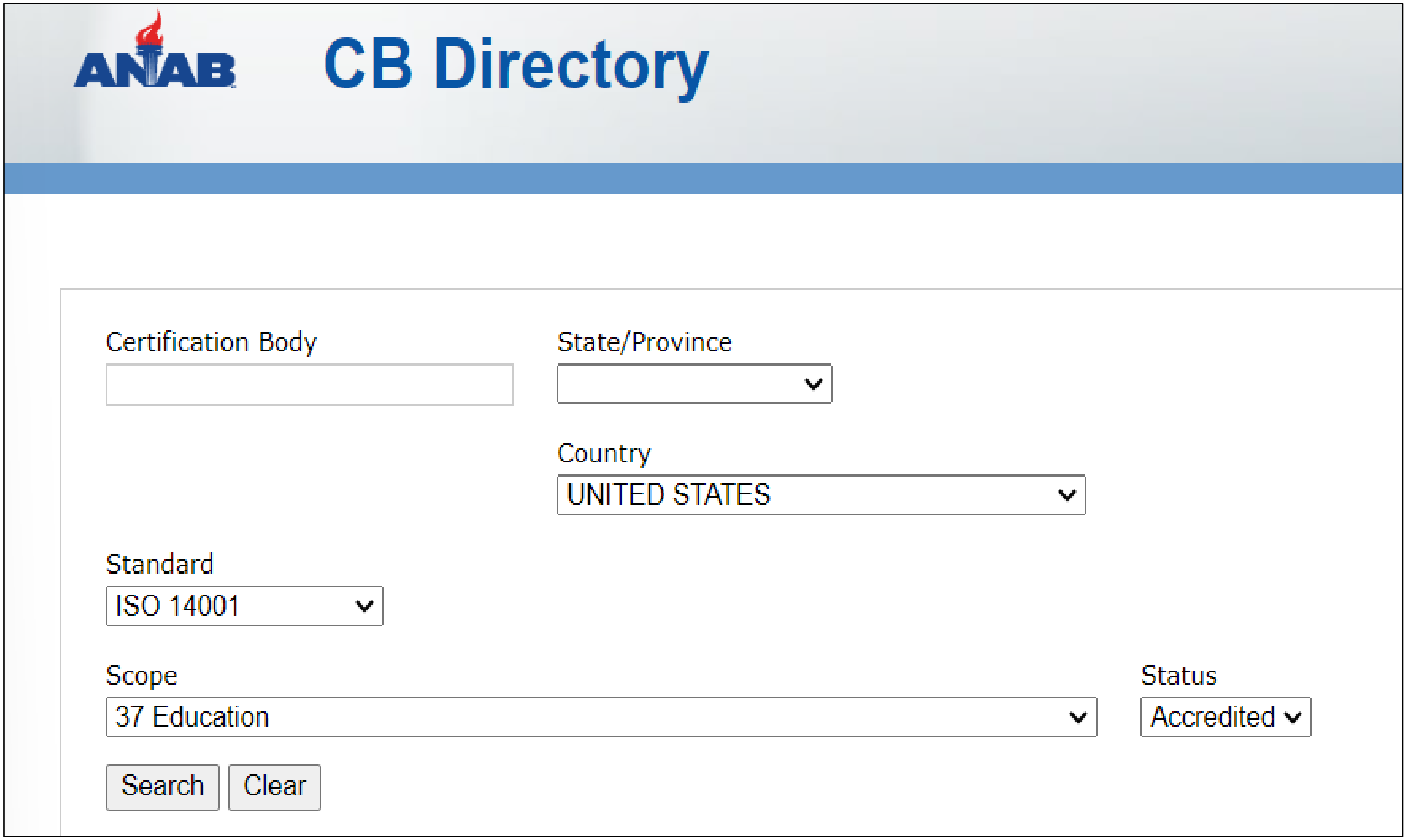


Figure 6. ANSI National Accreditation Board Certification Body Directory (ANSI National Accreditation Board Online, 2023).

Audit

A campus audit provides legitimacy to environmental studies programs. Of course, any green practices adopted in response to an audit can benefit the environment directly. In addition, environmental audits provide ancillary benefits to environmental education programs (Fisher, 2003). It is possible for an organization to become self-certified but becoming self-certified; however, becoming self-certified carries only limited credibility (Neumayer, 2004). Self-certification is not an option for SFA since SFA is not an accreditation nor certification body.

To obtain ISO 14001:2015 accreditation, SFA will need to participate in an initial audit by an external auditor conducted by a certification body. The reason for the initial audit is to identify nonconformity of the organization's EMS against the ISO 14001:2015 standard and provide corrective actions to conform to the standard. The frequency of audits varies based on the certification outline for the given organization. An EMS that is certified with regular internal and third-party audits provides a system with continuous feedback and follow-up (Sammalisto, 2007). The minimum number of audits required to remain ISO 14001:2015 compliant is expected to depend on the organization's EMS and what environmental targets have been set. Based on the targets set, the certification body with set up surveillance audits to be performed on an annual basis and a recertification audit performed every three years.

Cost

There are internal and external costs associated with the ISO 14001:2015 certification. Internally, organizing and incorporating EMS resources across the university would require employer and employee time. Externally, the cost of a third-party registrar to review and analyze the current EMS can be costly. As explained by Boiral et. al., "implementation and certification costs are often considered to be the main obstacle, due to the lack of resources in many organizations" (2017). The researcher is hopeful that the interviews conducted with third-party registers and organizations currently ISO 14001:2015 certified will provide a rough estimate of what the process will cost SFA to become ISO 14001:2015 accredited. Performing the economic analysis on the environmental indicators and overall EMS process will determine if the costs of incorporating certain environmental management objectives and proposed upgrades to the two chosen indicators will be too costly compared to the benefits. An obstacle SFA is expected to face if becoming ISO 14001:2015 is the cost associated with ISO 14001:2015 accreditation.

Benefits

Although the certification is voluntary, it demonstrates credibility and reinforces an organization's commitment to its environmental responsibilities (SafetyCulture, 2023). There is skepticism about obtaining a certification that requires constant upkeep. It is important to understand that there are also benefits with becoming ISO 14001:2015 accredited.

The benefits that are considered are environmental performance, efficiency, and profitability (Ernesto Di Noia and Nicoletti, 2016). There are many other benefits that companies should consider when becoming certified such as worker performance, increase in engagement, reputation, etc. (NQA, 2018). Although, many organizations that do become certified do so for regulatory compliance, benefits have been noticed. The most frequent social benefit of the standard is, by far, its impact on image, stakeholder relationships, and reputational benefits (Boiral et. al., 2017).

METHODOLOGY

The methodology of this research was divided into three sections. The first section included conducting interviews with three SFA personnel and a current organization ISO 14001:2015 certified. The second part conducted a economic analysis of more environmentally friendly and efficient alternatives for electrical and gasoline usage on campus. The third section of the methodology was to review SFAs current EMS against the ISO “Environmental Management Systems -Requirements with guidance for use” standard and recommend revisions to better align the EMS with the ISO 14001:2015 standard.

Interviews

This study conducted interviews with SFA personnel and a corporation that is currently ISO 14001:2015 certified. No interviews were conducted with external auditors. The purpose of performing these interviews was to allow the researcher to understand the real-world processes that need to be considered regarding accreditation as well as the expectation of applying for ISO 14001:2015 accreditation.

The researcher discloses that although an interview was anticipated to be conducted with Ms. Judy Kruwell, Interim Vice President of Finance and Administration as the individual in this position is second in command of top management (figure 3). Unfortunately, due to scheduling conflicts, an interview was not able to be held with Ms. Kruwell.

Ms. Kruwell was gracious enough to set up an interview for me with Mr. John Branch, Interim Associate Vice President of Finance and Administration (AVPFA). Please note, the AVPFA position is a temporary position and will expire once a President for the university is selected and sworn in.

SFA Personnel

Three interviews were conducted with the following personnel from SFA. Each interview with SFA personnel was conducted face-to-face and the questions asked can be seen in appendix d.

1. John Branch, Interim Associate Vice President of Finance and Administration and Director of Physical Plant Department

The AVPFA oversees eight departments that have the following values, "stability, energy, operational capacity and maintenance to support and promote the academic mission of Stephen F. Austin State University" (SFA Finance and Administration, 2023). The AVPFA is a liaison between the eight departments and the Vice President of Finance and Administration. As stated in Edwards, et al., Fisher, Kiatkulthorn and Sundstedt, and et. al., to have a smooth and operational ISO 14001:2015 accreditation system the full support of top management is required. Hence the purpose of conducting an interview with Mr. Branch.

The researcher would also like to point out that in addition to giving me the perspective of top management, Mr. Branch's interview provided insight from his position as director of PPD. If SFA were to become ISO 14001:2015 accredited, PPD would be vital in the day-to-day implementation of ISO 14001:2015. It was beneficial to be able to get his perspective as Director of PPD as well as AVPFA. Although Mr. Branch does not know ISO 14001:2015, extensively, he believes that environmental stewardship is important for a university and mentioned the Energy and Water Management Plan (see appendix c) as a step towards improving certain environmental aspects at SFA.

The interview conducted with the AVPFA allowed me to see that SFA has shown and practiced environmental stewardship in the past, but there is room for improvement and top management would like to hear it. The researcher disclosed that SFA would need to go through audits, initial costs, as well as upkeep costs for the accreditation and Mr. Branch was open to audits if the criticism was constructive, and the comments are beneficial for the university. A hesitation with becoming accredited would be the costs. The benefits Mr. Branch believes SFA would see are cost-savings, inclusivity, and true impact on initiatives across the campus.

2. Dr. Jeremy Higgins, Director of Environmental Health, Safety, and Risk Management Department

As the Director of the EHSRM department at SFA for the past 20 years, Dr. Higgins oversees the implementation of the EMS during everyday operations at SFA. I affirmed his support in this accreditation and discussed what obtaining and maintaining the certification will look like for the EHSRM department.

The EMS was necessary to implement in the eyes of Dr. Higgins. The voluntary participation SFA took part in a compliance audit program in 2011, allowed SFA to address 273 potential violations and areas of non-compliance. The Director believes that with the expected growth of SFA, the universities generator status will change, meaning regulatory requirements will become more stringent for SFA. Two environmental management areas that the EHSRM is focusing more attention to is air quality and stormwater permitting requirements. The researcher was advised that in order to communicate with top management, the researcher would need to speak in numbers. This is due to one of the hesitations, if not the main one of obtaining the accreditation, is the cost of accreditation. Another consideration the researcher was offered was although becoming ISO 14001:2015 certified can boost SFA's environmental reputation, the researcher should consider if it is worth it.

3. Gregory Moore, Assistant Director and Environmental Safety Office of Environmental Health, Safety, and Risk Management Department

The Environmental Safety Officer is responsible for applying SFA's current EMS to SFA's operations. The safety officer looks at the relevant regulatory program area(s), requirements to maintain compliance, and best management practices. The Environmental Safety Officer also communicates this information to the appropriate department Director, Chair, Dean, Supervisor, and/or university Leadership (SFA EMS 2023). The researcher expects to discuss the tasks and commitments that the Safety Officer will be expected to meet when becoming ISO 14001:2015 accredited and what that would look like for the future of this position.

Mr. Moore stated that environmental stewardship is very important at SFA because it allows SFA to maintain a clean campus, further consciousness for the campus, and ensure there are no over utilization of materials. A key improvement Mr. Moore believes SFA can focus on is recycling of materials. Although recycling is done throughout the campus, there are opportunities to further SFAs environmental stewardship. A few concerns Mr. Moore has with SFA moving forward in the accreditation process is ensuring there is enough funding and commitment with the upkeep of the accreditation and making sure the support across all levels is steady. The audits that SFA would need to go through to maintain ISO 14001:2015 should not pose an issue so long as resources are provided, and support is provided across all fronts. Mr. Moore emphasized that to obtain necessary funding, a plan must be made to ensure top management will support the costs associated with accreditation. Becoming accredited will make SFA attractive to potential students by showcasing that SFA is accomplishing and maintaining its environmental stewardship and possibly bring in support from outside sectors involved.

External Auditors

The purpose for conducting interviews with external auditors was to make aware what a certification body expects from the applicant. The researcher reached out to three companies and unfortunately, no auditors accepted the interview requested.

Organization currently ISO 14001:2015 Certified

The purpose for conducting an interview with a company currently ISO 14001:2015 accredited is to understand what the accreditation process looks like from the applicant's perspective. The researcher reached out to four universities and three companies that went through the ISO 14001:2015 accreditation process. No universities accepted the interview request and only one company participated. During the interview, the company requested to remain anonymous through-out this research. This company will be referred to as Company #1.

