Green Building Practices at Small Liberal Arts Universities: A Case Study of Southwestern University

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1) Introduction

The environmental movement of the 60s and 70s gave rise to one of the most important terms of the 21st century: “sustainable development” (Amarel et al, 2015). Dozens of definitions have been formulated since its introduction, but the United Nations has marked sustainable development as a type of progress that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (Hopkins, 2016, pg. 340). In 2015, the UN created a list of seventeen sustainable development goals to reach by 2030 (United Nations, n.d.). Of these seventeen goals, green building has the opportunity to fulfill six: good health and well-being, affordable and clean energy, industry, innovation and infrastructure, sustainable communities, and responsible consumption and production. Green building has since proven substantial in allowing further growth while also maintaining environmental responsibility.

The United States building sector, including homes, hotels, schools, and skyscrapers, accounts for about 40% of all carbon dioxide emissions (EESI, n.d.). Including construction and renovations, these buildings consume “a third of global resources, one sixth of global freshwater withdrawals, 25% of wood harvested, and 40% of all raw materials,” accounting for “40-50% of all energy usage and anthropogenic greenhouse gas emissions globally” (Doan et al., 2017, pg. 244). Because the energy demands of buildings are so large, designing and constructing energy efficient buildings can create meaningful decreases in energy consumption that align with the UN’s sustainable development goals. Constructing and preserving buildings is crucial to modern society, and pursuing green building design has the potential to be a crucial middle ground between growth and sustainability.

Sustainable development and climate mitigation are increasingly important as global temperatures continue to rise. The Intergovernmental Panel on Climate Change has reported with high confidence that climate change will cause irreversible damage to Earth's ecosystems and human life by 2100 (Allen et. al., 2018). Because green building incorporates mitigatory, and sometimes regenerative, architecture, this industry can positively influence organized actions against climate change. This positions universities to be leaders in green building because of their widespread commitment to counteract climate change through signatories to the Talloires Declaration, President's Climate Agreement, and membership to the Association for the Advancement of Sustainability in Higher Education (AASHE) and other sustainability in higher education organizations.

According to 2016-2017 data, there are over 4,500 college campuses in the United States (U.S. Department of Education & NCES, 2018). Many of these institutions have several educational, commercial, residential, and mixed-use buildings that consume large amounts of energy to maintain everyday operations. While green building and sustainable efforts should be at the forefront of any facility's developmental plans, universities play an even more crucial role in the progress towards making sustainable development more standardized. Higher education institutions have a "special social responsibility" in this specific societal development, "particularly on the education of future leaders and on the proliferation of public awareness about sustainability" (Amaral et al., 2015, pg. 156). Because of the massive influence the next generations will have on these pressing issues, universities have the power to promote a development pattern that advocates for environmental responsibility and the execution of appropriate sustainability efforts.

Pioneering this movement, many universities across the world have signed declarations that require campuses to build their sustainable initiatives (Amaral et al., 2015). To address these initiatives, universities commonly pursue green building certifications, such as LEED, WELL, and Living Building Challenge. A building does not need to be certified to be sustainable or well-built, but certification ensures a third-party assessment of the project to evaluate its adherence to the standards put forth. Certification proves the credibility of the project and provides opportunity for impactful marketing and educational lessons. However, there are valid critiques of green building, too. Certifications and green building practices ascribe a monetary value to the level of "greenness" a building possesses, which can hinder the social justice aspects of the environmental movement and deter the relationship it has with capitalism (Knuth, 2016). Depending on the level of certification that is pursued, green building can also be a prominent form of greenwashing--having the appearance of reducing environmental impacts without actually creating the change necessary to do so. The benefits and disadvantages of green building certifications must be evaluated to determine whether it makes sense for each institution.

Green building and building certifications have both positive and negative environmental impacts as each certification has its own benefits and limitations. This paper will discuss both these impacts through a 15-page literature review in Section 2. Our research and findings were then used to create a document of recommendations for improving green building on college campuses around the United States. The fourth section is a list of compiled findings to fit the frame of Southwestern; The Southwestern Green Building Commitment is a document for this university specifically to promote and promise the installment of green building initiatives. The goal of this paper, as well as our Capstone as a whole, is to provide a compelling argument for

the implementation of green buildings and sustainability initiatives on more college campuses in the United States in order to continue our work protecting the planet that we call home.

2) Literature Review

2.1) Defining Green Buildings

Green building aims to "use processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction" (Green Building, 2016, para. 1). The concept was developed in the 1990s, following the environmental movement of the 1960s and 70s. In addition to its focus on the responsible allocation of resources, green building strives to protect occupant health and reduce waste and environmental degradation while expanding on classical building design concerns of "economy, utility, durability, and comfort" (Green Building, 2016, para. 1). Because of its focus on reducing negative impacts on the environment, green building design is an essential component of building construction and renovation in order to mitigate climate change and lessen impacts on the environment.

Certifying a green building with a third party certification process differentiates the project from other green buildings. The certification's rating system is intended to measure the sustainability of construction and daily operations. Green building certification systems provide a standard and platform to promote projects that are environmentally responsible and strives for the most efficient use of resources throughout the life of the building. "The rating systems appraise and reward levels of compliance or performance with specific environmental goals and requirements." (Vierra, 2019). Regardless of the differing philosophies and approaches that types of certifications mandate, the main goals of these ratings are to implement designs while being

cognizant of and prevent any harmful impacts to human health and the natural environment the project inhabits.

Pursuing these certifications have a number of other benefits besides environmental protection. Although a building does not need to be certified to be sustainable or well-built, pursuing a certification "is the best and easiest way to obtain ethical and economical recognition for your projects" (Alpine Limited, 2016/17, p.2). In addition, certifications provide valuable education as a guidance for future construction practices, along with highly effective marketing that shows the project and developer's devotion to increasing the standard of sustainability when building (Vierra, 2019). It is also important to note that many green building certification programs have proven to lower operation costs while increasing overall value and return on investment (Vierra, 2019). Higher productivity and increased occupant health are another benefit of sustainable buildings because they implement "better indoor environmental quality, increases in natural daylighting, and healthier materials and products within," which creates a building that is not only better for the environment but for those who inhabit it (Vierra, 2019, para. 44).

2.2) Sustainable Materials used in Green Building

Resources, materials, and products used in construction, renovation, and daily use account for much of the negative environmental impact of buildings. According to the Environmental Protection Agency (EPA) "building-related construction and demolition (C&D) debris totals approximately 160 million tons per year, accounting for nearly 26 percent of total non-industrial waste generation in the U.S." (p. 6). According to the U.S. Green Building Council, the main areas of focus when it comes to building materials and resources are 1)

conservation of material, 2) environmentally preferable materials, and 3) waste management and reduction (USGBC, 2019a). These include eliminating excess materials during the planning and design phases, using materials that are sustainably grown or made from renewable materials, and recycling and reusing materials when possible (USGBC, 2019a). In addition, using energy efficient products in buildings helps protect the environment through reduced energy use and overall monetary costs throughout the lifetime of the building. Therefore, it is important to shift building design towards more sustainable building materials.

