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The State of Sustainability in Higher Education 2016: The Life Cycle of Higher Education Facilities

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2016 THE STATE OF SUSTAINABILITY IN HIGHER EDUCATION

The Life Cycle of Higher Education Facilities

UNH Sustainability Institute

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CONTENTS

EXECUTIVE SUMMARY

This report, the second in the "State of Sustainability" series produced by Sightlines and the University of New Hampshire, analyzes the dispersed, publically available data concerning campus efforts to reduce environmental impact during each phase of the building life-cycle—from construction to operation to capital reinvestment to demolition. It expands upon the view taken in the first (2015) State of Sustainability report, which focused on energy consumption and greenhouse gas (GHG) emission trends, to include consideration of activities like procurement, building certifications, and policy-implementation. Expanding our look at environmental impacts across the building life-cycle, the report identifies current sustainability "wins" in higher education, as well as areas for increased measurement and management.

Three key findings are outlined:

1. When measuring carbon emissions, institutions across higher education are consistently underestimating their impact by not measuring the carbon embedded in purchased goods and the construction, capital reinvestment, and demolition processes. Comparing the rare campus GHG profile that includes full life-cycle impacts against the average campus carbon profile suggests that current standards for reporting may lead to under-reporting by as much as 37%. New tools are emerging to estimate these "missing" emissions, but a shift in methodology may necessitate a sector-wide re-evaluation of how we track progress against carbon neutrality goals.

2. Formal policies that promote sustainability and help minimize environmental impact are common for new construction projects, but are largely absent for other phases of the building life cycle. For instance, 80% of Second Nature Carbon Commitment institutions have committed all new construction to a minimum of LEED (Leadership in Energy and Environmental Design) Silver. Such formal policies, however, are not yet widely adopted for the daily operations, capital reinvestment, or demolition of buildings.

3. Sustainability performance has improved sector-wide, but significant potential remains. To date,[1] over 2,700 LEED Building Design and Construction (LEED BD+C) projects in higher education are certified. In operations, energy consumption is down 8% and related emissions per square foot are down 14% from a 2007 baseline. Attention to sustainability during capital reinvestment and demolition phases is wan, but presents significant opportunity, as the need to invest into existing buildings is projected to increase substantially in the coming years. New construction continues to greatly outpace demolition across higher education, and even with integration of sustainable considerations throughout the building life-cycle, each new square foot exerts additional environmental impact. Limiting net space growth may be an important approach to managing the campus impact and increasing overall institutional sustainability—from both an environmental and financial perspective.

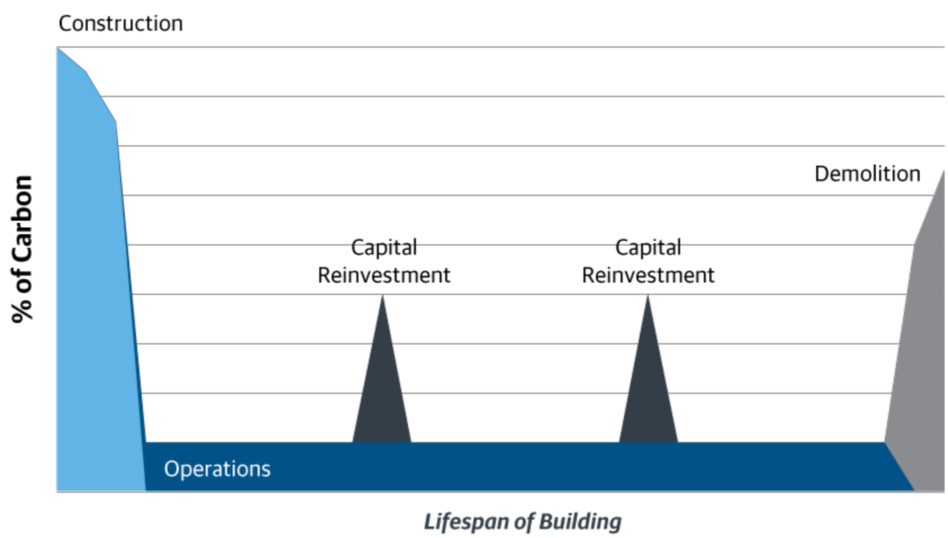
1 LEED project counts throughout this report are based on US & Canadian projects certified 2015 or earlier