1. Company #1

The interview proved influential in this research due to allowing the researcher to base the company's recommendations of accreditation based on the current ISO 14001:2015 certified body's answers.

The companies currently ISO 14001:2015 were identified utilizing the EHSO – Environment, Health, and Safety Online website. According to the website, EHSO identifies itself as "the site for free, objective, practical information about environment, health, and safety in 2023" (EHSO 2023). EHSO provides a webpage dedicated to the ISO 14000 series that includes the number of companies certified worldwide, and a list of companies in the U.S. that have ISO 14000 certifications. The researcher used this website to identify U.S. companies ISO 14001:2015 certified and dismissed the companies that were not ISO 14001:2015 certified.

Company #1 has been ISO 14001:2015 certified since 2005. The organization utilized the certifying body National Quality Assurance U.S.A (NQA) to become accredited. Company #1 set out to achieve the following environmental objectives for the accreditation, in no order:

- Protect the environment;
- Fulfill compliance obligations;
- Continual improvement of EMS to enhance environmental performance; and

- Set environmental objectives and targets.

According to Company #1, the ISO 14001:2015 accreditation process took about one year to obtain and the indicated initial cost was less than $20,000 with the average renewal cost also being less than $20,000. Company #1 stated that, “it was a pretty smooth transition, the site already practiced most of the principles of ISO 14001:2015. We have always had a dedicated team committed to the environment.” The researcher asked what advice company #1 would give to an organization that would like to obtain ISO 14001:2015 accreditation and the representative said that management buy-in is vital, gather a dedicated team, and structure a detailed plan for implementation. Company #1 answered that the accreditation added value in more ways than one. Accreditation gave credibility to the company name, compete for contracts, attract talent, and build better relationships with local authorities. The interview questions and answers can be viewed in appendix e.

Economic Analysis

An economic analysis is a systematic process to select the most efficient and cost-effective solution, by evaluating the worth of certain alternatives (DAU, n.d.). The economic analysis to be performed for this study will focus on the two indicators chosen: energy and gasoline usage. In this study, performing the economic analysis will prove helpful on both the business and environmental side at SFA. There are economic benefits to running an economic analysis before making significant organization decisions.

The goals and objectives of this economic analysis were to assist in the decision-making of potential upgrades to electricity and gasoline usage campus wide. The researcher believes the upgrades suggested can be beneficial for SFA to become more aligned with the ISO 14001:2015 standard. The economic analysis is expected to determine if these upgrades are feasible. If SFA were to move forward with the accreditation process, it is a possibility of the certification body conducting the audits to recommend or require these upgrades, but since no auditing companies accepted an interview request, there is no way of knowing what they look for. To disclose, the reason behind choosing these environmental indicators for the economic analysis were strictly the researchers decision and does not necessarily reflect ISO 14001:2015 requirements.

The basis for performing the economic analysis for each indicator included projecting the costs over a certain time. Due to this the researcher needed to calculate the overall cost of the newer equipment and the cost of current equipment. To estimate how much an investment would be during the projected time period, the Future Value (V_n) equation below was used.

$$V_n = V_o (1 + i)^n$$

V_n = Future value
V_o = Present value
i = Interest rate (%)
n = Number of times compounded annually

The present values used in the equation were based on the yearly operational costs associated with the light fixtures and vehicles for that given year. The interest rate was chosen based on previous literature review and set at 5% (Clark and Humphrey, 2024). The interest rate was kept constant throughout the projected time periods due to fluctuation that can occur in the next five-year and 20-year period. The n value rested on the time period, beginning at year one and decreased as the time period extended.

1. Electricity

The economic analysis performed regarding energy consumption at SFA involves the expected savings associated with converting 500 fluorescent bulbs to 500 LED bulbs over a ten-year and 20-year period. Clark and Dr. Humphrey (2024) stated that although the initial costs of switching to LED bulbs is higher, the savings down the road is greater when compared to maintaining fluorescent bulbs.

The cost of labor to install the LED bulbs was not included as PPD staff's salary includes the replacement of bulbs no matter the type. Before performing the economic analysis, the following assumption is that the electricity usage and rate per kWh will remain the same throughout the projected time periods.

First, the researcher gathered the cost of purchasing a new single, T8, 4 feet (ft) fluorescent and LED bulb. The estimated cost for a single fluorescent bulb and an LED bulb is $2.25 and $10.65. From there the researcher multiplied the cost of 500 bulbs for each type of bulb totaling to $1,125 for fluorescent bulbs and $5,325 for LED bulbs. To determine the kWh for 500 bulbs in a single year, the researcher used the wattage that each bulb type uses (table 3) and multiplied that by the hours of operation. The assumption that the lights are on for 12 hours a day, 365 days out of the year was made. The researcher used the W and hours of operations when computing the following equation:

$$kWh = 500\ x\ \left(\frac{Watts\ x\ time\ (hrs)}{1000}\right)$$

LED Equation: $kWh = 500\ x\ \left(\frac{15W\ x4380\ (hrs)}{1000}\right)$

Fluorescent Equation: $kWh = 500\ x\ \left(\frac{32W\ x\ 4380\ (hrs)}{1000}\right)$

For 500 bulbs, the yearly kWh usage for LED bulbs is 32,850kWh and for fluorescent bulbs the usage is70,080kWh. The researcher then multiplied the yearly kWh usage by the average cost rate for FY24 which is $0.06 per kWh. Multiplying the yearly kWh usage by the cost rate gives us the yearly operational cost, of 500 LED bulbs at $1,934.87 and for 500 fluorescent bulbs at $4,127.71.

Based on the above calculations, the researcher then projected the yearly operational costs for each type of bulb as well as the replacement cost for 500 new bulbs. The replacement rate varied between the type of bulbs with LED bulbs only needing to be replaced every 11 years as fluorescent bulbs need to be replaced every seven years (table 3). This results in fluorescent bulbs needing to be replaced more frequently than LED bulbs. Once tables 1 and 2 were created based on the operational costs and replacement costs, the researcher projected the the 10-year and 20-year total costs. This was accomplished by using the Future Value (V_n) equation to bring the projected costs over the 10-year to 20-year period back to present monetary value. The researcher then subtracted the V_n costs of LED bulbs from the V_n costs of fluorescent bulbs, to equate the potential savings, for SFA, in a 10-year and 20-year period.

2. Gasoline

In performing a economic analysis on gasoline consumption, the looked at the benefits of upgrading to newer modeled vehicles across SFA by comparing a 2023 Ford F-150 pickup truck to a 2014 Ford F-150 pickup truck, both of which are in SFAs inventory. Assumptions were made about calculating the economic analysis. Specifically, the maintenance and fuel costs remained the same throughout the five-year projection. This is due to not knowing how the vehicle will be used, mileage, and normal wear and tear.

The researcher spoke with Erik Santes, a safety officer for the EHSRM department, about the insurance policy at SFA. He stated that since SFA is under the UT System the yearly insurance rate for all brand, year, and model vehicles no more than 10 years old is set at $541.33 per year. The yearly maintenance rate was unknown, but per CarEdge, the average yearly maintenance rate for the 2023 truck is $543.60 and the 2014 truck is $793.00 (Card Edge, 2024). The annual fuel cost was estimated at $2,300 for the 2023 model truck and $2,650 for the 2014 model truck (U.S. Department of Energy, 2024). These values were projected over the five-year and 10-year period. Since SFA did not need to purchase the 2014 truck, because it was "recycled", the upfront costs of purchasing the 2014 model were not required; however, the 2023 truck was purchased brand new with an MSRP of $49,797.50.

The researcher followed the same Future Value (V_n) calculation for electrical usage but only over five-year and 10-year projected period of costs. Once the researcher subtracted the V_n costs of the 2023 truck from the 2014 truck, the potential cost savings in a five-year and 10-year period was determined.

Review and Revise EMS

Unfortunately, due to ISO auditing companies not accepting interview requests, the review and revision of this methodology was based on the researcher's findings and what the researcher believes would be beneficial for SFAs EMS to align with ISO 14001:2015. The researcher was hopeful that the interviews would shed light on certain aspects that are typically looked at when auditing occurs. Although no interviews were conducted with ISO auditors, there were some areas within SFAs EMS that could be revised. Currently, the 2024 version of the EMS is being reviewed by the EHSRM Environmental Safety Officer and Director for final approval.

The researcher reviewed and revised SFA's EMS and compared it to the "ISO 14001 Environmental Management System – Requirements with guidance for use" current standard booklet. This booklet outlines the management of an organization's environmental responsibility and is the basis for completing this section of the methodology. This standard book is what an organizations EMS will be compared to when becoming ISO 14001: 2015 accredited.

RESULTS AND DISCUSSION

Interviews

The main objective of conducting interviews was to affirm commitment from the environmental safety officer and top management at SFA as well receive insight from a company that is currently ISO 14001:2015 certified. The three interviews conducted with SFA personnel achieved the most important factor in a successful implementation of ISO 14001 accreditation which is the commitment of SFAs top management to strive for ISO 14001 accreditation, given that the cost and continual funding is considered. The main hesitation of moving forward with the ISO 14001 accreditation for SFA is mainly the cost of obtaining accreditation. The researcher believes that if funding is allocated to the initial and continual funding of accreditation, SFA would have no issue becoming ISO 14001 accredited.

The interview conducted with Company #1 revealed that the estimated time frame of ISO 14001 accreditation was between six months to two years. The initial cost Company #1 incurred was a maximum of $20,000 and the average renewal cost was less than $20,000. Company #1 was able to disclose that the ANSI ANAB-accredited certification body used was National Quality Assurance Inc. (NQA). The answers Company #1 provided, specifically to question number eight, gave the researcher comfort on SFAs potential accreditation process.

This is due to Company #1 stating they have already practiced the principles of ISO with a dedicated team and, SFA has already practiced ISO 14001:2015 principles i.e., developing and implementing an EMS.

Overall, John Branch affirmed the top management's commitment of SFA becoming ISO 14001 accredited so long as SFA went through the motions carefully, researched, and fully understood the process. Dr. Higgins is hopeful that newer generations of environmentally conscious individuals will bring more perspective. Dr. Higgins re-affirmed his commitment of SFA becoming ISO 14001 accredited. Gregory Moore supports SFA becoming ISO 14001 accredited and is optimistic of future environmental initiatives.

Economic Analysis

An economic analysis identifies areas of improvement, gathers relevant data, applies necessary calculations, and evaluates the results. The application of an economic analysis allows an organization to evaluate a decision free of biases. With the consideration of assumptions and limitations met, the economic analysis was able to be performed free of bias. The economic analysis performed proved that there are potential benefits to upgrading to more efficient products while also being cost-effective. If feasible, the alternatives discussed below should be considered or incorporated to SFA operations.

1. Electrical

The purpose of performing the economic analysis on electricity was to determine if upgrading to LED lights will reduce the environmental impact of current electricity consumption at SFA while also determining potential cost-savings. The researcher was able to conclude that the conversion from fluorescent light bulbs to LED light bulbs is a great alternative based on environmental factors as well as cost-savings over a 10-year and 20-year period. To support this, tables 1 and 2 and figures 8 and 9 displays the cost-savings for 500 bulbs, over a 10-year and 20-year period, with a total savings of +$20,724.38 and +$55,096.88. Even though the upfront costs of purchasing the LED bulbs is roughly 5X the price of purchasing the fluorescent bulbs, the lifespan and efficiency of the LED bulb compensates because of its higher efficiency.

Table 1. Present Value (Pv), Future Value (Vn) Equation, Total Costs and Savings over a 10-year period calculated based on operational and replacement costs of 500 LED T8, 4ft and 500 fluorescent T8, 4ft bulbs (Table by Breanna Duran, 2024).