Embodied energy refers to the energy associated with the entire life cycle of building materials. This includes the extraction, production, and usage of these products, which each generate carbon and other greenhouse gases (Architecture 2030, n.d.). As buildings are demolished before the end of their expected life cycles, the ratio of embodied carbon to carbon emissions is rising and becoming more important. Concrete and steel have a relatively high amount of embodied energy when compared to wood, a material that requires small amounts of energy to produce (IPCC, 2007). Concrete cannot be reused (Humphries, 2014). When a concrete building is demolished, the remains cannot be repurposed and are generally sent to landfill. Steel is newer than concrete, but shares similar negative environmental impacts. In fact, current estimates show that every ton of wood used as an alternative to other materials helps avoid 2.1 tons of carbon--both embodied and emitted (Lippke & Edmonds, 2019). Its incredible impact on carbon emissions and embodiment is bolstered by its reliability as a building--houses built over 800 years ago still stand today (Hoibo et. al., 2015). A shift towards wood in construction again will help avoid the most drastic energy consumption and carbon emissions during production.

Resource efficiency is another consideration when picking out sustainable materials for construction. Wood is renewable, but it should also be harvested from sustainably managed sources (CalRecycle, n.d.) The Forest Stewardship Council (FSC) certifies companies that responsibly manage their forest resources in order to ensure that there will be enough timber available in the supply chain (FSC, n.d.). Local availability is also an important consideration for sustainable materials--transportation as a whole contributes to 29% of greenhouse gas emissions in the U.S. (EPA, n.d.). Sourcing materials locally cuts down on emissions from transportation, and consequently their embodied energy. Resource efficiency plays a large role in determining the most sustainable options for construction.

Beyond construction, it is important to consider the sustainability of products used in buildings. From furniture to cleaning products, there is room to reduce toxic emissions that improve tenant well-being. Volatile organic compounds (VOCs) can react with other gases to form air pollutants that have been known to cause cancer and respiratory illnesses (American Lung Association, n.d.). VOCs can be found in paint, flooring, furniture, and cleaners. MAS Certified Green is a certification standard that ensures products are low VOC emissions to reduce the harmful effects of these air contaminants (MAS Certified Green, n.d.). Since there are no federally enforceable standards for VOC emissions in the U.S., MAS Certified Green is the only current option to certify that a product is not emitting these harmful air pollutants.

2.3) Green Building Certifications

In 1990, sustainable design received a significant push with the introduction of the first green building rating system in the world, Building Research Establishment's Environmental

Assessment Method (BREEAM) (Vierra, 2019). Ten years later, the U.S. Green Building Council (USGBC) followed the lead and introduced similar criteria through its Leadership in Energy and Environmental Design (LEED) rating system. Today, there are many different types of green building certifications that are suitable for a wide range of building types from residential single-family homes to corporations and university campuses.

LEED focuses specifically on non-residential buildings and implement practices such as energy efficiency and overall best sustainability practices in order to limit impact on the environment. Certifications focusing on residential homes and the components of a home include Energy Star for Homes and HERS (Home Energy Rating System, and National Green Building Standard) and work with homeowners to gain certification. WELL Building certifications focus on the health and wellness impacts that buildings have on occupants and concentrate on areas such as air, water, nourishment, and light. The Living Building Challenge is under the International Living Future Institute and have very high standards that focus on creating a building that has net zero energy, water, and beauty.

After researching various certification types, it has been found that LEED, WELL, and the Living Building Challenge are best suited for implementation on a college campus. The following sections will go into more detail about each of these certification types and their certification process.

2.3.1) USGBC and the LEED Certification

The USGBC has worked closely with LEED to build a contemporary standard of new construction that maintains the health and vitality of communities. Established in 1993, the

USGBC now has over 12,000 member organizations that represent more than 13 million people around the world. There are four levels of membership for the USGBC that range from the following: Organizational ($450/year), Silver ($1,500/year), Gold ($5,000/year), and Platinum ($20,000/year). The USGBC has worked to assist universities in meeting LEED, Parksmart, PEER, SITES, TRUE, and WELL certifications and provide a Campus Implementation Workbook to track their progress along the way. Each of these certifications contribute to the overall health and sustainability of college campuses. Additionally, they help institutions integrate sustainability into all facets of education, such as enhancing courses to prepare students for the LEED Green Associate Exam.

Since its introduction and the kickstart it gave sustainable design, LEED has maintained a high level of awareness, becoming the green building standard of the United States, and arguably the most well known green building certification in the world (Alpin Limited, 2016/17, p.3). LEED has worked to register and certify commercial buildings, college campuses, multi-use skyscrapers, hospitals, and single family homes (USGBC, n.d.). According to the USGBC, LEED is currently operating in over 2.2 million square feet, with more than 90,000 projects across 165 countries and territories, surpassing any other green building certification in all three categories (USGBC, n.d.).

In order to pursue LEED certification, the first step is to register with the site. Registration costs $1,500, but that price is cut by $200 if the team is firstly a member of the USGBC. LEED argues there's a certification "for every type of building project," which creates a variety of certification categories for different forms of buildings and projects (USGBC, n.d., para. 2). The certification process consists of five different rating systems corresponding to

varying building types and phases: Building Design and Construction, Interior Design and Construction, Building Operations and Maintenance, Neighborhood Development, and Homes. Fees that come along with certification are based on the specific rating system pursued and the overall size of the project (USGBC, n.d.). There are several pursuable credits specific to each rating system chosen, but all fall under the categories of "location and transportation, sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and more" (USGBC, n.d., para. 6). Beyond these credentials and their specific credits, LEED offers different combinations in order to create a LEED community that can easily adapt to any building type that may not fit into the categories. After picking the most appropriate credential and completing the pre-assessment requirements, a third party organization associated with LEED reviews the project's credibility and awards a certification level. Based on the number of points achieved in each category, a project can earn a Certified, Silver, Gold, or Platinum certification (USGBC, n.d.).

2.3.2) IWBI and the WELL Certification

In 2014, the International Well Building Institute introduced the WELL Building Standard. Alongside monitoring its environmental impact, this newer certification focuses specifically on the health and wellbeing of the humans inhabiting the space as it strives to create buildings "designed, constructed, and maintained to improve the health, happiness, wellness, and productivity of its users" (WELL, n.d., para. 7). WELL membership and certification costs increase with the square foot of the building project which range from $1,800 to $4,200 for registration and $5,000 to $116,000 for initial certification costs with required recertification

every three years. Educational facilities, such as public and private schools, primary, secondary and universities are qualified for a 35% discount which serves as an incentive for attaining certification. WELL has been running its first standard version, V1, since 2014, but in 2018 released the pilot version of the new WELL V2. Today, there are over 3,700 projects operating under the WELL Building Standard across 58 countries, accounting for 443 million square feet of WELL (WELL, n.d.). In the United States, three universities are currently utilizing the WELL certification on their campus (personal email).

WELL V1 and V2 operate on a points system that rate a project's health and wellness impacts between seven different Concepts: Air, Water, Nourishment, Light, Fitness, Comfort, and Mind. Since its first version, V2 has included three extra Concepts; Sound, Materials, and Community (WELL, n.d., para. 15). Each Concept focuses on specific health and wellness concerns, highlighting the potential impact of effective intervention.