INTRODUCTION

As with the first "State of Sustainability" report released by Sightlines and the University of New Hampshire, this report explores campus efforts focused on environmental sustainability.[2] Over the past two decades, colleges and universities have embraced numerous programs to minimize their environmental impacts. These initiatives have had beneficial effects: helping to contain or even reduce long-term campus operating expenses; demonstrating leadership; increasing market demand for environmentally-friendly products and services; and meeting the demands of students themselves. Campus sustainability leaders have much to be proud of. This annual State of Sustainability report aims to quantify and celebrate the sector's progress, as well as outline specific and actionable opportunities for continuous improvement. This year's report analyzes the dispersed, publically available data concerning campus efforts to reduce environmental impact during each phase of the building life-cycle—from construction to operation to capital reinvestment to demolition.

Life cycle analysis is a "cradle-to-grave" approach to assessing the environmental impact associated with each stage of a product's life: raw material extraction and processing, manufacturing, distribution, consumer use, repair and maintenance, and disposal. This 360-degree look gives the most complete and comprehensive picture of impact—whether of a specific project, a building, or an entire campus. For this reason, sustainability frameworks that primarily address one stage of life have moved towards incorporating considerations of impacts from other stages. For example, the U.S. Green Building Council's LEED framework, while historically focused on the construction of new buildings, incorporates elements related to sustainable procurement, building operations, and waste diversion.

Fig 1. A Building's Carbon Profile
Theoretical emissions profile of a building



Source: UNH Sustainability Institute Fellow Brendon Hellebusch

2 Sustainability is, of course, broader than just environmental considerations. It is also about thriving communities and healthy bottom lines. Subsequent reports are likely to focus on these important social & economic metrics.