Year	LED Present Value (P_v) Cost	LED Future Value (V_n) Equation	LED V_n Cost	Fluorescent Present Value (P_v) Cost	Fluorescent Future Value (V_n) Equation	Fluorescent V_n Cost
2024	$7,259.87[a]	$\$7,259.87 \times (1+0.05)^{9}$	$11,262.44	$4,127.71	$\$4.127.71 \times (1+0.05)^{9}$	$6,403.43
2025	$1,934.87	$\$1,934.87 \times (1+0.05)^{8}$	$2,858.68	$4,127.71	$\$4.127.71 \times (1+0.05)^{8}$	$6,098.51
2026	$1,934.87	$\$1,934.87 \times (1+0.05)^{7}$	$2,722.56	$4,127.71	$\$4.127.71 \times (1+0.05)^{7}$	$5,808.10
2027	$1,934.87	$\$1,934.87 \times (1+0.05)^{6}$	$2,592.91	$4,127.71	$\$4.127.71 \times (1+0.05)^{6}$	$5,531.53
2028	$1,934.87	$\$1,934.87 \times (1+0.05)^{5}$	$2,469.44	$4,127.71	$\$4.127.71 \times (1+0.05)^{5}$	$5,268.12
2029	$1,934.87	$\$1,934.87 \times (1+0.05)^{4}$	$2,351.85	$4,127.71	$\$4.127.71 \times (1+0.05)^{4}$	$5,017.26
2030	$1,934.87	$\$1,934.87 \times (1+0.05)^{3}$	$2,239.85	$5,340.45[b]	$\$5,340.45 \times (1+0.05)^{3}$	$6,182.24
2031	$1,934.87	$\$1,934.87 \times (1+0.05)^{2}$	$2,133.19	$4,127.71	$\$4.127.71 \times (1+0.05)^{2}$	$4,550.80
2032	$1,934.87	$\$1,934.87 \times (1+0.05)^{1}$	$2,031.61	$4,127.71	$\$4.127.71 \times (1+0.05)^{1}$	$4,334.10
2033	$1,934.87	$\$1,934.87 \times (1+0.05)^{0}$	$1,934.87	$4,127.71	$\$4.127.71 \times (1+0.05)^{0}$	$4,127.71
Total Costs			**$32,597.41**			**$53,321.79**
Savings in 2033 Dollar Value	**$20,724.38**					

[a] - Year 2024 includes the annual electricity replacement cost for 500 LED bulbs.
[b] - Year 2030 includes the annual electricity replacement cost for 500 fluorescent bulbs

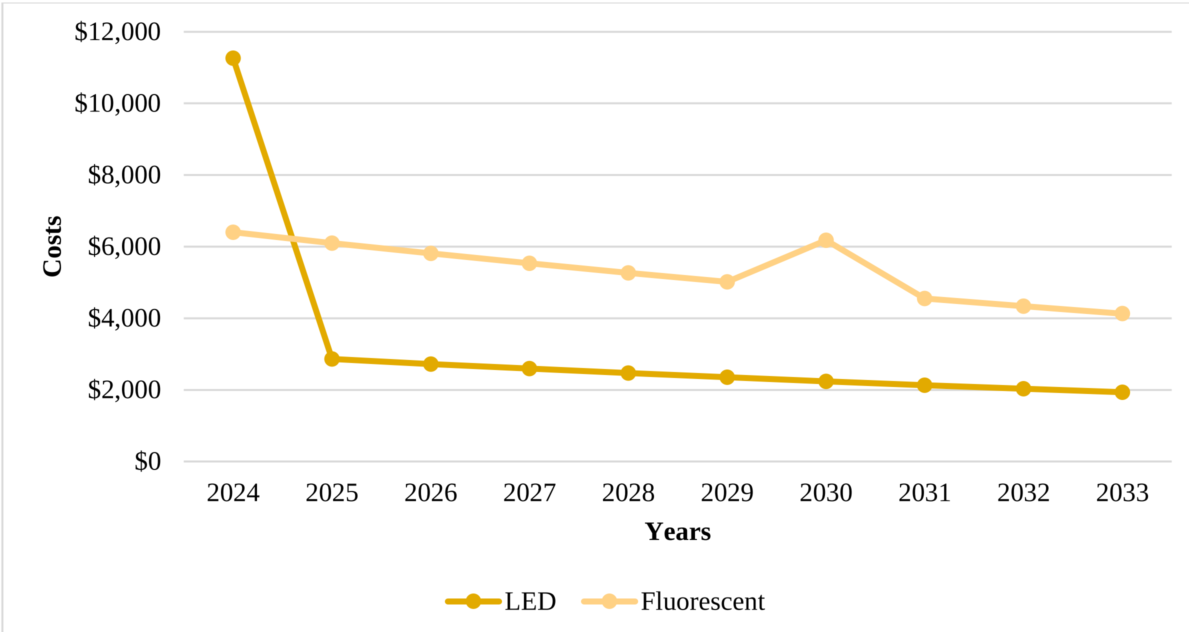


Figure 7. Total costs over a 10-year period calculated based on operational and replacement costs of 500 LED T8, 4ft and 500 fluorescent T8, 4ft bulbs (Figure by Breanna Duran, 2024).

Table 2. Present Value (Pv), Future Value (Vn) Equation, Total Costs and Savings over a 20-year period calculated based on operational and replacement costs of 500 LED T8, 4ft and 500 fluorescent T8, 4ft bulbs (Table by Breanna Duran, 2024).

Year	LED Present Value (P_v) Cost	LED Future Value (V_n) Equation	LED V_n Cost	Fluorescent Present Value (P_v) Cost	Fluorescent Future Value (V_n) Equation	Fluorescent V_n Cost
2024	$7,259.87[a]	$7,259.87 × (1+0.05)^{19}$	$18,345.33	$4,127.71	$4.127.71 × (1+0.05)^{19}$	$10,430.52
2025	$1,934.87	$1,934.87 × (1+0.05)^{18}$	$4,656.50	$4,127.71	$4.127.71 × (1+0.05)^{18}$	$9,933.83
2026	$1,934.87	$1,934.87 × (1+0.05)^{17}$	$4,434.76	$4,127.71	$4.127.71 × (1+0.05)^{17}$	$9,460.79
2027	$1,934.87	$1,934.87 × (1+0.05)^{16}$	$4,223.58	$4,127.71	$4.127.71 × (1+0.05)^{16}$	$9,010.27
2028	$1,934.87	$1,934.87 × (1+0.05)^{15}$	$4,022.46	$4,127.71	$4.127.71 × (1+0.05)^{15}$	$8,581.21
2029	$1,934.87	$1,934.87 × (1+0.05)^{14}$	$3,830.91	$4,127.71	$4.127.71 × (1+0.05)^{14}$	$8,172.58
2030	$1,934.87	$1,934.87 × (1+0.05)^{13}$	$3,648.49	$5,340.45[b]	$5,340.45 × (1+0.05)^{13}$	$10,070.21
2031	$1,934.87	$1,934.87 × (1+0.05)^{12}$	$3,474.75	$4,127.71	$4.127.71 × (1+0.05)^{12}$	$7,412.77
2032	$1,934.87	$1,934.87 × (1+0.05)^{11}$	$3,309.28	$4,127.71	$4.127.71 × (1+0.05)^{11}$	$7,059.78
2033	$1,934.87	$1,934.87 × (1+0.05)^{10}$	$3,151.70	$4,127.71	$4.127.71 × (1+0.05)^{10}$	$6,723.60
2034	$1,934.87	$1,934.87 × (1+0.05)^{9}$	$3,001.62	$4,127.71	$4.127.71 × (1+0.05)^{9}$	$6,403.43
2035	$7,259.87[a]	$7,259.87 × (1+0.05)^{8}$	$10,726.13	$4,127.71	$4.127.71 × (1+0.05)^{8}$	$6,098.51
2036	$1,934.87	$1,934.87 × (1+0.05)^{7}$	$2,722.56	$4,127.71	$4.127.71 × (1+0.05)^{7}$	$5,808.10
2037	$1,934.87	$1,934.87 × (1+0.05)^{6}$	$2,592.91	$5,340.45[b]	$5,340.45 × (1+0.05)^{6}$	$7,156.71
2038	$1,934.87	$1,934.87 × (1+0.05)^{5}$	$2,469.44	$4,127.71	$4.127.71 × (1+0.05)^{5}$	$5,268.12
2039	$1,934.87	$1,934.87 × (1+0.05)^{4}$	$2,351.85	$4,127.71	$4.127.71 × (1+0.05)^{4}$	$5,017.26

Table 2 Continued. Present Value (Pv), Future Value (Vn) Equation, Total Costs and Savings over a 20-year period calculated based on operational and replacement costs of 500 LED T8, 4ft and 500 fluorescent T8, 4ft bulbs (Table by Breanna Duran, 2024).

Year	LED Present Value (P_v) Cost	LED Future Value (V_n) Equation	LED V_n Cost	Fluorescent Present Value (P_v) Cost	Fluorescent Future Value (V_n) Equation	Fluorescent V_n Cost
2040	$1,934.87	$\$1{,}934.87 \times (1+0.05)^3$	$2,239.85	$4,127.71	$\$4.127.71 \times (1+0.05)^3$	$4,778.34
2041	$1,934.87	$\$1{,}934.87 \times (1+0.05)^2$	$2,133.19	$4,127.71	$\$4.127.71 \times (1+0.05)^2$	$4,550.80
2042	$1,934.87	$\$1{,}934.87 \times (1+0.05)^1$	$2,031.61	$4,127.71	$\$4.127.71 \times (1+0.05)^1$	$4,334.10
2043	$1,934.87	$\$1{,}934.87 \times (1+0.05)^0$	$1,934.87	$4,127.71	$\$4.127.71 \times (1+0.05)^0$	$4,127.71
Total Costs			**$85,301.78**			**$140,398.66**
Savings in 2043 Dollar Value	**$55,096.88**					

[a] - The years 2024 and 2035 include the annual electricity replacement cost for 500 LED bulbs.
[b] - The years 2030 and 2037 include the annual electricity reaplcement cost for 500 fluorescent bulbs.

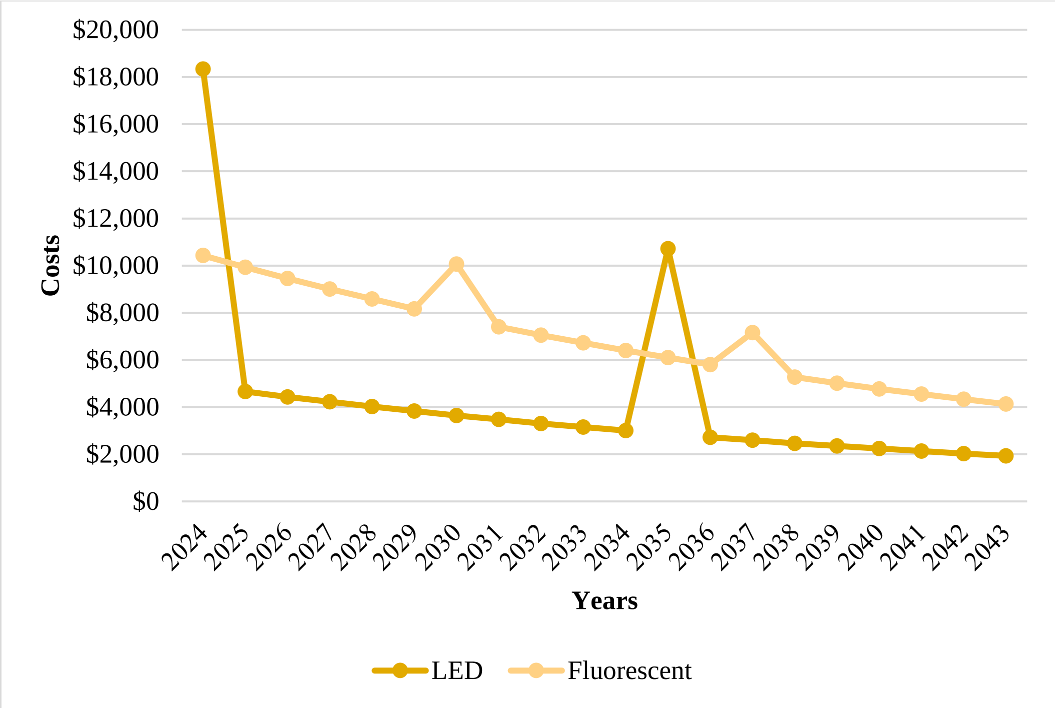


Figure 8. Total costs over a 20-year period calculated based on operational and replacement costs of 500 LED T8, 4ft and 500 fluorescent T8, 4ft bulbs (Figure by Breanna Duran, 2024).