2.3.3) ILFI and the Living Building Challenge

The International Living Future Institute (ILFI) first presented the Living Building Challenge in 2006 as a regenerative green building standard that goes above and beyond its predecessors (ILFI, 2019a). It markets itself as "a philosophy first, an advocacy tool second, and a certification program third" (ILFI, 2019b, p.4). Buildings that qualify for certification must meet the requirements while operating for at least twelve consecutive months and address all seven performance categories. These categories are referred to as Petals, and they cover place, water, energy, health and happiness, materials, equity, and beauty (ILFI, 2019b, p.14). A total of twenty target imperatives fall under these Petals, and work together to create buildings that are livable for everyone. This means achieving net-zero or net-positive energy and water, creating a circular economy that focuses on non-toxic, regenerative materials, reconnecting people to their environment and optimizing their health, and foster equitable and enjoyable surroundings (ILFI, 2019b). Hampshire College and Georgia Tech are two vastly different universities who have both successfully constructed a Living Certified building on their campuses (Draper & Rogers, 2018). Since then, more universities have started to consider Living Building Challenge as they begin new construction and renovation projects.

The Living Building Challenge has fees associated with project registration and determines total cost based on square footage. The registration fee is $900, which includes access to resources and documents to aid in the certification process. Depending on the square footage of the project, the price can range from $4,000 to up to $21,000. The initial certification fee includes a single Petal. Projects desiring to add additional Petals after certification are required to pay an additional fee that is less than the cost of the initial certification.

In addition to the Living Building Challenge, ILFI has other program types available that universities also pursue. Some universities, like San Francisco State University, have started to look at the Living Community Challenge (Steele & Kordesch, 2019). The Living Community Challenge helps organizations create master plans that connect communities to their natural surroundings (ILFI, "Living Community Challenge," n.d.). Instead of an individual building producing its own energy and water, the entire campus becomes responsible for these tasks. ILFI also has programs that are narrower in scope, like Zero Energy certification and the Living Product Challenge. The former focuses on achieving net-zero or net-positive energy, while the latter aims to inspire manufacturers to create products that improve the quality of the environment. Each of these help to lead campuses and other organizations towards fulfilling imperatives and Petals under the Living Building Challenge.

2.4) Benefits of Green Building and Certifications

In the age of climate change and environmentalism, more prospective college students are taking campus sustainability into consideration when applying to universities. According to the Princeton Review's 2019 College Hopes & Worries Survey, 64% of the respondents (prospective college students) said that "having a way to compare colleges based on their commitment to environmental issues would very much contribute to their decision to apply or attend" (The Princeton Review, 2019, p. 6). Marketing a university as sustainable and environmentally friendly can greatly increase student interest in the school as well as provide educational opportunities about the benefits of being sustainable and environmentally friendly.

Buildings with certifications such as LEED, Energy Star, Green Star, Well, etc. have the advantage of third-party assessment systems to ensure that the project is credible. Certified buildings offer visible benefits such as "higher rental or resale value, occupant and tenant satisfaction, worker productivity, pride of place, lower operating costs, and national recognition opportunities" (Green Building Alliance, 2016, para. 1). Having a green certified building serves as a valuable marketing opportunity that can increase the esteem of the institution.

Although certifications can be costly, there are numerous tax incentives available for green building in different states and municipalities across the country. These benefits can include tax credits, grants, expedited building permits, and reductions/waivers in fees (USGBC, 2019b). In many metropolitan areas across America, these standards have been successfully implemented due to an increasing trend in urban sustainability and connectivity as well as government transparency (Cease, et. al, 2019). The USGBC has identified 3 key features for effective tax incentives: 1) Measuring energy savings compared to the existing building baseline, 2) Linking the amount of the incentive to energy savings achieved, and 3) Tying a portion of the tax incentive to implementation of efficiency measures and a portion to demonstrated energy savings (USGBC, 2015).

Studies have shown that green certification standards pay for themselves in as little as three years through efficiency of resources such as water and electricity. According to the USGBC, LEED certifications have decreased some operating costs by 13.6% for new construction and 8.5% for existing buildings. The overall value of new construction can increase by 10.9% and 6.8% for existing projects, which has immediate benefits to the proprietor (USGBC, 2019b, para. 4). The cost savings from more green buildings on college campuses

would allow for universities to spend their money on other needs of their students, faculty, and staff rather than on building costs such as large energy and water bills.

Green building not only benefits the finances of a university but the social well-being of students, faculty, and staff on campus as well. Campus spaces are frequently occupied throughout the day, which make strategies to improve occupant well-being very important. According to the USGBC, it has been found that retrofitted buildings that improved indoor air quality have resulted in "reductions of: communicable respiratory diseases of 9-20%; allergies and asthma of 18-25%; and non-specific health and discomfort effects of 20-50%" (2019b, para. 6). Improved lighting design has also been linked to a "27% reduction in the incidence of headaches, which can lead to productivity loss and increased health care costs (USGBC, 2019b, para. 6). Focusing on social and environmental sustainability as a unit will not only benefit universities monetarily but also through increased productivity, decrease work loss, and higher satisfaction of student, faculty, and staff with their school and work environment.

2.4.1) Utilizing Sustainability to Improve Retention

A great benefit of green building on university campuses is the opportunity to improve student retention. Based on the responses from benchmarking, universities have been able to use their sustainability initiatives as a way to not only attract prospective students, but to increase overall student satisfaction and well-being while in college.

When asked if sustainability initiatives have helped with marketing and student retention, Colorado State University responded they market sustainability to their students and have also found that prospective students are choosing CSU because of their sustainable reputation. Based

on a survey they conducted, 96% of students said sustainability is important to CSU, 95% said sustainability is important to them, and 76% said it influenced their decision to attend CSU.

It is currently estimated that 39% of college students experience severe mental health issues, and many college counseling centers are worried that this public health issue is on the rise (Active Minds, n.d.; Mistler et. al., 2012). Addressing mental health at universities is a good way to improve the lives of these students, but also improve retention rates from year to year. Multiple studies have begun to explore the possibility for building design to influence mental health and well-being. For example, Dell Children's Medical Center of Central Texas is the first hospital to receive LEED Platinum certification, and as a result has seen increased happiness and reduced hospitalization times among their patients (Dell Children's, n.d.). It is important to note that the structure of the building was the primary thing that has changed--operations and services have continued as usual. Green building offers a unique opportunity for universities to connect with their students and directly improve their health and well-being.

2.5) Criticisms of Green Building Certifications

The degree to which green certifications decrease long-term spending and meet the overall needs of building and community inhabitants is largely contested. Certifications and green building practices also ascribe a monetary value to the level of "greenness" a building possesses, which could potentially have detrimental effects on the future of environmentalism (Knuth, 2016). Most of the criticisms of green building procedures focus on LEED certification, as it is one of the most widely used programs and therefore frequently cited within academic

literature (Bernardi, 2017). However, many of these criticisms can be applied to other green building standards because they all use similar methodologies to gauge their certifications. Common critiques of LEED certification standards include:

1. Can add significant costs to projects
2. Not context-specific for building needs
3. Point system can lead to a minimum level of effort to gain certification with limited environmental benefits
4. Often times LEED buildings are less energy efficient than counterparts

Buildings like One Bush Plaza in San Francisco and The Bank of America (BofA) Tower in New York have been posited as revolutionary examples of green building in the U.S., but, in reality, they have shown the limitations and pitfalls of certifications (Knuth, 2016; Roudman 2013). One Bush Plaza was retrofitted to adhere to green building standards in the years following the 2008 financial collapse (Knuth, 2016). Knuth argues that these retrofitting standards are a means to financialize a "second nature;" green buildings become a new commodity and therefore are exploited as a resource for capital gain (Knuth, 2016, p. 627). This leads to an oversimplification of the environmental needs in urban areas. The greening process "disconnect[s] buildings in time and space from...their environmental footprint while capitalizing on others" (Knuth, 2016, p. 629). This has been the case for both One Bush Plaza and The Bank of America Tower.