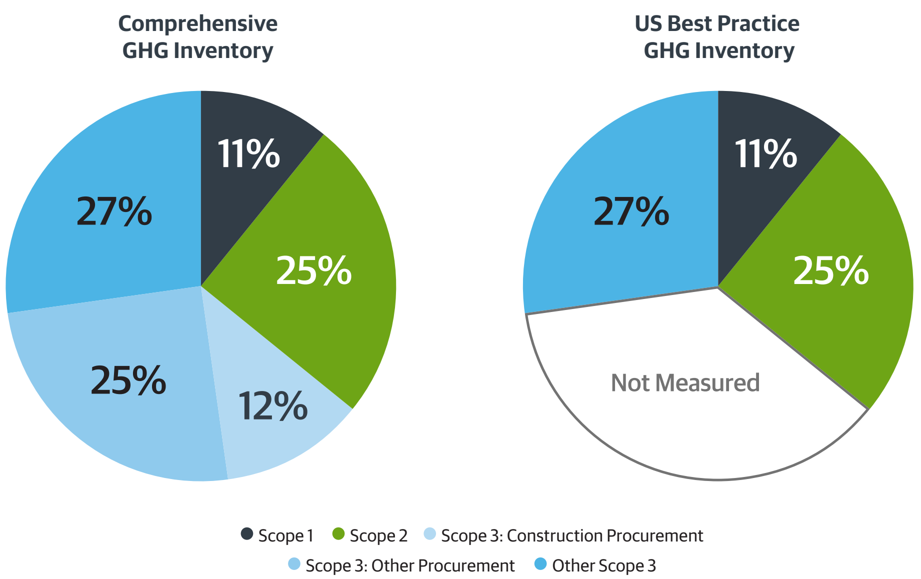
INTRODUCTION

A life-cycle impact framework is represented in **Figure 1**, on the previous page, which shows the theoretical carbon emissions profile associated with an individual building. Moving from left to right, you see the building's complete emissions impact—varying from year to year as it travels through the construction, operations, capital reinvestment, and demolition life-cycle phases. The large peak at the beginning of the life cycle illustrates emissions associated with the building's construction phase, including the raw material extraction and processing associated with the production of building components. Once the new space comes online, there are lesser but consistent emissions associated with the building's day-to-day operations; for example, daily resource consumption and waste generation by the building's occupants. Then, as the building ages, capital reinvestment projects are necessary to keep the space operational. The smaller peaks in dark grey represent the emissions impacts of these capital projects. Finally, as the building reaches end of life, there is a last peak in emissions associated with the demolition of the space and the disposal of the building components.

Within United States higher education, robust emissions data is only available for certain portions of this life cycle. **Figure 2** shows the categories included in a sample comprehensive greenhouse gas (GHG) inventory conducted within United Kingdom higher education. The comprehensive GHG inventory from the UK accounts for construction products and the procurement of products purchased for campus use, in addition to other Scope 1, Scope 2, and Scope 3 emissions. If we consider only the categories included under the United States best practice, the inventory is substantially incomplete.