In addition to the LED bulbs having cost-savings value, LED bulb's environmental performance has increased benefits compared to fluorescent bulbs. An example benefit is that since LED lighting gives off very little heat the cost of cooling will be reduced (Clark and Dr. Humphrey, 2024.). The equivalence wattage (W) of a T8, 4 feet (ft) LED to fluorescent bulb is 18W to 32W, hence, using less energy (table 3). To further support this, the yearly electricity usage for 500 LED bulbs is 32,580 Kilowatts/hour (kWh) and 70,080 kWh for 500 fluorescent bulbs. Electricity usage contributes to the operational cost of LED lighting so therefore, 500 LED bulbs will cost less than 500 fluorescent bulbs. Per the Energy and Water Management Plan, "SFASU will continue to upgrade lighting campus-wide to LED fixtures as funding becomes available" (2022). Currently, SFA is only replacing fluorescent bulbs with LED bulbs as fluorescent bulbs go out.

Table 3. Environmental performance comparison between LED T8, 4ft bulbs and fluorescent T8, 4ft bulbs (Table by Breanna Duran, 2024).

Item	**LED Bulbs**	**Fluorescent Bulbs**
	Value	
Wattage	18W	32W
Expiration of LED bulbs	50,000 Hours	30,000 Hours
Replacement rate	11 years	7 years
Disposal Route	Regular trash	Bulb Crusher or Universal Waste pick-up

2. Gasoline

The economic analysis performed on gasoline consumption resulted in no cost-savings are associated with purchasing a 2023 model vehicle versus a 2014 model vehicle over a 5-year and 10-year period as shown in tables 4 and 5 and figures 10 and 11. However, a newer modeled vehicle can reduce its environmental impact, slightly, as seen in table 5. In fact, the savings, over the 5-

year period and 10-year period are -$57,211.03 and -$69,705.32. Also, the reason as to why the costs associated with the 2023 model vehicle was higher as compared to the 2014 model vehicle is since SFA did not have to purchase the 2014 truck while the 2023 truck was purchased brand new. Fleets are "recycled" throughout the campus and what this means is if another department no longer has use for a vehicle, yet another department does, the vehicle will change ownership to the other department.

Table 4. Present Value (Pv), Future Value (Vn) Equation, Total Costs and Savings over a five-year period calculated based on purchasing a 2023 Ford F-150 truck and a 2014 Ford F-150 truck (Table by Breanna Duran, 2024).

Year	2023 Present Value (P_v) Cost	2023 Future Value (V_n) Equation	2023 Model V_n Cost	2023 Present Value (P_v) Cost	2023 Future Value (V_n) Equation	2014 Model V_n Cost
2024	$53,177.43[a]	$\$53,177.43 \times (1+0.05)^4$	$64,637.50	$3,984.33	$\$3,984.33 \times (1+0.05)^4$	$4,842.98
2025	$3,384.93	$\$3,384.93 \times (1+0.05)^3$	$3,918.48	$3,984.33	$\$3,984.33 \times (1+0.05)^3$	$4,612.36
2026	$3,384.93	$\$3,384.93 \times (1+0.05)^2$	$3,731.89	$3,984.33	$\$3,984.33 \times (1+0.05)^2$	$4,392.72
2027	$3,384.93	$\$3,384.93 \times (1+0.05)^1$	$3,554.18	$3,984.33	$\$3,984.33 \times (1+0.05)^1$	$4,183.55
2028	$3,384.93	$\$3,384.93 \times (1+0.05)^0$	$3,384.93	$3,984.33	$\$3,984.33 \times (1+0.05)^0$	$3,984.33
Total Costs			**$79,226.97**			**$22,015.94**
Savings in 2028 Dollar Value	**-$57,211.03**					

[a] – The year 2024 includes the annual maintenance, insurance, and fuel costs and purchasing the 2023 model truch new.

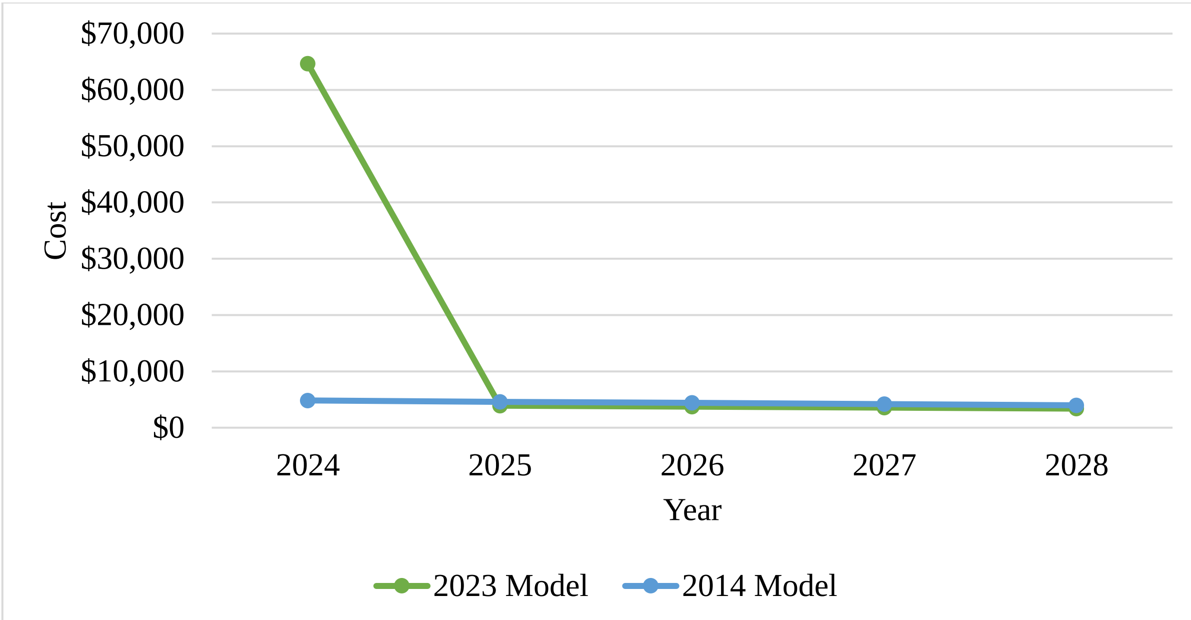


Figure 9. Total costs over a five-year period calculated based on costs of purchasing a newer modeled Ford F-150 truck compared to a 2014 Ford F-150 truck (Figure by Breanna Duran, 2024).

Table 5. Present Value (Pv), Future Value (Vn) Equation, Total Costs and Savings over a 10-year period calculated based on purchasing a 2023 Ford F-150 truck and a 2014 Ford F-150 truck (Table by Breanna Duran, 2024).

Year	2023 Present Value (P_v) Cost	2023 Future Value (V_n) Equation	2023 Model V_n Cost	2023 Present Value (P_v) Cost	2023 Future Value (V_n) Equation	2014 Model V_n Cost
2024	$53,177.43[a]	$\$53,177.43 \times (1+0.05)^9$	$82,495.65	$3,984.33	$\$3,984.33 \times (1+0.05)^9$	$6,181.00
2025	$3,384.93	$\$3,384.93 \times (1+0.05)^8$	$5,001.08	$3,984.33	$\$3,984.33 \times (1+0.05)^8$	$5,886.67
2026	$3,384.93	$\$3,384.93 \times (1+0.05)^7$	$4,762.94	$3,984.33	$\$3,984.33 \times (1+0.05)^7$	$5,606.35
2027	$3,384.93	$\$3,384.93 \times (1+0.05)^6$	$4,536.13	$3,984.33	$\$3,984.33 \times (1+0.05)^6$	$5,339.38
2028	$3,384.93	$\$3,384.93 \times (1+0.05)^5$	$4,320.12	$3,984.33	$\$3,984.33 \times (1+0.05)^5$	$5,085.13
2029	$3,384.93	$\$3,384.93 \times (1+0.05)^4$	$4,114.40	$3,984.33	$\$3,984.33 \times (1+0.05)^4$	$4,842.98
2030	$3,384.93	$\$3,384.93 \times (1+0.05)^3$	$3,918.48	$3,984.33	$\$3,984.33 \times (1+0.05)^3$	$4,612.36
2031	$3,384.93	$\$3,384.93 \times (1+0.05)^2$	$3,731.89	$3,984.33	$\$3,984.33 \times (1+0.05)^2$	$4,392.72
2032	$3,384.93	$\$3,384.93 \times (1+0.05)^1$	$3,554.18	$3,984.33	$\$3,984.33 \times (1+0.05)^1$	$4,183.55
2033	$3,384.93	$\$3,384.93 \times (1+0.05)^0$	$3,384.93	$3,984.33	$\$3,984.33 \times (1+0.05)^0$	$3,984.33
Total Costs			**$119,819.80**			**$50,114.47**
Savings in 2033 Dollar Value	**-$69,705.32**					

a - Year 2024 includes the annual maintenance, insurance, and fuel costs and purchasing the 2023 model truch new.

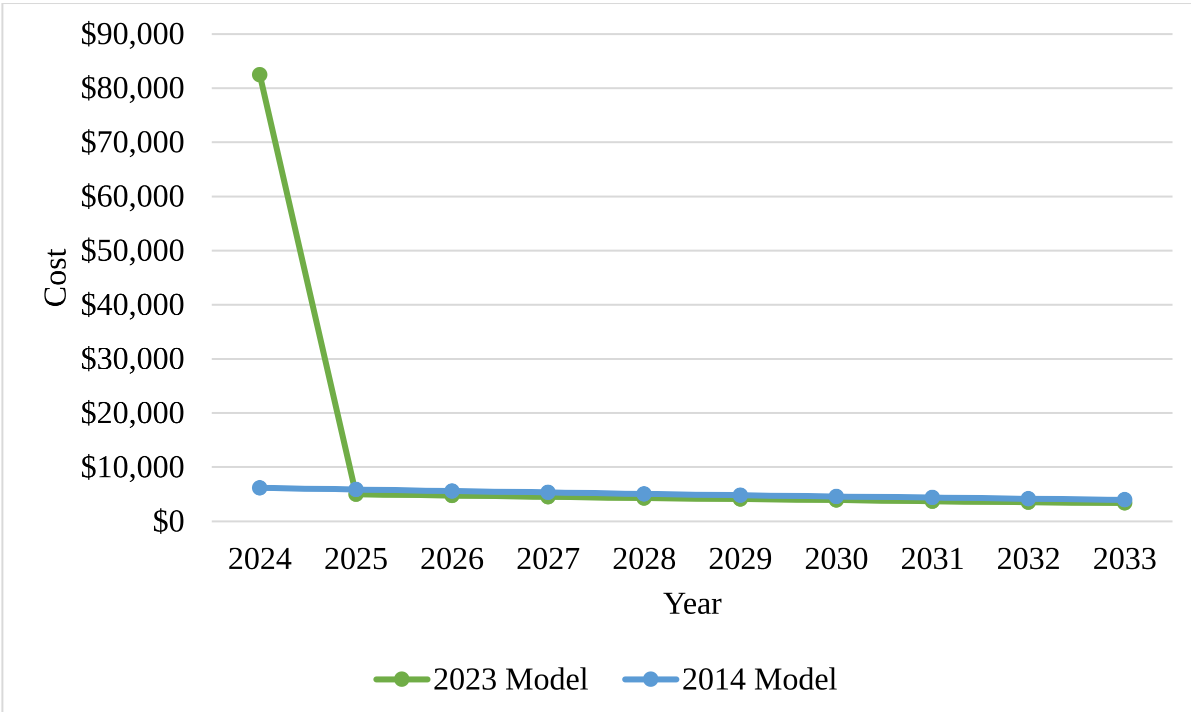


Figure 10. Total costs over a five-year period calculated based on costs of purchasing a newer modeled Ford F-150 truck compared to a 2014 Ford F-150 truck (Figure by Breanna Duran, 2024).

However, the researcher believes the benefits that are associated with purchasing a newer modeled vehicle come from the environmental side (table 6). The 2023 model vehicle can go three miles more per gallon as compared to the 2014 model vehicle (U.S. Department of Energy, 2024). To further support the benefits, the 2014 model truck is likely to use over one barrel more of petroleum, in a single year, compared to the 2023 model. The SMOG rating, which represents the amount of smog-forming air pollutants a vehicle emits, scoring from 1 (worst) to 10 (best) is the same for both vehicles at a 6 rating (Department of Energy). The National Highway Traffic Safety Administration (NHTSA) safety rating is also the same for both vehicles. In contrast, the 2014 truck has a fuel tank size one gallon greater than the 2023 truck which infers the petroleum storage capacity.

Table 6. Environmental performance comparison between 2023 Ford F-150 pickup truck and a 2014 Ford F-150 pickup truck (U.S. Department of Energy) (Table by Breanna Duran, 2024).