One Bush Plaza has a LEED Platinum certification for Existing Buildings: Operations and Maintenance (EBOM). LEED for Existing Buildings (EB) differs from LEED for New Construction (NC) based on the fact that existing buildings have actual performance data as a basis for certification rather than design expectations that are set for new construction. This completely ignores the conditions under which it was built—in a densely populated,

water-constrained location—while also rewarding the building for simple changes to its original infrastructure. Points were awarded to the building for switching water-hungry plants with native species, being conveniently located next to the Bay Area Rapid Transit rail system, and other superficial action items that bear no real weight on the building's harmful outputs. This gives weight to common criticisms that these certifications only truly achieve greenwashing—the illusion that environmental performance has improved while barely affecting real change (Knuth, 2016; Van der Heijden, 2015).

Likewise, the 55-story Bank of America Tower in New York City was certified as LEED Platinum in 2010 and boasts "waterless urinals, daylight dimming controls, and rainwater harvesting" features as part of their efforts to be the greenest building in Manhattan (Roudman, 2013, para. 1). However, it became evident in the fall of 2011 that the building was actually releasing more greenhouse gases than any other similarly sized office building in the area—even the Goldman Sachs headquarters, which has a lower LEED certification and is arguably the most similar to the BofA tower (Roudman, 2013b). This is the result of over-relying on predictions and plans, rather than focusing on how the building actually operates. Many speculate that because LEED is a private company without public input with architects and engineers who stand to gain from its utilization, that the focus is less on the operations of the building and more on the theoretical frameworks for the building (Medina, 2013). Even more, this speaks to the criticism that LEED certification, and others like it, aid more with green publicity than with actual energy and consumption reductions. It even speaks volumes over other criticisms of these certifications, which still claim that higher ratings reduce emissions while lower ratings do little to help (Alpine Limited, 2016/17, p. 3). The BofA Tower proved this wrong as it continued to

consume more energy and release more emissions than even the Empire State Building (Roudman, 2013). Both One Bush Plaza and the Bank of America Tower, while located on opposite coasts of the US, share a common failure in the green certification process.

LEED and other green certifications have also had issues accommodating the needs of entire communities. The Temescal neighborhood in Oakland, CA serves as a critical reminder of the shortcomings of these certifications. Boeing et. al. (2014) explores the livability of this neighborhood based on resident surveys. The results were then compared to current LEED community standards to evaluate whether this certification truly meets current societal and community needs. LEED for Neighborhood Development (LEED + ND) aims to "inspire and help create better, more sustainable, well-connected neighborhoods," and was influenced by traditional neighborhood designs like Temescal (LEED, n.d., para. 1; Boeing et. al., 2014). The University of Washington, Johns Hopkins, Columbia University, Syracuse University, University of Connecticut, and West Washington University have adapted LEED + ND to use on their campuses. These neighborhoods incorporate mixed-use development allowing for commercial and residential buildings to exist in harmony (Complete Communities, n.d.). LEED + ND has three prerequisites for communities wishing to become certified: (1) walkable streets, (2) compact development, and (3) connected and open community (LEED, n.d.). Immediately, Temescal was unable to attain LEED + ND certification because 23% of the streets had either a garage or driveway as frontage features, which disqualifies them as a connected and open community (Boeing et. al., 2014). LEED + ND assumes that this community is not livable, and Temescal scored very low on the LEED scorecard even after its immediate disqualification. Despite this, Temescal residents gave their neighborhood a livability score of 4.16/5, which

indicates that they find their neighborhood to be somewhere between *livable* and *very livable*. This discrepancy between the two scores shows that LEED and other green certifications do not immediately improve the lives of their constituents. This offers a genuine argument against pursuing these certifications on a case-by-case basis.

Understanding the criticisms of green building certifications is an essential part of any construction project in order to create an effective product. Following third party standards in building design holds architects accountable for the implementation of sustainability initiatives in their projects. Following a standard for designing green buildings on college campuses is essential in order to ensure sustainable practices are being met and to set a precedent for building design at other universities.

2.6) Green Building on College Campuses

Colleges are often labeled as hubs of knowledge and technology because of the focus on research in various educational fields. Sustainability has been integrated into many different courses as a means to solve environmental issues through research and/or publications. This prepares students to take this knowledge into the professional sector to continue working towards a more just world. College campuses and their students are a crucial part of the fight against climate change through the incorporation of sustainability initiatives on their campuses. Many of the top liberal arts universities have also adopted similar sustainability initiatives and policies. While some of these are more inventive and abstract, most of these policies still adhere to standardized benchmarks, like LEED.

Universities must invest in new buildings to accommodate a growing student population. Therefore, colleges should stress the importance of designing buildings with sustainability and longevity in mind. Konvalinka (2014) explains that "the motivation for an institution's commitment to sustainable design and construction...is driven by...environmental responsibility, institutional sustainability, student interest in environmental stewardship, and economic benefit" (p. 12). This is relevant to the nationwide discussion on the shift towards sustainable design in on-campus housing. Although the cost of constructing housing that qualifies for LEED certification is higher than the average housing unit, the return on investment is notably much higher (Konvalinka, 2014, p. 4). Universities around the country have implemented and are continuing to implement green building design through standards such as LEED, WELL, and Living Building Challenge and have experienced many benefits from doing so. However, implementing these initiatives also comes with their share of challenges and setbacks.

3) Findings From Other Universities

3.1) Methods

This project evaluated the green building standards at 74 American universities during the 2019 fall semester by researching their websites to understand the standards set in place for green building. Universities were picked based on their membership to one or more of the following categories:

1. Southwestern's peer and aspirant schools to assess what other universities are able to do with similar endowments

2. Schools with the highest endowments per student (excluding university systems) to evaluate what green building standards are adopted by universities with a surplus of funding
3. The top 25 Cool Schools (Sierra Club) to gauge the endowments of the most sustainable schools in the country

After compiling this list from online resources (The Best Schools, 2019; Sierra Club, 2019), we evaluated each website to understand their green building policies and procedures. From there, their contact information was recorded from their sustainability or facilities web pages. Contacts for this project hold titles like *Sustainability Coordinator*, *Director of Sustainability, Coordinator for Sustainability,* and *Director of Facilities*. Each of these positions contributes to a campus' building guidelines and procedures. All 74 universities were contacted via email and we received 27 responses. The following questions were included in the emails:

1. Does your university use LEED standards? If so, why did you choose this certification over other certifications? If not, why not?
2. What barriers have you faced in implementing these standards or similar sustainability initiatives?
3. Did you work with architects, consultants, or other external offices to implement these policies?
4. Have you been able to use these initiatives as a marketing strategy?
5. What advice do you have for a university attempting to develop new affordable and practical green building standards?

The information gathered linked trends between universities around the country and the implementation of green building standards on each of their campuses. From this data, information about the effectiveness of certain strategies over others can be found which helps when attempting to understand the best approach for green building design on college campuses.