Fig 2. US Higher Ed Emissions Profile Incomplete

Scope 3 emissions from procurement account for 37% of UK Higher Ed profile

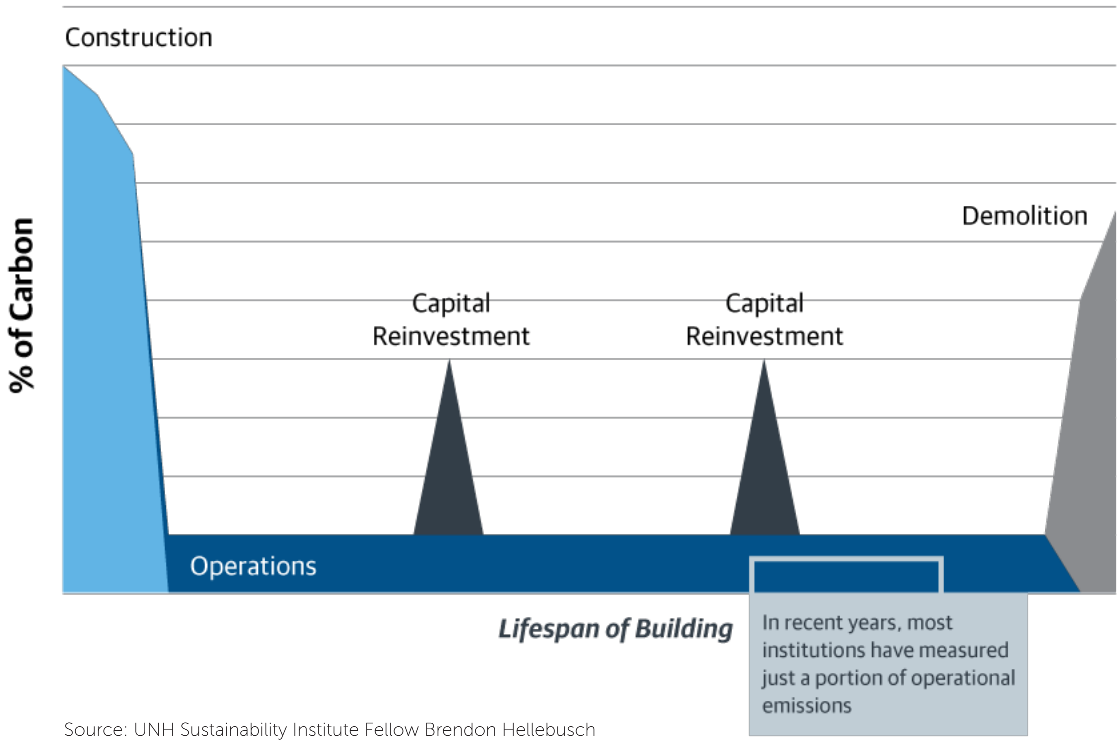


Source: Higher Education Funding Council for England

The effect is clear: omitting emissions from purchasing, including construction-related purchasing, misses a significant piece of the picture when it comes to environmental impact. Within the UK higher education carbon profile, 37% of total emissions are attributable to procurement, and within those procurement emissions, 12% of total emissions are attributable to the procurement of materials and services specifically for facilities construction. By excluding procurement (as well as other optional Scope 3 sources such as upstream/downstream energy activities or investment) from our GHG profiles, institutions run the risk of missing opportunities regarding the sources they are not measuring. Institutions also risk misunderstanding and miscommunicating the relative impact of the activities they are measuring.

The building life-cycle framework offers another powerful illustration of this principle. The solid light blue box in [**Figure 3**] shows the portion of a building's emissions profile that current best-practice GHG reporting in higher education captures annually. By going back only to an

Fig 3. Majority of a Building's Carbon Profile Unmeasured
Theoretical emissions profile of a building



Source: UNH Sustainability Institute Fellow Brendon Hellebusch arbitrary baseline rather than to the building's construction, and by omitting Scope 3 emissions related to purchased goods and services (including construction, capital reinvestment, and demolition), most institutions measure only a fraction of the actual GHG impact of their campuses.

The purpose of this report, with its expanded look at environmental impacts across the building life-cycle, is to identify areas of opportunity for being more strategic and impactful in our campus environmental leadership efforts. Although emissions related to construction, procurement, capital reinvestment, and demolition do not appear within the carbon profile of most campuses, institutions are paying attention to environmental impacts in other ways, including through the adoption of established sustainability schemas. [**Figure 4**] below lists the data sources we analyzed in order to assess higher education's progress towards environmental sustainability. The findings section of this report will present US higher education's performance against a 2007 baseline. Details of the study methodology are available in Appendix 2.

Fig 4. What Other Metrics Allow us to Assess Progress

Sightlines	**AASHE**	**National Association of Educational Procurement**
ROPA + Database	STARS Database	Annual Survey
USGBC	**Second Nature**	**Living Building Institute**
Higher Education Project List	Tangible Action Statistics	Higher Education Project List

Construction Phase

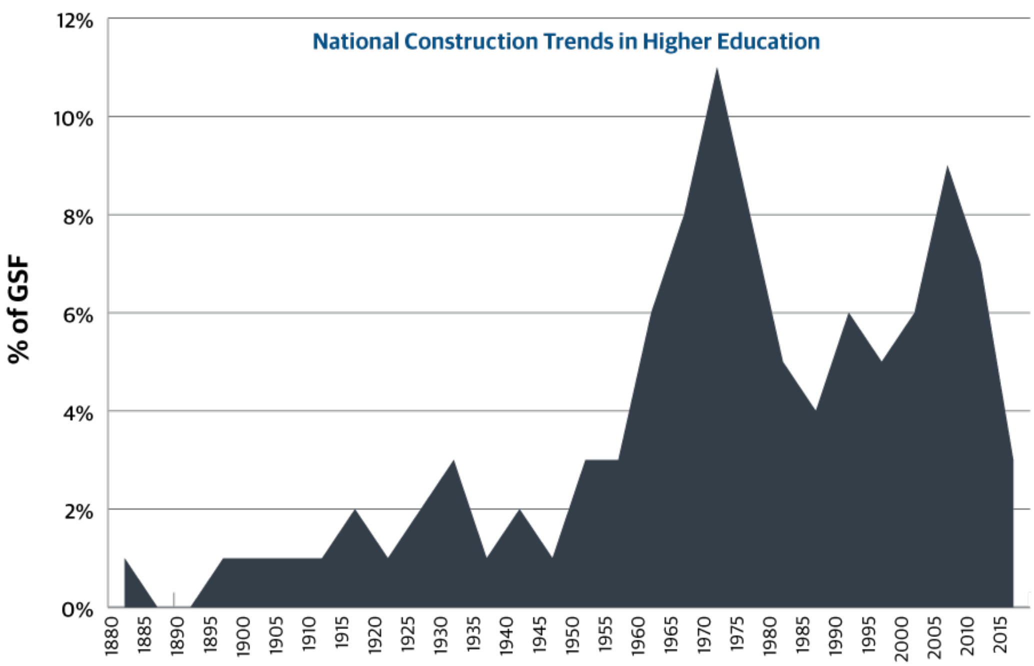
This analysis begins in the construction life-cycle phase, tracking new construction trends across North American campuses through building inventories in the Sightlines database. This data shows two major spikes in new construction, centered around 1970 and 2005 [**Figure 5**]. In total, 39% of the gross square footage (GSF) in Sightlines' database was constructed during the first building boom (1951-1975), and 30% was constructed during the second one (1991-2015).