Item	**2023 Ford F-150 Truck**	**2014 Ford F-150 Truck**
	Value	
Miles per Gallon (combined)	22 MPG	19 MPG
Environmental Impact Score (EIS)	13.5 barrels	15.7 barrels
Greenhouse Gas Emissions (GHG)	6.7 tpy	7.7 tpy
Tank Size	30 g*	31 g*
SMOG Rate	6	6

tpy – Tons per year
g - Gallons

Although there are no cost-savings associated with purchasing a newer modeled vehicle, there are potential environmental performance benefits that should be considered. SFA has stated that the university will carefully consider the feasibility of alternative forms of transportation as each fleet vehicle is due for replacement (EWMP, 2022).

Review and Revision of SFA EMS

As stated above, no ISO certifying bodies accepted my interview request and provided no reasoning. The researcher hoped that the interviews with external auditors would give insight on what is looked for during the accreditation process and use that information when reviewing SFAs EMS. However, the researcher was able to conduct the routine review and revisions of the EMS that is normally done. Since SFA is not actually in the process of becoming ISO 14001 certified, the findings related to aligning the EMS to ISO 14001 standards were noted. Many of the findings were related to updating the EMS to reflect the modification made when SFA became the 14th institution under the University of Texas System. Specifically, adding the newest revision of SFAs Handbook of operation procedures on Environmental Management Policy (appendix b).

Regarding SFAs EMS with the ISO 14001:2015 standard, the researcher believes that the PDCA model should be applied to the objectives that are stated in SFAs EMS. This would be an important step in positioning SFAs EMS with ISO 14001. Also, reviewing the EMS, the researcher agrees with Gregory Moore that more environmentally focused initiatives could assist in enhancing SFAs environmental performance. The researcher believes the Environmental Services Committee has utilized the ESF to support environmental improvement projects. Lastly, the researcher believes verification of the written programs for each regulatory area currently managed under the EMS and made readily available.

RECOMMENDATIONS AND LIMITATIONS

With any research, limitations are expected. The researcher would like to point out that one of the limitations met when conducting the research was the accurate quantity of fluorescent bulbs and LED bulbs at SFA. This resulted in the set quantity of bulbs used when conducting the economic analysis for this research. However, as SFA continually makes upgrades to more efficient equipment and materials, the researcher is confident that this limitation will not pose an issue on future research. Another limitation was the unexpected decline in interviews from external auditors and companies currently ISO 14001:2015 certified. This resulted in a limited perspective of the overall ISO 14001:2015 accreditation process.

Although SFA is not in the market of becoming ISO 14001:2015 accredited at this time, the researcher believes the implementation of the PDCA would be most beneficial for SFAs EMS. Also, the research believed that performing an economic analysis on other environmental indicators would allow personnel to view other areas that could improve environmental wise while also being cost-effective. Secondly, the researcher recommends that future initiatives, such as recycling, are proposed to enhance SFAs environmental performance. One way this can be accomplished is proposing these projects to SFAs Environmental Service Committee, which solely focuses on funding environmental projects.

Thirdly, conducting more interviews with ISO auditing companies and organizations currently ISO 14001:2015 accredited would allow a more accurate representation of costs and potential savings. Fourth, it is recommended that a more accurate list of fluorescent and LED light fixtures on campus are maintained as newer equipment and materials are introduced.

CONCLUSION

In conclusion, this study aimed at providing an accreditation framework on SFAs EMS for becoming ISO 14001: 2015 Environmental Management System accredited. As stated in the beginning of this research, SFA is not currently in the process of ISO 14001 accreditation; however, this research is based on SFA's option to become accredited, if ever decided upon.

Though ISO 14001 accreditation is not yet popular at the university level, especially in the United States, many of the universities that have implemented an EMS and obtained accreditation have seen significant pros, whether short-term or long-term. SFA has shown commitment toward environmental stewardship by implementing the Energy and Water Management Plan in 2008 where SFA was able to reduce various utility consumption as well as develop and implement the EMS in 2016.

To review, this study was able to carry-out the objectives outlined in the beginning of this thesis. First, the interviews conducted with SFA personnel affirmed top managements and the environmental safety officer lively commitment. Also, the interview conducted with Company #1 provided insight of what to expect from an applicant's viewpoint. Next, the researcher was able to review and suggest modifications on the EMS to closely align with ISO 14001:2015 standard as well as understand environmental performance progress SFA has made.

Moreover, the economic analysis performed on electrical and gasoline consumption was able to show that switching over from fluorescent bulbs to LED bulbs has great cost-benefit while also improving SFAs environmental impact. However, there are no cost-benefits, of purchasing newer vehicles unless necessary. Each new equipment used in the economic analysis showed great environmental advantage compared to the older modeled equipment. A disadvantage of becoming ISO 14001:2015 accredited would be the costs and continual audits expected to be performed, which are not feasible for SFA at this time. A few advantages that should be considered and are related to becoming ISO 14001:2015 accredited are environmental performance, regulatory compliance, and operational excellence.

Overall, If SFA were to decide to move forward with ISO 14001:2015 accreditation, it would be feasible based on the framework. There are considerations that would need to be looked at first. Obtaining ISO 14001:2015 accreditation would be the highest environmental management recognition achieved and ensure SFA meets its environmental management objectives while holding worldwide recognition.

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APPENDIX A

Environmental Management System for Stephen F. Austin State University

Environmental Management System

Stephen F. Austin State University

Environmental Health, Safety,
& Risk Management Department
PO Box 6113, SFA Station

430 East Austin Street
Nacogdoches, TX 75962

Original Implementation: March 2016
Revision Date: January 2023

APPENDIX B

Stephen F. Austin State University Handbook of Operating Procedures: Environmental Management 05-507

Environmental Management

Purpose

The purpose of this policy is to aid in protecting the environment and promote environmental stewardship among Stephen F. Austin State University's faculty, staff, students, and visitors. To achieve this purpose the Environmental Health, Safety, and Risk Management (EHSRM) department is committed to continuous environmental improvement and protection through a variety of training and inspection programs.

Persons Affected

This policy aids in protecting the environment and promoting stewardship among SFA faculty, staff, students, and visitors.

Definitions

Environmental Management System: a framework for environmental management and the implementation of environmental policies and procedures.

Policy

The EHSRM department has primary responsibility for promulgating environmental health, safety, and risk management policies and procedures, to ensure that the university complies with University of Texas System policies, federal, state, and local guidelines, as well as best management practices related to environmental compliance and protection. Program safety manuals and detailed safety procedures are available on the EHSRM website.

Stephen F. Austin State University is committed to the protection and enhancement of the environment, while continually seeking new ways to minimize the environmental impact of our past, present, and future activities. As a result of this continuous effort, an environmental management system (EMS) has been created to serve as a planned, documented, systematic, and comprehensive program for managing environmental compliance at SFA. Detailed information on the EMS can be found on the EHSRM website.

Goals

Stephen F. Austin State University shall:

A. Ensure compliance with applicable University of Texas System policies, federal, state, and local environmental legislation, regulations, and best management practices.
B. Prevent pollution by managing and reducing: water and energy consumption, air emissions, discharges to water, and contamination of soil and/or groundwater.
C. Facilitate employee and student awareness of environmental issues through education and training for further protection of the surrounding environment.
D. Promote and facilitate the reduction, reuse, and recycling of waste.
E. Consider the impact on the environment when designing new projects and procedures or changing existing practices.

Responsibilities

It is imperative that Stephen F. Austin State University employees comply with University of Texas System policies, federal, state, and local environmental health, safety, risk management legislation, and relevant environmental compliance and protection codes. In addition, it is essential that employees observe industry best practices and comply with SFA safety policies, programs, and procedures. Noncompliance may result in disciplinary action.

The director of EHSRM (or designee) has primary responsibility for administration of and compliance with the university's EMS. Duties of the EHSRM department include:

A. Ensure the most current legal environmental requirements are identified and evaluated for compliance.
B. Establish, coordinate, and adhere to the environmental management programs outlined in the university's EMS, to comply with regulatory requirements or upon request of department supervisors.
C. Provide training focused on protecting the environment and ensuring environmental compliance.
D. Inspect university buildings and property for environmental compliance and protection, or in response to a notice of a possible violation. In carrying out this duty the EHSRM director or representative shall have the authority to enter any university building, structure, room, office, or laboratory without prior notice to department supervisors and staff.
E. Serve as the official university contact for federal, state, and local environmental regulatory agencies regarding environmental compliance and communicate compliance requirements to university officials. These include, but are not limited to: the U.S. Environmental Protection Agency (EPA), Texas Commission on Environmental Quality (TCEQ), Texas Department of State Health Services (TDSHS), and the city of Nacogdoches.

University employees must comply with the following guidelines and responsibilities:

A. Comply with all permit requirements, regulations, programs, and procedures specified by the EHSRM department and described in the university's EMS.
B. Attend environmental training courses and use required protective equipment provided by departments.
C. Handle all hazardous waste in accordance with the SFA hazardous waste and universal waste manuals. Each department is responsible for the payment of fees associated with the disposal of their hazardous and/or regulated waste.
D. Report environmental noncompliance issues or concerns through administrative channels or to the director of EHSRM.

Related Statutes or Regulations, Rules, Policies, or Standards

SFASU Environmental Management System: https://www.sfasu.edu/docs/safety/environmental-management-system.pdf
SFASU Hazardous Waste Manual: https://www.sfasu.edu/docs/safety/prog-man-hazardous-waste.pdf
SFA Universal Waste Guidelines: https://www.sfasu.edu/docs/safety/universal-waste-guidelines.pdf

Responsible Executive

Director of Environmental Health, Safety, and Risk Management

Forms

None

Revision History

October 23, 2017
March 27, 2023

APPENDIX C

Energy and Water Management Plan for Stephen F. Austin State University

nagement Plan

2022

Finance & Administration

Stephen F. Austin State University

October 31, 2022

Progress Report

In January of 2009, SFASU embarked on a mission to reduce utility costs that involved an issuing of a RFQ for a performance contract with an energy service contractor. Prior to that time, little had been done on campus to reduce energy or water consumption and curb associated costs. Building systems were run indiscriminately—often being left in "hand" position, therefore bypassing automated controls—in order to minimize impact to business operations. As a result, SFASU combined annual utility costs reached nearly $10.9M in fiscal year 2008, and the energy use index (EUI) peaked at 152.1 MBtu per conditioned square foot of space.

SFASU began by establishing an Energy Conservation Committee with a goal of reducing energy consumption by 30% over a 10-year period. After a lengthy review and evaluation process, SFASU selected Siemens Building Technologies Inc. (Siemens Industry, INC.) as its energy service contractor and authorized the preparation of a detailed utility assessment report. After securing necessary funding, and subsequently completing all approved conservation measures (phases 1 & 2), SFASU reduced annual utility costs to under $7.5M in 2013, while reducing its EUI to 118.0. Continued fine tuning of building systems and favorable utility rates further reduced the annual utility spend to $6.56M in fiscal year 2014.

As a result of the success of the initial energy service contract, SFASU commissioned another study (phase 3) to identify additional facility improvement measures to reduce the consumption and/or costs of campus utilities. These improvements were completed in March of 2016 and included building HVAC/Automation improvements, water sub-metering for sewer credits, and additional lighting projects. The third full year energy savings for electricity and natural gas were 8.43 MWh and 55,340 MMBtu respectively. Sewer credits from irrigation activities, cooling tower evaporation, and swimming pool water loss were 34,932 kgals for the same period.

Most recently, Siemens had prepared a preliminary report for the next round of facility improvement measures (phase 4). The scope of work and associated costs were reviewed by SFASU Administration and tabled for future discussions. Siemens has since offered to implement their Desigo CC Management Platform, which is a flexible, full client-server architecture and it presents a single point of entry for users to operate, monitor, and optimize building automation. SFASU has fully implemented this system allowing facilities staff to review and analyze current energy saving techniques aimed at continuous improvement in energy reduction initiatives.

In addition to saving energy and dramatically reducing costs, SFASU has strategically replaced inefficient, aging equipment that may have otherwise ended up on a long list of capital replacement needs in line fighting for shrinking funds with other institutional factions. To further this initiative, all new light fixtures installed are of the LED type. This includes new installations and replacement of fixtures that have failed. In FY22, SFA underwent a full relighting project of the McGee Business building. A total of 836 fluorescent light fixtures were replaced with LED fixtures and will reduce energy consumption from lighting in that building by approximately 40%. SFASU will continue to upgrade lighting campus-wide to LED fixtures as funding becomes available.