3.2) Green Building Standards at U.S. Universities

After gathering data from university websites and email responses, each university was grouped into six categories; 1) total schools benchmarked, 2) schools with LEED certified buildings, 3) schools with policies requiring new construction and renovations to meet at least LEED-silver standards, 4) schools with policies requiring new construction and renovations to meet at least LEED-gold standards, and 5) schools that created their own green building standard (see Figure 1.1).

It became clear that the green building touchstone for U.S. universities is the use of LEED due to its early origins. Many of the benchmarked schools had LEED-certified buildings on their campuses, as well as policies that require new construction and renovation to be LEED certified. Although LEED was present on the majority of campuses, not all of the universities have policies in place for future buildings to become certified. The presence of other certifications in recent years has led schools to move beyond LEED and look to other certification standards such as WELL and Living Building Challenge. In addition, several of the universities made the decision to create their own green building standard that is more specific to the context of their school and goals. Although only 74 universities were benchmarked, each school can fit into multiple categories which creates overlap of the categories.

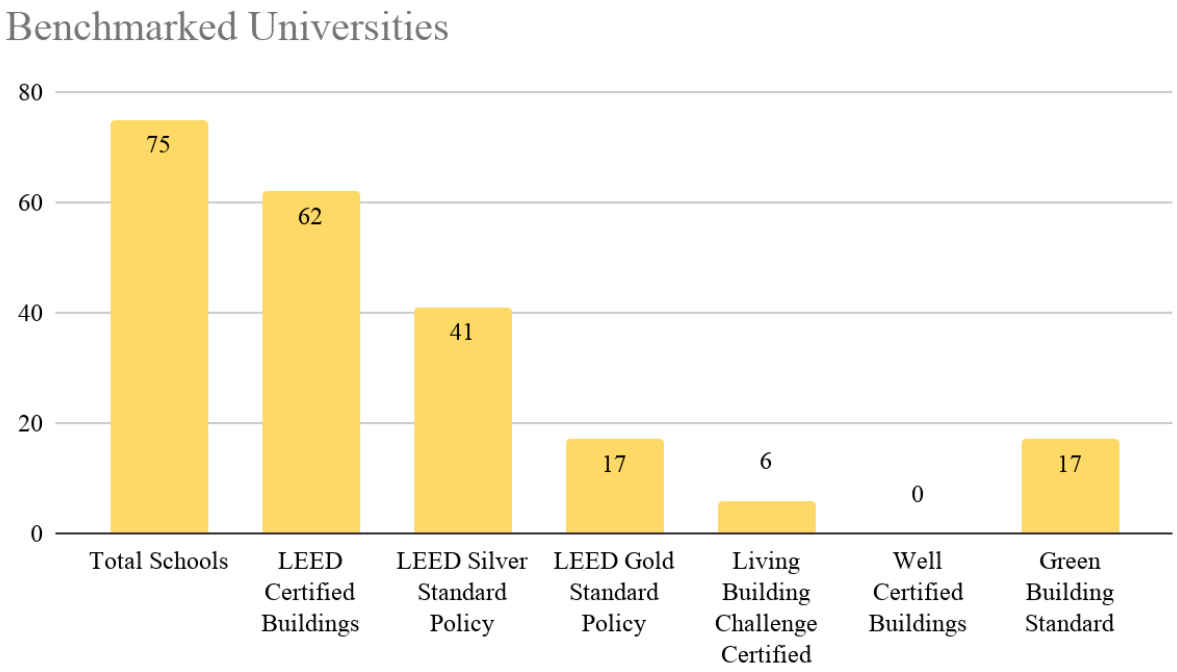

Figure 1.1

3.2.1) Why Universities Choose LEED

Based on responses from emails and phone calls it was found that out of the 83% of universities who chose LEED for their green building initiatives, 16% stated LEED was chosen because of its early prominence as a reputable certification and the industry standard at the time. While Lawrence University specifically mentioned these benefits of LEED certification (i.e., credibility, comparability, and marketing opportunities), this was a common thread between 26% of the benchmarked universities. As noted in their email response Carleton College believes using LEED benefits their college due to the fact that striving for a certification, although costly and time consuming, holds their architects to a sustainability standard that may not be achieved without the goal of a certification. For Carleton, their sustainability goals outlined by their

college are of the utmost importance and without striving for LEED certifications it is believed by their college that these goals would not be met.

In addition to using LEED on their campuses, 78% of the benchmarked universities have adopted a policy that requires all new construction and major renovation projects to be LEED certified at the level of silver standards or higher. According to the sustainability pages of university websites, as well as their email responses, obtaining LEED silver standards or higher for every project ensures a high level of sustainability is being met on their campus. Certifying buildings to meet higher LEED standards such as silver and gold will ensure the building is built to a higher level of sustainability than the baseline standards. This not only certifies a more sustainable building but gives universities a competitive edge over schools with lower LEED certification ratings.

While many universities use LEED for certification of their buildings, other universities solely use LEED as a benchmark for their building design without obtaining certification. For example, Bates College found it to be more important to focus on the environmental impacts of their building initiatives rather than the plaque that comes with certification. As outlined on their website and through email, the university felt that funding the project, investing in their infrastructure, and focusing on the environmental impact of their initiatives were more important than obtaining LEED certification. In addition, Duke University has decided to transition away from LEED because it no longer reflected their needs and it would be more beneficial for their university to adopt a more suitable model for their school.

3.2.2) Obstacles of LEED

Despite LEED being the most well known and understood certification in the U.S., there are many obstacles universities have faced when pursuing certification. Based on the email responses, the greatest obstacle faced by 12% of the universities when pursuing LEED certification has been cost. Obtaining certification for buildings adds a significant cost to the already large cost of constructing or renovating buildings. Because of this, many schools face problems surrounding money because of smaller endowments, budget constraints, and lack of funding. Rice University acknowledges the obstacles of LEED while still incorporating LEED into their environmental standards for buildings and maintaining that it is the most credible certification available. The benchmarking process also revealed that the universities and colleges that have a larger endowment are most-often the schools that tend to have more LEED-certified buildings on their campuses (i.e. Harvard has 100 LEED-certified buildings). Schools with larger endowments can absorb the significant costs of certification. Schools with smaller endowments struggle to add this extra cost into the budget for already expensive projects.

There is a current trend to move away from LEED as it does not align university building needs. For example, University of Richmond stated in their email response that they have faced problems with LEED because it is not context-specific to their school in regards to the accommodation of facilities for commuter students. University of California, Irvine and Notre Dame University noted that their biggest obstacle was the complexity of the certification and the fast-paced changes of the standard. Dickinson College noted that another obstacle with LEED certification is that it can be difficult to apply LEED standards to smaller renovation projects. Since renovation projects are much more common on campuses than new construction due to

money and time constraints, it is important to be able to implement sustainable design into renovation projects on campus. Many universities stated clearly on their sustainability pages that LEED certification was only required for larger renovations over a certain dollar amount which may be both because of the difficulty of implementing LEED standards on small renovation projects and because of budgetary constraints that do not leave room for certification costs.

Because of obstacles and other problems with LEED as a certification, many universities have decided to move past LEED for other certification standards such as WELL and Living Building Challenge. In addition, many universities have begun to create their own green building standard in order to have a standard that is specific and well-tailored to their respective schools and goals.