It was during this second wave of new construction that institutions began to incorporate sustainability considerations. In 2000, the U.S. Green Building Council unveiled the LEED rating system, which certified building projects for fulfilling various criteria to lessen their environmental impact.

The first new construction project on a higher education campus was certified under LEED in 2002.

Fig 5. Putting Campus Age in Context

Higher Ed has experienced 2 major building booms



Source: Sightlines

3 LEED BD+C applies to new buildings, as well as full gut renovations

THE FINDINGS

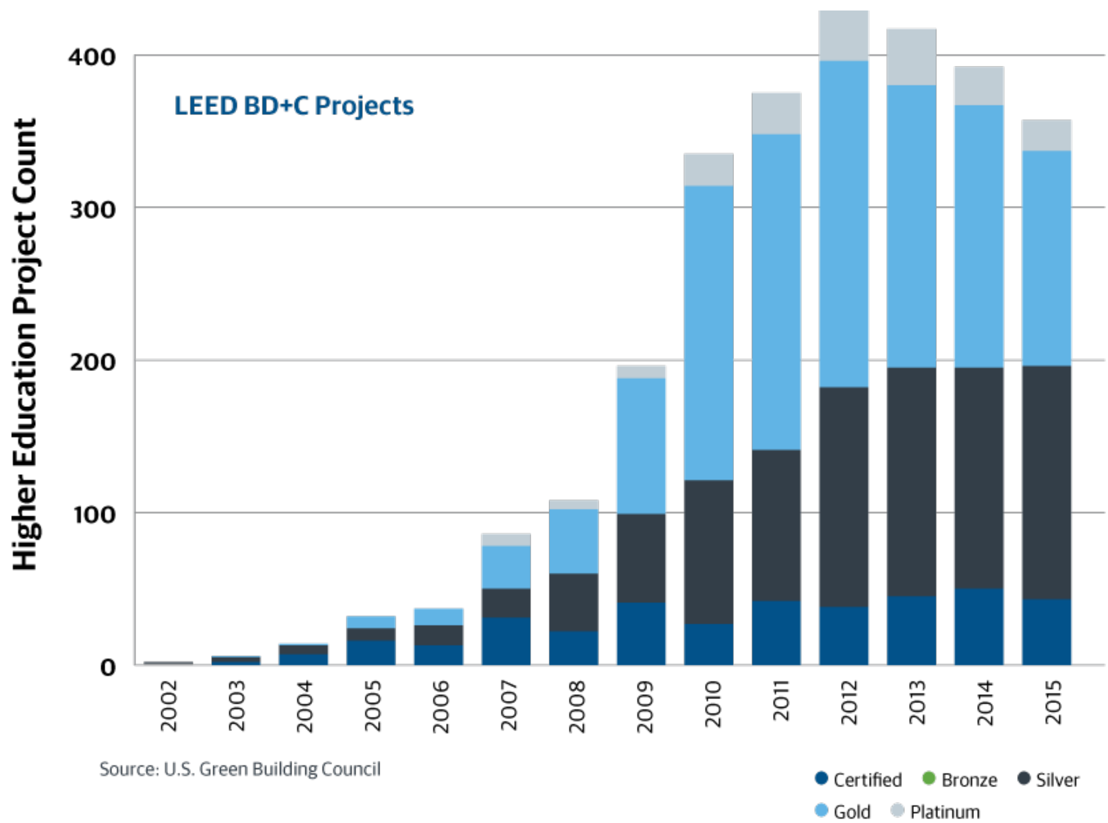
The annual count of certified LEED BD+C[3] projects in higher education grew rapidly, peaking at 429 projects in 2012. The rating system quickly became standard on many college campuses, with 80% of Second Nature Carbon Commitment signatory campuses mandating that all future campus buildings be built to standards for achieving LEED Silver certification or higher.