Energy and water usage reductions coupled with favorable electricity and natural gas commodity rates reduced SFASU fiscal year 2022 utility spend to approximately $5.33M, down 51% from the baseline year of 2008. It should be noted that conditioned space gross square footage increased by approximately 8.9% (338,000) during this same period, city water and sewer rate increased significantly, and SFASU lost the benefit of a 20% electricity distribution credit in 2017. Furthermore, the global COVID-19 Pandemic dramatically changed the landscape of the University and affected the energy consumption across the entire footprint of SFASU. SFASU transitioned to near 100% online instruction in March of 2020 through August 2020. The campus has returned to nearly 100% in-person instruction however enrollment is down compared to previous years.

Rising utility costs as a result of winter storm Uri in February 2021 combined with recent market uncertainty will unavoidably impact the university's utility budget primarily in regards to electricity and natural gas. SFASU has secured a new electricity contract beginning January 1, 2024 and will effectively raise electricity spending by approximately 22%. The university will also renew the natural gas contract in FY23 to take effect at the start of FY24 and is currently exploring options for that contract with the goal of obtaining the lowest possible rate but it will undoubtably be significantly higher than our current contract rate.

Summaries of each phase of utility facility improvement projects are included on the following page.

Phase 1 Summary:

- Start Date: July, 2010
- Completion Date: December, 2011
- Scope of Work:
- ✓ Energy Management and Control Systems – Chiller Plant Optimization
- ✓ Energy Management and Control Systems – Airside Optimization
- ✓ Water Management Upgrades (80% of total in phase 1; 20% in phase 2)
- Project Cost: $9,817,962
- Cumulative 8-year Guaranteed Savings: $9,590,850
- Cumulative 8-year Measured Savings: $14,168,369 (148% of guarantee)

Phase 2 Summary:

- Start Date: July, 2010
- Completion Date: December, 2011
- Scope of Work:
- ✓ Deferred Maintenance (central plant #1 boiler replacement, outside air handling unit – Music Building)
- ✓ Water Management and Upgrades (20% of total in phase 2; 80% in phase 1)
- ✓ Lighting Efficiency Retrofits (lamp technology and controls)
- ✓ Power Factor Correction
- Project Cost: $7,427,500

- Cumulative 8-year Guaranteed Savings: $8,060,712
- Cumulative 8-year Measured Savings: $8,556,647 (106% of guarantee)

Phase 3 Summary:

- Start Date: January, 2015
- Completion Date: March, 2016
- Scope of Work:
- ✓ Building automation/HVAC upgrades in 15 buildings (combined 1.3M gross square feet)
- ✓ Deferred maintenance (central plant #2 and auxiliary building boiler replacement), lighting retrofits
- ✓ Sewer credit sub-metering for irrigation, cooling tower evaporation, and swimming pool water.
- Project Cost: $11,345,915
- Cumulative 46-month Guaranteed Savings: $3,337,714
- Cumulative 46-month Measured Savings: $3,806,686 (114% of guarantee)

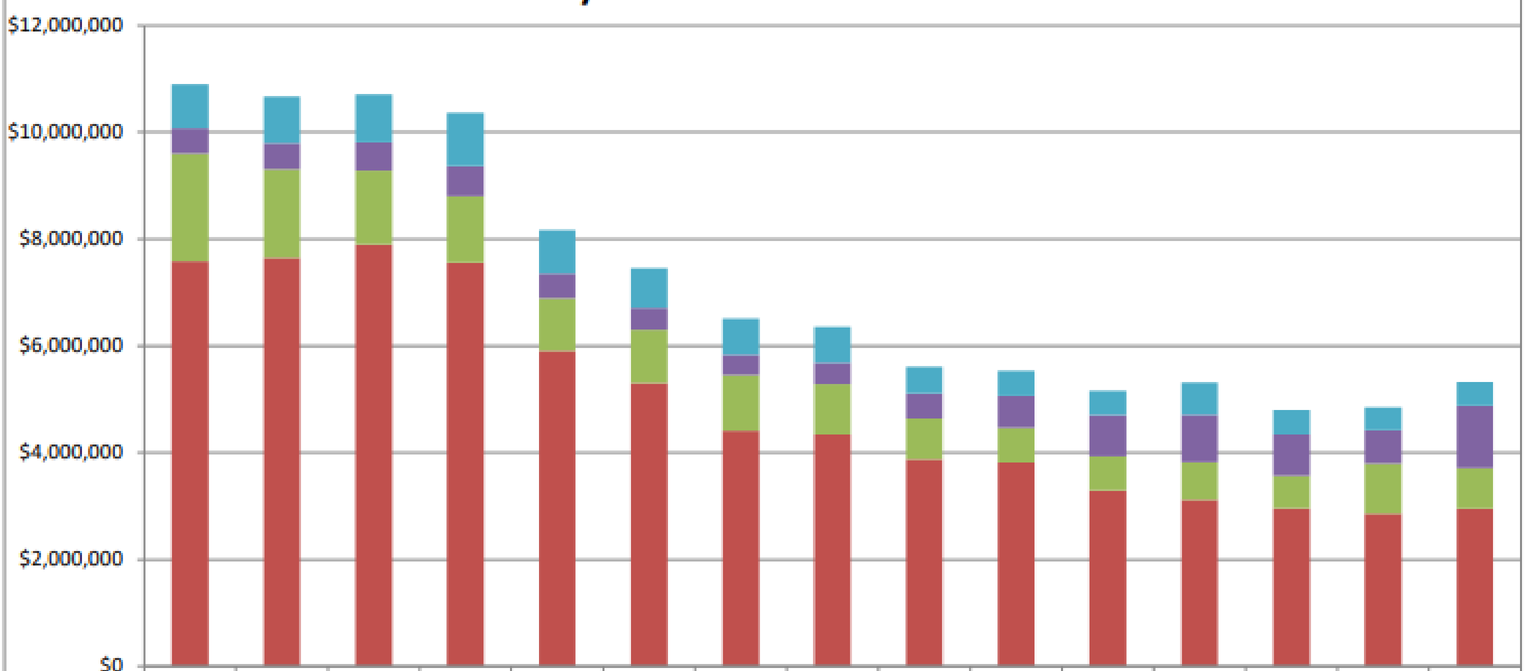
Phase 4 Summary:

- Survey completed in September, 2015
- Proposed scope was reviewed by SFASU Administration in FY2019 and Phase 4 was tabled.
- Scope included additional building system upgrades (automation & HVAC upgrades), and campus-wide irrigation system upgrades.

Historical Data:

The chart below shows the utility costs (Electricity, Natural Gas, Water, & Sewer) since FY2008. Note that while total costs have gone down substantially, there has been a net gain of approximately 340,000 conditioned square feet of space.

Utility Costs - FY2008 to Present



	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022
Totals	$10,901,432	$10,672,172	$10,712,074	$10,362,482	$8,172,276	$7,449,719	$6,513,872	$6,354,458	$5,612,966	$5,536,660	$5,158,676	$5,312,531	$4,795,332	$4,624,879	$5,326,716
Sewer	$826,531	$870,556	$896,648	$995,334	$821,619	$737,392	$674,209	$667,997	$506,552	$475,116	$458,607	$605,154	$453,114	$424,203	$451,712
Water	$470,776	$494,881	$534,578	$566,795	$455,621	$411,942	$384,164	$404,487	$459,465	$589,909	$768,042	$884,416	$777,064	$630,452	$1,166,945
Gas*	$2,020,319	$1,660,012	$1,382,633	$1,244,712	$981,181	$996,840	$1,040,235	$937,826	$772,618	$654,560	$635,023	$702,175	$605,065	$932,564	$751,730
Electricity	$7,583,805	$7,646,722	$7,898,215	$7,555,641	$5,913,855	$5,303,544	$4,415,264	$4,344,148	$3,874,331	$3,817,075	$3,297,004	$3,120,785	$2,960,089	$2,861,314	$2,956,329

**Figures exclude LP gas consumed at the Agriculture Center*

UAR Documentation:

The Utility Assessment Reports and Annual Savings Reports are on file with the SFASU Physical Plant Department.

Goals

SFASU has made tremendous strides reducing utility consumption by implementing various facility improvement measures as well as reducing associated rates by employing strategic negotiating techniques. As a result, SFASU has reduced the total annual utility spend (electricity, natural gas, water & sewer) by 51% since the base year of FY2008. Results and future short-term goals for each utility are listed below.

Electricity:

Achieved:

SFASU reached its peak electrical consumption in FY2008 with just over 88.5 MWh. Electricity costs peaked in FY2010 at just under $7.9M. FY2022 actual figures were 62.1 MWh and $2.96M. These figures represent reductions of 29.8% in consumption and 61% in associated costs from the respective peak years. Note that FY2022 figures are slightly higher than the previous year (FY2021) due to the decrease in COVID-19 and subsequent return of students to campus thus increasing utility usage.

Future:

Negotiated electric rate reductions are in effect for fiscal years 2018 – 12/31/2023 saving approximately $700k per year in electricity costs as compared to previous years. The contract end date coincides with the TX General Land Office terminations of all electricity contracts as directed by the TX Legislature. Therefore, SFASU has secured a new electricity contract beginning 01/01/2024 through the TX A&M Consortium with a rate approximately 22% higher than the current contract rate. Market rate increases are primarily due to winter storm Uri in 2021 along with market uncertainty related to the new U.S. presidential administration and the recent war in Ukraine. The university will unavoidably be facing higher electricity rates beginning 01/01/2024.

Natural Gas:

Achieved:

SFASU reached its peak natural gas consumption in FY2009 with just over 227,000 MMBtu. Natural gas costs peaked in FY2008 at just over $2.0M. FY2022 actual figures were 173,812 MMBtu at a cost of $751,730. This represents a reduction in consumption of 22.4% and a cost reduction of 62.8% from the FY2008 peak year. While the previous (FY2021) year's consumption was lower, the cost for that year was higher. The increased natural gas cost in FY2021 was due to a one-week period in Feb. 2021 when winter storm Uri caused market prices for natural gas to soar to over $400/MMBTU as compared to $3.42/MMBTU just one week prior. While SFASU is protected (to some extent) by a fixed rate contract, the estimated daily volumes are secured under the contracted fixed rate and any amount used over the estimated daily volume is charged at the current market rate for that day. During the winter storm in Feb. 2021, the university went over the estimated volumes for a number of days and the overage amounts were billed at the current market rates which varied from $11.23 - $400.21/MMBTU during the one-week period.

Future:

The current 2 yr. contract for natural gas was signed at the beginning of FY2022 and will expire at the end of FY2023. The university is currently exploring options for locking in the most favorable rate for the upcoming contract period but due to elevated natural gas prices, it's anticipated that SFASU will unavoidably spend more on natural gas beginning in FY2024. Market rate increases are primarily due to winter storm Uri in 2021 along with market uncertainty related to the new U.S. presidential administration and the recent war in Ukraine.

Water & Sewer:

Achieved:

Annual water and sewer reduction results are more difficult to track at SFASU because of the lack of historical data available and the influence of weather conditions on consumption.

During the four-year period from FY2008 – 2011, the campus averaged 215,668 kgals per year. Over the past five years, the average consumption has dropped to 155,609 kgals per year. This figure represents an average reduction in consumption of 27.9%. Water and sewer charges combined peaked in FY2011 at $1,562,129. While water usage has decreased from the FY2011 peak year, increased water and sewer rates have kept costs relatively stable. The combined costs in FY2022 were $1,618,657.

In addition, adding sub-meters throughout the campus to measure irrigation, cooling tower evaporation, and swimming pool water loss helped reduce the annual billed sewer units from an average of 163,250 to 107,426 kgals in FY2022 which represents an overall reduction of 52%. Despite an increase in city sewer charges, these costs fell from a high of $995k in FY2011 to $451k in FY2022 (54.6% reduction) despite a 30% increase in city sewer charges beginning in October 2016.

Future:

Phase 4 Implementation has been tabled as previously stated, however SFASU will evaluate future possibilities in savings and usage reduction and discuss the feasibility of incorporating initiatives in FY2023.

Strategy for Achieving Goals

SFASU will continue to build on the success achieved through the implementation of recent facility improvement measures, including the use of performance contracting, opportunities presented through the capital renewal process, taking advantage of available funding incentives, and by achieving best practices through its operations and maintenance programs. Specifically this includes, but is not limited to the following:

Performance Contracting:
SFASU has already realized the benefits of performance based contracts in its pursuit of achieving utility reductions. Due to the results achieved through this partnership, it is expected that SFASU will continue exploring other viable facility improvement measures in this manner.