3.2.3) Moving Beyond LEED

The decision to move away from LEED and seek out alternatives for creating sustainable buildings on their campuses can be connected to many factors, such as the growing popularity of certification standards like WELL and Living Building Challenge, and the non-specific nature of LEED. Of the benchmarked universities, 23% have started creating their own green building policies which are specific and well-tailored guidelines for their respective schools. Using different standards is a good way for universities to find a better fit for their needs as well as to incorporate green buildings on their campuses in an affordable way.

One of the simpler options is to follow the standards of a certification standard, such as LEED, WELL, or Living Building Challenge, without applying for the certification itself. Having a clear list of the steps to take to create a green building is important for universities to

achieve their sustainability goals. In addition, using LEED as a standard without paying for the certification ensures the building is following a credible standard and benefiting the environment. Many universities around the country are using a combination of more than one certification standard and incorporating other sustainability initiatives into their green building plans. By using more than one standard, their green building plans are much more well-rounded and comprehensive than one on its own.

In addition, 23 % of the benchmarked universities have shifted away from obtaining LEED certification and have instead opted to create their own green building plan. Since LEED in itself is so well known and well understood by designers and the public, it has become the norm for most colleges' green building initiatives. These guidelines are oftentimes a collaborative effort between staff, faculty, and students of the university which creates a guideline that can clearly articulate the university's values in regards to protecting the environment.

A unique and specific guideline is not only beneficial for reducing the university's environmental impact but also beneficial for everyone who comes to the campus because it is created with the needs of the students, staff, faculty, and guests in mind. For many universities, a unique sustainability guideline is typically a document which goes in depth into the sustainability approach. The guideline should discuss the unique goals and vision of the university and the strategies the university should implement for future construction and renovation projects. University green building guidelines may also incorporate certification standards such as LEED, WELL, or Living Building Challenge as a benchmark which can be used in conjunction with the unique guidelines outlined by the university.

SOUTHWESTERN UNIVERSITY

Green Building Commitment

Indoor Air Quality

Air quality is an essential aspect of building design because it creates a comfortable, healthy and more productive space for occupants. The university has implemented a number of air quality strategies in order to help benefit the health, productivity, and performance of Southwestern's students, faculty, and staff.

Tenant Health & Well-Being

Building designs and functions can greatly influence tenant well-being by creating spaces that encourage movement and healthy practices to reduce the level of chronic illnesses. By establishing wellness areas and promoting healthy consumption habits, Southwestern has created an active and unimpaired work environment for its inhabitants to thrive.

Energy Use

Designing and constructing energy efficient buildings can decrease energy consumption and create opportunities for long-term savings. The university took steps to monitor energy consumption in each building as a way to lessen its dependency on natural gas.

Water Consumption

Resource management is key to ensuring efficiency and sustainability of building functions. With the installation of water-efficient appliances and monitoring runoff, Southwestern campus is committed to providing clean drinking water to all building occupants while also emphasizing the reduction of overall water use in buildings.

Outdoor Environment

A sustainable landscape is designed to be both attractive and in balance with the local environment, requiring minimal resource inputs. By utilizing native plants, reducing light pollution, and maintaining biodiversity certifications, Southwestern created a functional and visually pleasing campus.

Materials, Resources, & Waste

Materials used in construction, renovation, and daily use account for much of the negative environmental impact of buildings. By eliminating excess materials during the planning and design phases, using materials that are sustainably grown or made from renewable materials, and conducting regular audits, Southwestern campus is meaningfully decreasing its carbon footprint when pursuing construction endeavors.

Executive Summary

Sustainable building design allocates value to environmental impacts that have been neglected in the past. It helps to reduce energy use and water consumption, which directly reduce a building's environmental footprint, but there is also an opportunity to design buildings that improve human health. Today, universities are exploring green building design through certifications like LEED. Other universities, however, have started to move beyond LEED and create their own standards. These new campus standards are designed with specific considerations for the university's context.

This document seeks to establish a unique standard—drawing upon the work of other certifications and universities—that is tailored to the context of Southwestern University. Currently, the school has two LEED certified buildings—the Wilhelmina Cullen Admissions Center and Charles & Elizabeth Prothro Center For Lifelong Learning. The goal of this document is to create a green building standard that is specific to the needs of Southwestern University, while using LEED certification standards as a benchmark for all future construction and renovation projects. It will outline specific standards targeting principal areas that are often glazed over in more general guidelines. This standard allows Southwestern to remain competitive with other schools that have adopted similar guidelines while also adhering to our goals for sustainability. It ensures that all new construction and renovation on campus is built in the most sustainable way—for both human and environmental health. Finally, it will also address and correct greenwashing that has historically taken place at Southwestern and guides the school towards committing to reduce the university's environmental impact. With each of these considered, this document should create a complete and accurate representation of sustainability on this campus.

We have identified six categories for evaluating the impacts of a building project: 1) indoor air quality, 2) tenant health and well-being, 3) energy use, 4) water consumption, 5) outdoor environment, and 6) materials, resources, and waste.

Each of these action items was carefully considered when creating the green building commitment—they cover a broad scope of environmental and human health needs, while also maintaining an ethos of fiscal responsibility.

LEED Policy

Southwestern is committed to pursuing the most sustainable practices during construction and renovation projects. Although sustainability is a high priority for the campus as a whole, accountability can become an issue without the inclusion of a third party organization to review the projects credibility as a sustainable building.

Because of this, all new construction and major renovations over $5 million must adhere to a minimum of LEED v4.1 Gold Standards. Certifying a green building with third party certification processes differentiates the project from other green buildings and allows for the comparison of the sustainable efforts of Southwestern with similar universities across the country. Adhering to a minimum of LEED Gold standards over lower LEED standards ensures projects will reach the sustainability goals outlined by Southwestern in this document.

Key Terms

- **ASHRAE:** The American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- **BeeCampus USA certification:** Endorses a set of commitments, defined in an application, for creating sustainable habitats for pollinators, which are vital to feeding the planet.
- **BeWell:** A global health initiative managed by the American College of Sports Medicine (ACSM), to promote fitness and general health in the workplace by utilizing standing workstations and alternative seating options.
- **BIFMA:** Business and Institutional Furniture Manufacturers Association which creates standards for promoting a healthy work environment.
- **Dark Sky System:** Numeric ranking system, based on the level of light pollution given off in a certain area.
- **Daylight Harvesting:** The technique of using daylight to adjust the amount of electrical lighting needed to properly light a space.
- **EnergyStar:** A program run by the U.S. Environmental Protection Agency and U.S. Department of Energy that promotes energy efficiency. It provides information on the energy consumption of appliances and products.
- **Gray Water:** Waste water generated from houses and commercial buildings.
- **Light Pollution:** Inappropriate or excessive use of light.
- **MAS Green Certified:** Materials Analytic Services LLC is an emissions testing firm focusing on residential and commercial building products for green building projects.
- **REC:** Renewable Energy Credits provide an instrument for documenting traded and purchased renewable energy.
- **TerraCycle:** A global leader in free recycling programs for a variety of non-typical recyclable products.
- **TreeCampus USA certification:** Recognizes college and university campuses for effective management and diversification of trees on all school property and on the main campus.
- **VOC:** Volatile Organic Compounds are organic chemicals that evaporate at ordinary room temperature. As a carcinogen, they are a component of paint that causes headaches, nausea, irritated nose and throat, and other health risks.
- **Zero Waste:** Policies to promote the best use of materials in order to eliminate waste and pollution, emphasizing a closed-loop system of production and consumption.