Since the 2012 peak, there has been a steady decline in LEED BD+C projects on campuses, with only 359 projects certifying in 2015. This decline may be driven by an overall decline in new construction activity and/or a shift away from pursuing formal certification in favor of simply incorporating the LEED standards into "business as usual" construction practices.

80% of Second Nature Carbon Commitment signatories committed to a LEED Silver construction policy.

Source: Sightlines

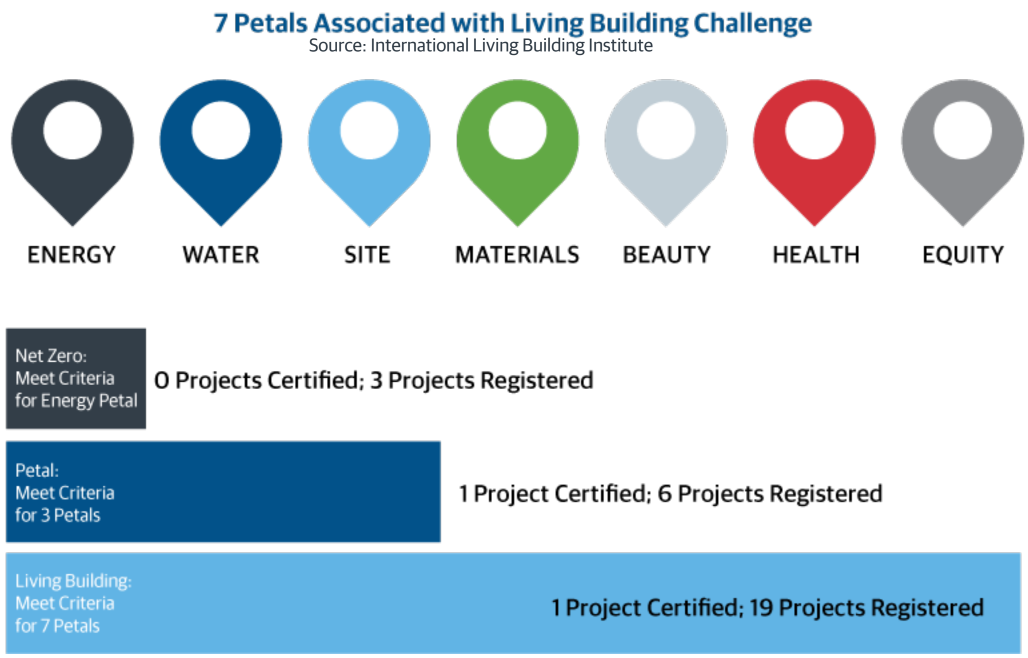
Fig 6. LEED Construction Popular in 2nd Building Boom
In the future, Sightlines will track non-certified projects built to LEED standards