Capital Renewal Program:

- Perform economic analysis and life cycle costing for major system purchases.
- Specify cool roofing technology for replacement projects.
- Upgrading constant volume air distribution systems with variable air volume systems.
- Replacing pneumatically controlled systems with direct digital control.
- Replacing boilers with more efficient condensing units.
- Upgrading existing HID lighting at outdoor athletic venues to LED technology.

Incentive Programs:

- Apply for utility rebates where applicable.
- Utilize tax credits where appropriate.
- Applying for grants when available.
- Negotiate better rate contracts for utilities whenever possible.

Operations & Maintenance Practices:

- Controlling conditioned environments remotely through an integrated building automation system to approved standards and schedules.
- Continue upgrading lighting as reliable technological advancements dictate.
- Replacing motors with premium efficiency units; installing variable frequency drive units where feasible.
- Perform maintenance on all related equipment and components in accordance with manufacturer recommendations and established and evolving best practices.
- Monitoring and reporting consumption levels and variances for all utilities.

Implementation Schedule

Due to the tabling of Phase 4, SFASU entered into an agreement with a professional engineering & consulting service to expand Central Utility Plant #1. The agreement and subsequent results from evaluation(s) have been completed under the first step of a project that will enable Central Utility Plant #1 to feed three additional buildings in conjunction with planned construction activities. This construction project began in November 2020 was completed in FY2022. This upgrade will create greater efficiencies in Power Plant #1 operations to serve the 3 additional buildings and is expected to reduce overall utility consumption.

The SFASU plan for measurement and verification of savings for each facility improvement measure (FIM) is consistent with the International Performance Measurement and Verification Protocol. Depending on the improvement measure, one of the following four options will be used:

Option A – Retrofit Isolation: Key Parameter Measurement

Savings are determined by field measurement of the key performance parameter(s) which define the energy use of the FIMs affected system(s) and/or the success of the project. Measurement frequency ranges from short-term to continuous, depending of the expected variations in the measured parameter, and the length of the reporting period. Parameters not selected for field measurement are estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter is required. The plausible savings error arising from the estimation rather than measurement is evaluated.

Option B – Retrofit Isolation: All Parameter Measurement

Savings are determined by field measurement of the energy use of the FIM-affected system. Measurement frequency ranges from short term to continuous, depending on the expected variations in the savings and the length of the reporting period.

Option C – Whole Facility

Savings are determined by measuring energy use at the whole facility or sub-facility level. Continuous measurements of the entire facility's energy use are taken throughout the reporting period.

Option D – Calibrated Simulation

Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility. Simulation routines are demonstrated to adequately model actual energy performance measured in the facility.

Finance Strategy

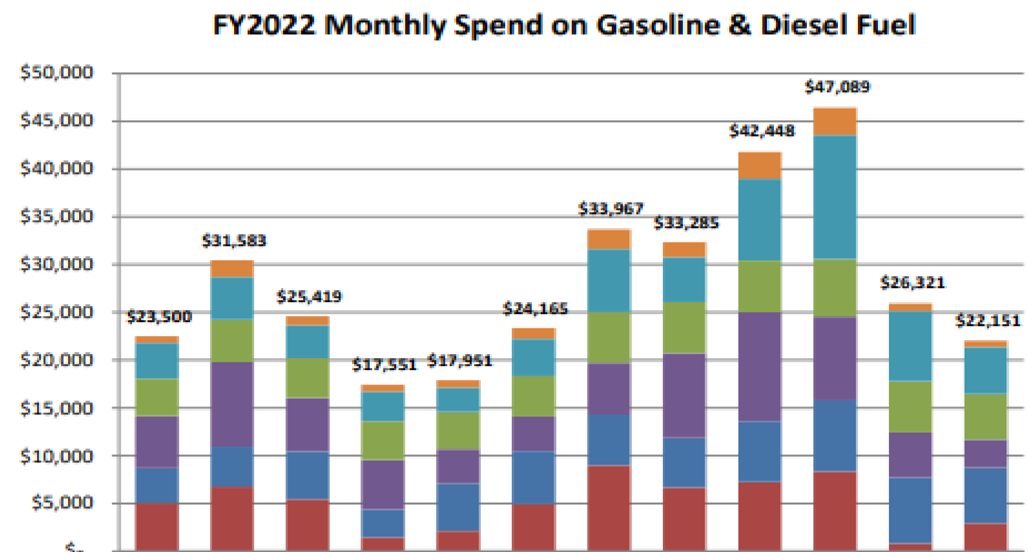
SFASU has incurred debt in excess of $28M to finance various facility improvement measures to reduce energy and water consumption. As of September 1, 2022, SFASU had the following outstanding debt related to energy service contracts:

Date (Fiscal Year)	Phase l & ll Beg Balance	Phase l & ll Payment	Phase lll Beg Balance	Phase lll Payment
FY 2021	$1,655,805	$1,506,436	$8,723,373	$956,737
FY 2022	$182,666	$190,913	$8,001,294	$977,991
FY 2023	$0		$7,238,538	$999,735
FY 2024			$6,433,520	$1,021,979
FY 2025			$5,584,603	$1,044,735
FY 2026			$4,690,093	$1,068,017
FY 2027			$3,748,240	$1,091,834
FY 2028			$2,757,234	$1,116,202
FY 2029			$1,715,202	$1,141,133
FY 2030			$620,208	$620,208
FY 2031			$0	

SFASU will continue exploring feasible opportunities while managing its debt obligations. Future projects will be funded with available capital improvement funds and likely will utilize energy service performance contracting.

Gasoline Consumption

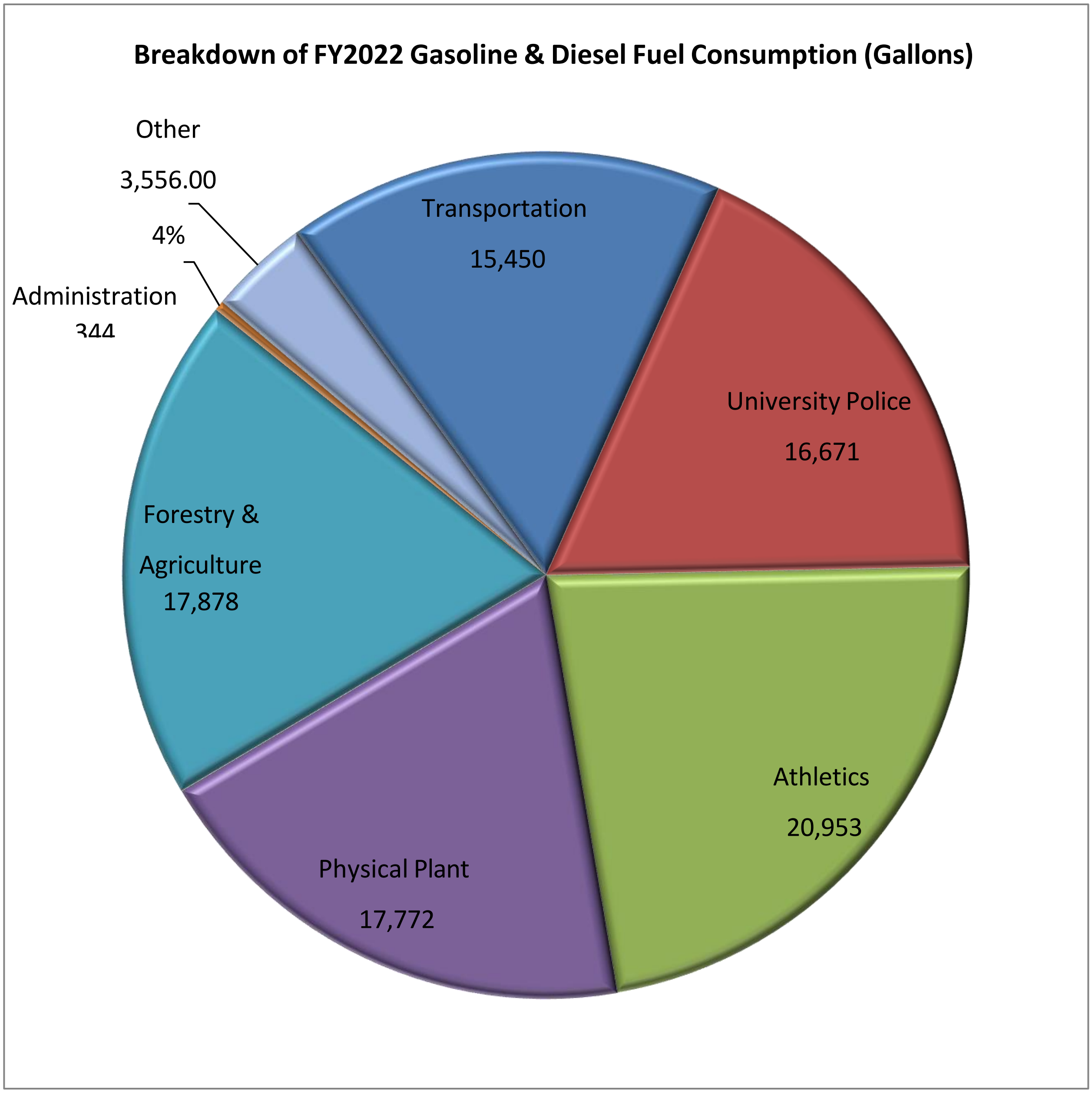
During fiscal year 2022, SFASU reported using 95,382 gallons of gasoline and diesel (fuel) at a total cost of $345,430 and an average cost of $3.62 per gallon. These figures represent an increase in consumption of 1.2% and a cost increase of $123,499 compared to FY2021. The increases in consumptions can be attributed to the return of faculty, staff, and students to campus as cases of COVID-19 continue to decline. The average cost per gallon increased by $1.27 for the year. Monthly consumption is broken down on the following chart. Note that SFASU was shut down for twelve days around the Christmas / New Year's holiday season, another nine days in March for Spring Break and nine days for the week of Thanksgiving.



	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22
Totals	$23,500	$31,583	$25,419	$17,551	$17,951	$24,165	$33,967	$33,285	$42,448	$47,089	$26,321	$22,151
Other	$671	$1,755	$936	$682	$703	$1,113	$2,036	$1,551	$2,796	$2,844	$786	$667
Forestry & Agriculture	$3,788	$4,480	$3,464	$3,118	$2,577	$3,907	$6,626	$4,742	$8,561	$13,025	$7,379	$4,888
University Police	$3,842	$4,452	$4,112	$4,065	$3,876	$4,197	$5,306	$5,336	$5,438	$6,016	$5,316	$4,740
Athletics	$5,492	$8,807	$5,603	$5,219	$3,563	$3,588	$5,384	$8,846	$11,347	$8,752	$4,694	$2,951
Physical Plant	$3,612	$4,175	$5,006	$2,902	$5,015	$5,567	$5,317	$5,174	$6,387	$7,420	$6,911	$5,832
Transportation	$5,076	$6,782	$5,459	$1,452	$2,126	$4,956	$9,002	$6,687	$7,249	$8,370	$826	$2,935

The chart on the following page shows the breakdown of fuel (gallons) by SFASU department. The Athletics Department surpassed the Transportation Department as the biggest user of fuel in FY2022. The Athletics Department travels extensively for games and recruitment activities. The Forestry/Agriculture Department was the second highest consumer of auto fuel. This department takes many field class trips and travels for research activities throughout the year. The Physical Plant

Department, which is the largest department on campus providing various building trades, custodial andtrash collection services, and grounds maintenance was the third highest user. The University Police Department followed as the fourth highest user of fuel. This department is driving "rounds" throughout the campus on a 24/7 basis. The Transportation Department provides vehicles, vans, road buses, and shuttle service for the campus community and came in as the fifth highest consumer of fuel in FY2022.



Identified gasoline reduction opportunities, include:

- Continue updating fleet with models that offer improved mileage.
- Research and implement fuel saving technologies such as fuel additives, alternative fuels, electric vehicles, hybrids where feasible as well as any infrastructure improvements necessary to support the technology.
- Plan fleet design and utilization starting from the top, as a whole institution, rather than individualized departments.
- Set department limits on fuel consumption and/or award/penalize departments who cannot meet limits or cannot improve fuel consumption.
- Consider renting vehicles for longer trips when rental vehicles offer better fuel mileage.
- Plan of choosing the most economical vehicle for the desired trip (i.e. do not use a twelve- passenger van with only two passengers).
- Analyze and implement department head approval for travel and what type of vehicle should be taken.
- Encourage utilizing online training and meeting options in lieu of travel.
- Encourage car-pooling for travel and or work assignments.
- Plan daily trips to maximize traveling efficiency.
- Encourage walking or using the shuttle service for inter-campus travel.
- Implement stronger security controls over fuel purchases.
- Reduce access to fuel cards for vehicles in each department.