4.1) Indoor Air Quality

Air quality is an essential aspect of building design because it creates a comfortable, healthy and more productive space for occupants. According to the EPA, most Americans spend around 90% of their lives indoors (U.S. EPA, 2019a). Indoor environments can have higher levels of air pollutants than outdoor environments which can lead to illness and decreased productivity. Focusing on the air quality of buildings will help benefit the health, productivity, and performance of Southwestern's students, faculty, and staff.

4.1.1) Goal

Monitor and maintain acceptable indoor air quality standards.

Justification
Poor indoor air quality leads to less productive environments and illness.

Recommendations

- Comply with ASHRAE (or local equivalent) standards on indoor air quality
- Provide outdoor air monitors for all mechanical ventilation systems, which measure minimum outdoor air intake flow
- Incorporate air purifying plants (i.e. snake plants, aloe vera) into all offices

4.1.2) Goal

Limit air contamination during construction or renovation projects.

Justification
Poor air quality during construction and renovation can lead to the endangerment of worker health and others occupying the building.

Indoor Air Quality

Recommendations

- Comply with ASHRAE Indoor Air Quality Guide - Best Practices for Design, Construction, and Commissioning
- Implement a plan to contain and lessen exposure to particulate matter to prevent disbursement of these materials
- Schedule construction or renovation work during periods of low building occupancy
- Isolate construction work areas from occupied areas using appropriate containment barriers

4.1.3) Goal

Use low or no VOC emitting materials and products.

Justification

VOC's are harmful for human health and have been seen to cause health problems such as eye, nose and throat irritation, frequent headaches, and nausea.

Recommendations

- Ensure that all paint, adhesives, carpet and other construction materials comply with low or no VOC emission standards, preferably those that are MAS Green Certified
- Properly ventilate buildings during construction, renovation, or when using other products that may release VOCs
- Buy furniture with low or zero VOCs, preferably those with Greenguard and/or LEVEL by BIFMA certifications

4.2) Tenant Health & Well-Being

Building designs and functions can greatly influence tenant well-being by creating spaces that encourage movement and healthy practices to reduce the level of chronic illnesses. While lifestyle behavior is not a replacement for medical management of chronic illness, there are preventative measures that can be integrated into building design that encourages living well. Certain strategies and techniques can be adopted to encourage physical activity, proper nutrition, and increased productivity to improve the overall well-being of students, faculty, and staff on campus.

4.2.1) Goal

Establish wellness areas to promote fitness and well-being in campus buildings.

Justification
Wellness areas have been known to boost mood and increase energy and productivity. Promoting fitness areas on campus increases the well-being of students through the reduction of a sedentary lifestyle.

Recommendations

- Continue to implement and maintain BeWell areas
- Use signage to communicate healthy occupant habits (i.e., no smoking areas, washing hands, encouraging the stairs over the elevator)
- Install ADA compliant infrastructure and signage for those that are not able-bodied (i.e. ramps, door opening mechanisms)

4.2.2) Goal

Promote healthy consumption habits with access to healthy food.

Justification
Healthier foods can decrease complications associated with high blood pressure, diabetes, and coronary diseases.

Tenant Health & Well-Being

Recommendations

- Enforce healthy eating habit signage in dining hall
- Implement vending machines in every building that offer healthy snacks
- Create a goal for self-operated dining system that is organized by the university to improve transparency in the food sourcing process and allow for more student input into what kind of food is being served.[1]

4.2.3) Goal

Incorporate strategies to increase natural lighting.

Justification

Natural lighting improves the productivity and mood of students, staff, and faculty.

Recommendations

- Design buildings to incorporate skylights and windows to provide natural views of outdoor areas
- Provide lighting that is the most beneficial color temperature, level of illuminance, and glare to support productivity and performance
- Use dimmable LED lighting to provide occupant control

[1] **Aspirational Goal

4.3) Energy Use

As a university, Southwestern has an obligation to reduce greenhouse gas emissions in the face of climate change. The American building sector accounts for 40% of carbon dioxide emissions because of their intense energy demands (EESI, n.d.) Designing and constructing energy efficient buildings can decrease energy consumption and create opportunities for long-term savings. While Southwestern purchases 100% Renewable Energy Credits (RECs) for electricity, we are still using natural gas to heat buildings. Therefore, this section will focus on ways for Southwestern to transition away from natural gas to incorporate more sustainable options.

4.3.1) Goal

Measure energy consumption of buildings on an individual level.

Justification
This is needed to support campus energy management and identify opportunities for energy consumption reduction through building-level tracking and evaluation of energy use.

Recommendations

- Install advanced energy metering for all buildings that are permanently installed, record at intervals of one hour or less, and transmit data to a remote location
- Generate reports that record and track changes of energy input and output

4.3.2) Goal

Increase on-site renewable energy production.

Justification
Increasing the supply of renewable energy sources would decrease the carbon footprint and reduce the campus' contribution to global warming.

Energy Use

Recommendations

- Maintain solar panels on Heather Hall
- Evaluate possibilities for the use of renewable energy (such as solar panels, solar water heaters, electric heat pumps, and wind turbines)
- Create an on-site solar farm based on the framework from Sustainability Coordinator[2]

4.3.3) Goal

Lessen dependence on natural gas for heating.

Justification

Although natural gas is a better source of heating compared to other non-renewable energy sources, burning natural gas produces greenhouse gases which causes pollution and contributes to global warming.

Recommendation

- Consider the use of steam, solar power, waste vegetable oil, or other sustainable energy source for water heating
- Design heating systems for optimized heat recovery
- Replace the natural gas-fired boilers with air-source heat pumps that produce high temperature hot water[3]

4.3.4) Goal

Enforce the use of energy efficient appliances and lighting systems.

Justification

Appliances and lighting systems utilize large amounts of energy either for continuous 24 hour use such as refrigerators or for large time periods such as lighting. Maximizing energy efficiency for these systems can reduce energy usage and long-term monetary costs.

[2] Aspirational Goal
[3] Aspirational Goal

Energy Use

Recommendations

- Purchase EnergyStar certified appliances and products
- Convert old products and appliances to EnergyStar rated products when needed
- Optimize all HVAC units
- Utilize LED lighting in all design projects
- Incorporate occupancy based lighting controls for spaces with intermittent occupancy including classrooms, offices, and study rooms
- Design rooms to incorporate lighting control systems that use “daylight harvesting”

4.4) Water Consumption

In a changing climate, resource management is key to ensuring efficiency and sustainability of building functions. One of the most fundamental resources is water. According to the EPA (U.S. EPA, 2019b), 40 out of 50 states expect that there will be water shortages under average conditions in some portion of their states in the next decade. The EPA (U.S. EPA, 2019c) also states that the commercial and institutional building sector in the United States is the 2nd largest consumer of water, taking up around 17% of withdrawals from public water supplies. The installation of water-efficient fixtures and appliances can reduce building water use by 20% as well as decrease water expenses.

4.4.1) Goal

Create infrastructure to increase water conservation, provide groundwater reserves, and minimize stormwater runoff.