SFASU uses two battery powered ATV's for grounds maintenance. These vehicles are out and about campus each weekday. They help campus gardeners perform their duties and the special services group to collect trash from exterior waste receptacles on a regular basis.

SFASU will carefully consider the feasibility of alternative forms of transportation as each fleet vehicle is due for replacement.

Employee Awareness Plan

Employee awareness initiatives on the SFASU campus include the following:

1. Maintaining a sustainability website that includes:

- Definition of sustainability
- Vision Statement
- Goals and objectives (with graphs of results)
- Campus initiatives – outlines various facility improvement initiatives completed at SFASU
- Getting Involved – campus and local events
- News – i.e. announcing new electric utility vehicles for grounds maintenance
- Fun facts
- Student Tips (shown below)

Tips for Students

In the Residence Hall:

- Use compact fluorescent bulbs, which last longer and use less energy than regular bulbs.
- Turn off unnecessary electrical devices when you leave a room for more than 15 minutes.
- Do not leave computers on all night.
- Unplug appliances and electronics when not in use, or use a power strip and turn it off when not using it.
- Use natural light rather than electric whenever possible.
- Buy inexpensive mugs and plates that you can wash rather than disposable ones and avoid over-packaged takeout food.
- Buy a water filter and refill a reusable container instead of buying cases of bottled water.
- Share magazines and books.

In the bathroom:

- Take shorter showers; don't run the water before getting in, and turn off the water when lathering.
- Report leaky faucets and showerheads.
- Don't use the toilet as a garbage bin. Toss tissues and waste in the trash cans.

In the laundry room:

- Only wash full loads of laundry.
- Wash your clothes in cold water.
- Use products containing the least amount of bleaches, dyes and fragrances.
- Air dry whenever possible.

In the classroom:

- Use refillable binders instead of notebooks or use a laptop.
- Take notes on both sides of paper.
- Unless you're handicapped, don't use automatic handicap doors.
- If it's OK with your professor, hand in assignments by printing on both pages, or online.

In the dining hall:

- Carry a reusable cup or water bottle. Some water bottles come with built-in filters if you're worried about the quality of the tap water.
- Limit the use of paper napkins.
- Only take what you will eat to limit food waste.
- Dispose of waste in the correct container.

2. Communications from senior management to all staff regarding the conservation program, results achieved, and contractual obligations of SFASU.
3. Friendly shutdown reminders during the institution down time encouraging all to turn off everything possible and avoid using the facilities.

From: VP of Finance and Administration No Reply
To: ALLFACSTAFF-L
Subject: Spring Break 2020 Campus Notification
Date: Monday, March 2, 2020 10:47:24 AM

Notice:

In an effort to maximize utility savings associated with the Spring Break week closure, the following operational changes will be in effect from March 7 - March 15, 2020.

- Power Plant Chillers (cooling) and building air handling equipment will operate only for critical areas.
- Buildings with dedicated HVAC equipment will be shut down or adjusted manually to conserve energy.

In addition, we ask that you please do your part by participating in the reduction efforts. Below is a list of actions that will help us realize our energy consumption and associated cost reduction goals:

- Minimize use of SFASU buildings (this will help stabilize interior conditions and keep the lights off).
- Turn off peripheral electronic equipment (printer, monitor(s), copier, etc.) before leaving on the afternoon on Friday, March 6, 2020.
- DO NOT turn off your PC; there will be updates applied by IT over Spring Break and all machines MUST remain on to receive these updates.
- Adjust your thermostats down or turn the heating option "off" if you are in one of the smaller off-campus buildings.

Should you have questions or concerns, please contact the following:

During Normal Working Hours
[redacted]
Manager of Mechanical Maintenance & Building Trades
Office: x4546 / Mobile: [redacted]
[redacted]

After Normal Working Hours
University Police Department
x2608

4. Passive reminders reminding everyone to conserve, such as lighting controls throughout the campus and water aerators at bathroom/kitchen lavatories and resident showers.
5. In January, 2014, SFASU officially opened the Ina Brundrett Conservation Education Building in SFASU's Pineywoods Native Plant Center. The 3,100 square foot facility will assist with the development and presentation of environmental education programs year-round, rain or shine. Funded entirely through private donations, the building is designed to integrate educational and outreach programs offered to the more than 17,000 SFASU Gardens visitors each year. The facility includes a 12.75 kW solar array system installed on the building's roof which results in approximately 50% energy savings. The solar array was acquired through a $30,000 donation from the Sun Club, a program of Green Mountain Energy, which is the country's longest-serving renewable energy retailer. The array and its energy-use monitoring system also will serve to educate students and visitors about solar energy.
6. Annual Earth Day activities held in the main plaza in which various student organizations participate in order to raise awareness to their specific causes.
7. Consolidation of observed holidays to achieve prolonged equipment shutdown periods in order to reduce energy consumption and realize greater savings.

Designated Contact:

Matt Romig
Plant Operations Analyst, Physical Plant Dept.
P.O. Box 13031, SFASU Station Nacogdoches, TX 75962-3031

Work: (936) 468-7232
Fax: (936) 468-4446
Email: romigmatt@sfasu.edu

APPENDIX D

Interview Questions for SFA Personnel

1. How important is environmental stewardship for SFA (pollution prevention, recycling, waste management, etc.)?
2. Is there a specific area of environmental management that you believe we can focus more attention on?
3. Do you have any hesitations or concerns that SFA may face moving forward in the ISO 14001 accreditation process?
4. What is something that I should consider or be aware of from the perspective of top management?
5. What would top management want to see or be informed of throughout the ISO 14001 accreditation process?
6. Becoming accredited would require SFA to be audited on an annual basis. Would this pose an issue or concern?
7. The cost of becoming accredited and the upkeep of accreditation is expected to be high. How would this affect SFA moving forward in the ISO 14001 accreditation process?
8. Do you believe this accreditation will benefit SFA? If so, in what way(s)?
9. Did you know about ISO 14001 or ISO, as a whole, before this interview?
10. As the Interim Vice President of Finance and Administration, would you support SFA becoming ISO 14001 accredited?

APPENDIX E

Interview Questions and Answers with Organization

Currently ISO 14001:2015 Accredited

CONSENT FORM

STEPHEN F. AUSTIN STATE UNIVERSITY

Arthur Temple College of Forestry and Agriculture, Division of Environmental Science

CONSENT FORM

Thank you very much for your willingness to participate in my interview process which is part of my Master's Thesis: ISO 14001:2015 Environmental Management System Accreditation Framework for Stephen F. Austin State University (ISO 14001). The interview process will include a list of questions about ISO 14001. This will allow me to better understand the ISO 14001 implementation process.

Participation in the ISO 14001 interview process is voluntary and you may discontinue participation at any time. Please feel free to share with us any discomfort you have during the interview process. There are no negative consequences if you choose not to participate. We do not anticipate any risks of participation. You will be asked to complete a consent sheet when you are interviewed. Consent sheets and attendance lists are kept to ensure that the appreciative inquiry is representative.

All information gained from the interview process and your answers will be used for the benefit of my Master's Thesis. Your specific response will be confidential. As a participant you are also eligible and encouraged to request a full copy of reports. This will be available after the interview process has been completed.

We believe that your involvement in the interview process will be very valuable to this study.

If there are any questions or concerns you are welcome to contact Graduate Research Student, Breanna Duran at duranbg@jacks.sfasu.edu or (936) 468-4442, Dr. Sheryll Jerez (Director of Environmental Science) at (936) 468-6614 or the SFA Office of Research and Graduate Studies (936) 468-2807.

Please sign the form. This form will be kept with Breanna Duran. Please contact the Impact Breanna if you would like a copy.

Participant

29 Aug 2023

Date

QUESTIONS

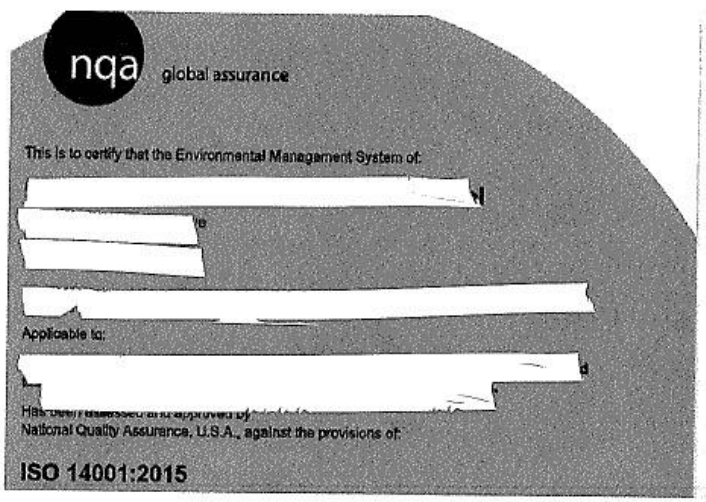
1. How long has [redacted] been ISO 14001 certified?

   The site has been ISO 14001 certified since 2005.

2. Does have additional ISO certifications?

   The site is only 14001, other sites such as to have the additional 45001 cert.

3. What ANAB-accredited certification body did I use to obtain ISO 14001: EMS standing?



nqa global assurance

This is to certify that the Environmental Management System of:

Applicable to:

Has

National Quality Assurance, U.S.A., against the provisions of:

ISO 14001:2015

4. How long did the initial process take to obtain ISO 14001?

   Estimated at or around 1 year

5. What objectives were set to be achieved (environmental, socio-cultural, economic, etc.)? Please list and/or describe.

Protect the environment • Fulfil the organization's compliance obligations • Setting environmental objectives & targets • Continually improve the EMS to enhance environmental performance.

6. **Please indicate the initial cost of obtaining ISO 14001 standing:**

☐ < $20,000

☐ $20,000 to $40,000

☐ $40,001 to $60,000

☐ $60,000 <

7. Please indicate the average renewal cost of maintaining ISO 14001 standing:

☐ < $20,000

☐ $20,000 to $40,000

☐ $40,001 to $60,000

☐ $60,000 <

8. What was the most important aspect that l needed to implement or revise to align with ISO 14001?

   For the it was a pretty smooth certification, the site as a whole already practiced most of the principles of ISO 14001. We have always had a dedicated team committed to the environment.

9. What was and is currently a key factor in implementing and maintaining the EMS (e.g., training or commitment from management)

   Dedication from management to support and push for continuous improvement once certified.

10. What circumstance interfered with the ambition and/or implementation of the EMS?

None

11. What commitments are embodied in the EMS, for example, support for continual improvement, support for the prevention of pollution, monitoring, meeting or exceeding legal requirements, and consideration of the expectations of interested parties?

All the above!

) has a solid program that works hand in hand with the management team to ensure every aspect of support is received. We go above and beyond to continuously improve our environmental programs and exploring solutions that are beneficial to the company and conservation efforts.

12. Did the ISO 14001 accreditation, overall add value or benefits to

I ı?

Certification added value in more ways than one. This cert helped us add credibility to the company name, compete for contracts, attract talent, and build a better relationship with both the (

13. What advice would you give to an organization that would like to obtain the ISO 14001 accreditation, especially a small-scale university such as SFA?

Get 100% management buy in, dedicate a team, and structure a detailed plan of action for implementing and growing the program.

14. Would _____ like to remain anonymous throughout the research and any possible publication that may result once this Thesis is completed?

Yes

Additional Notes/Comments:

Any publication will need to be pre-approved through L corporate.

8/28/2023

Participant

Date

The above agree that all questions were answered truthfully and to the best of their knowledge.

Interviewer

Date

VITA

Breanna G. Duran attended Angelina College in Lufkin, Texas where she earned her Associate of Arts in General Studies in Fall 2019. In Spring 2020, she transferred to Stephen F. Austin State University where she received her Bachelor of Science in Environmental Science under the Division of Environmental Science at Arthur Temple College of Forestry and Agriculture in Spring 2022. Following graduation, she entered the Graduate School to pursue a Master of Science in Environmental Science at Stephen F. Austin State University in Nacogdoches, Texas.

Permanent Address:

1210 County Road 392
Nacogdoches, Texas 75961

This thesis was typed by Breanna G. Duran and is based on the Chicago Manual of Style, 16th edition.