Justification

In times of water shortages, conservation tools and techniques go a long way to ensuring that there is enough water conserved for every tenant or building occupant to use. Stormwater runoff is important to contain since it consists of pollutants which can contaminate surface water, drinking water or contaminate organism habitats.

Recommendations

- Use green stormwater infrastructure to create permeable surfaces around buildings and on sidewalks
- Capture rainwater from impervious areas of the building for groundwater recharge or reuse
- Design pavements to reduce stormwater velocity and to ensure water infiltrates the soil
- Implement a rainwater catchment system based on the fall 2018 capstone project[4]
- Use rainwater and/or consider establishing gray water infrastructure for non-potable water uses such as irrigation, toilets, sewage transport, HVAC/process makeup water, etc.
- Increase vegetative land cover on building grounds to ensure entrapment of runoff

[4] Aspirational Goal

Water Consumption

4.4.2) Goal

Install water-efficient infrastructure across campus.

Justification

Water-efficient infrastructure ensures that water is being consumed or used at a more sustainable and less wasteful rate. Water-efficient infrastructure can also save tenants or building owners money on the water bill.

Recommendations

- Use low flow faucets, dishwashers, and washers that are EnergyStar rated or equivalent
- Install low flow toilets, urinals, sink faucets, and showerheads in bathrooms in residential and non-residential buildings on campus
- Use infrared faucet sensors and delayed action shut-off/automatic mechanical shut-off valves[5]

[5] Aspirational Goal

4.5) Outdoor Environment

A sustainable landscape is designed to be both attractive and in balance with the local environment, requiring minimal resource inputs. This can be achieved by implementing minor projects such as utilizing native plants, reducing light pollution, and maintaining biodiversity certifications.

4.5.1) Goal

Increase the use of native species to improve biodiversity and improve resource efficiency.

Justification
Using native plants in landscaping practices can lower the time spent on upkeep and general maintenance since they require less water on a weekly basis while saving time and energy spent as well as water. They also increase biodiversity in the areas they are planted by attracting local pollinators and accommodating the native wildlife.

Recommendations

- Maintain TreeCampus USA certification
- Achieve BeeCampus USA certification
- Maintain the use of native plants around campus
- Commit to 100% drought tolerant plants for all new landscaping design
- Plant trees that have a lifespan of 30 years or greater
- Plant trees and shrubs that are located to support heating and cooling in outdoor spaces

4.5.2) Goal

Create and maintain more sustainable transportation options.

Justification
Increasing the amount of pirate bikes and bike racks around campus can decrease the flow of automotive traffic. This will lower the amount of auto-emissions and create a safer environment for pedestrians. In addition, ensuring that bike racks are not installed directly on sidewalks would reduce obstacles to wheel-chair users.

Outdoor Environment

Recommendations

- Build bike racks in front of all buildings
- Continue growing the bike share program on campus
- Implement and maintain energy efficient and electric vehicle parking spots
- Implement and maintain handicap parking spots
- Ensure that bike racks are not installed on sidewalks

4.5.3) Goal

Reduce light pollution.

Justification

The brightening of the night sky can have consequences for human health, ecosystems and the animals who occupy them. Reducing light pollution will also increase access to the night sky and improve nighttime visibility.

Recommendations

- Replace street lights with LED bulbs
- Install proper shields over street lights to reduce potential for glare

4.6) Materials, Resources, & Waste

Materials, resources, and products used in construction, renovation, and daily use account for much of the negative environmental impact of buildings. Including construction and renovations, buildings consume “a third of global resources, one sixth of global freshwater withdrawals, 25% of wood harvested, and 40% of all raw materials,” accounting for “40-50% of all energy usage and anthropogenic greenhouse gas emissions globally” (Doan et al., 2017, p. 244). By eliminating excess materials during the planning and design phases, using materials that are sustainably grown or made from renewable materials, and conducting regular audits, Southwestern campus can meaningfully decrease its carbon footprint when pursuing construction endeavors.

4.6.1) Goal

Reduce waste from construction, renovation, and demolition of buildings.

Justification
Sending construction waste directly to the landfill causes air and water pollution, increases construction costs, and wastes natural resources. Reducing waste and reusing materials will be beneficial to reduce impacts on human health and the environment that landfills reside.

Recommendations

- Create a log of construction waste tracking receipts calculating overall project diversion rate
- Divert 95% of waste from landfills for all new construction and renovation projects

4.6.2) Goal

Design buildings for adaptability and disassembly.

Justification
Designing buildings for adaptability allows well calculated preparations for the changing climate instead of adapting reactively.

Recommendations

- Consider site planning and building configuration to accommodate future additions and alterations
- Use structure systems that maintain integrity when demounted or disassembled
- Use homogeneous materials rather than composite materials

4.6.3) Goal

Work towards a campus-wide zero-waste goal.

Justification

Zero-waste policies promote the best use of materials to eliminate waste and pollution, emphasizing a closed-loop system of production and consumption. This goal ensures that materials of economic value, whether for reuse, resale, or recycling, won't be put in landfill.

Recommendations

- Conduct regular waste audits throughout campus to maintain awareness of current diversion rates
- Keep at least 90% of discarded materials out of landfill and partner with Terracycle to do this
- Maintain an on-campus store to buy/sell school supplies, appliances, clothes, and office furniture
- Complete transition to 100% recycled disposable paper products
- Implement water bottle refill stations in residence halls, new construction, and renovation projects
- Develop a program to recycle, reuse, and/or refurbish electronic waste generated

Materials, Resources, & Waste

4.6.4) Goal

Integrate green purchasing policies.

Justification

Green purchasing is the investment in products that have a lesser negative effect or increased positive effect on human health and the environment when compared to competing products that serve the same purpose. Waste, emissions, and environmental risks are often directly linked to the quality of goods and materials used.

Recommendations

- Partner with vendors and suppliers who have active sustainability programs, carbon neutral initiatives, and/or buy-back programs
- Minimize the life-cycle impact of materials and resources by creating a procurement process and end-of-life evaluation for all incoming materials and resources
- Only purchase wood certified by the Forest Stewardship Council
- Purchase furnishings that are built using environmentally sound materials, recycled content, and ergonomic design
- Convert to 100% Green Seal or equivalent cleaning products

5) Conclusion

Green building design has become an impactful way to reduce ecological footprints and improve the mental and physical health of occupants. Buildings have intense energy, material, and water demands that green standards aim to ameliorate. Additionally, studies have shown how thoughtful building design that incorporates natural lighting and other amenities can directly influence the mood and productivity of tenants. LEED, WELL, and the Living Building Challenge are three of the most popular green building standards across the U.S. that each address these concerns. While each of these standards use different metrics to create sustainable habits and initiatives, they share a common goal to improve human satisfaction with their surroundings. The difference between them lies in scope and severity, and how each organization implements them.

Universities have taken great strides in incorporating green building practices on their campuses to reduce their carbon footprint, financial costs, and negative effects on mental health. While pursuing these goals, various universities have created their own sustainability standards in order to create guidelines that are more specific to their campus contexts. However, this document asserts that there is a more beneficial middle ground that combines the use of standardized certifications (LEED) and specific goals that address the needs of a university in order to alleviate these broader environmental and human health concerns. The goal of this document is to provide a compelling argument for the implementation of green buildings and sustainability initiatives on more college campuses in the United States in order to ensure the protection of the environment for future generations.

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