Source: U.S. Green Building Council

While the LEED framework aims to establish a leadership standard for mainstream adoption, other sustainable construction frameworks are more experimental, pushing the envelope on what is possible in green building design. In 2010, the International Living Future Institute certified its first project under what would eventually become a portfolio of sustainable construction frameworks. The most prominent of these frameworks, the Living Building Challenge, is comprised of seven "petal" criteria, with three certification options available depending on the number of petals achieved [**Figure 7**]. Due to the rigor of its criteria, including on-site blackwater treatment and net-positive energy and water usage, the Challenge is not widespread. To date, North American campuses have certified 1 Full Living Certification Building and 1 Petal Certified Building. An additional 28 campus projects are slated to pursue these emerging designations in the future.

Fig 7. Emerging Green Building Regimes
Create "stretch goals" for green construction



Source: International Living Building Institute

Operations and Maintenance Phase

Moving into the operations phase of a building's life, we set the context here by analyzing the prevalence of sustainable operations and maintenance (O&M) policies on higher education campuses. Only 42% of institutions submitting data to the Association for the Advancement of Sustainability in Higher Education (AASHE) through their Sustainability Tracking, Assessment and Rating System (STARS) have formally adopted sustainable O&M policies. These policies include guidelines that cover all of the following: impacts on surrounding site, energy and water consumption, building-level energy and water metering, usage of environmentally preferable materials, and indoor environmental quality. Many other STARS reporting institutions, while lacking such a comprehensive policy, do maintain standard operating practices that incorporate at least one of these elements.[4]

Of institutions reporting under STARS v 2.0,

42%

have formally adopted sustainable

operations & maintenance guidelines or policies

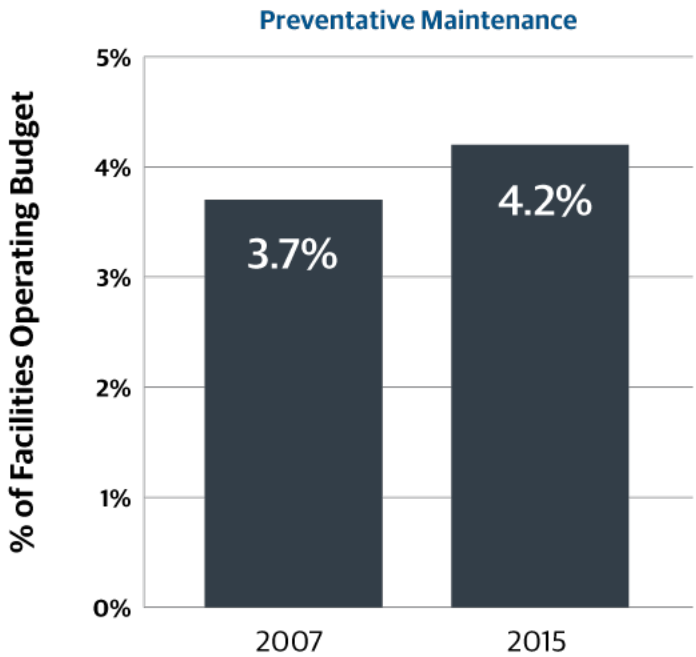
Source: AASHE

A look at campus operational spending trends corroborates this attention to sustainable operations. In recent years, campuses have increasingly focused on preventative maintenance (PM) work as part of daily operations. PM is

4 These best practices often include waste management and transportation programs. We do not measure these sector-wide trends here, but you can access blog posts regarding these topics on the Sightlines website.

proactive work that extends life cycles and keeps building components operating at top efficiency, thereby reducing resource consumption and the environmental impact associated with capital replacement. The Sightlines database documents a slight increase in the proportion of operating budgets spent on PM, reaching a high of 4.2% of total operating budget in 2015, up from 3.7% in baseline year 2007 [**Figure 8**].

Fig 8. Preventative Maintenance Spending Growing
Evidence of progress implementing programs that extend life cycles

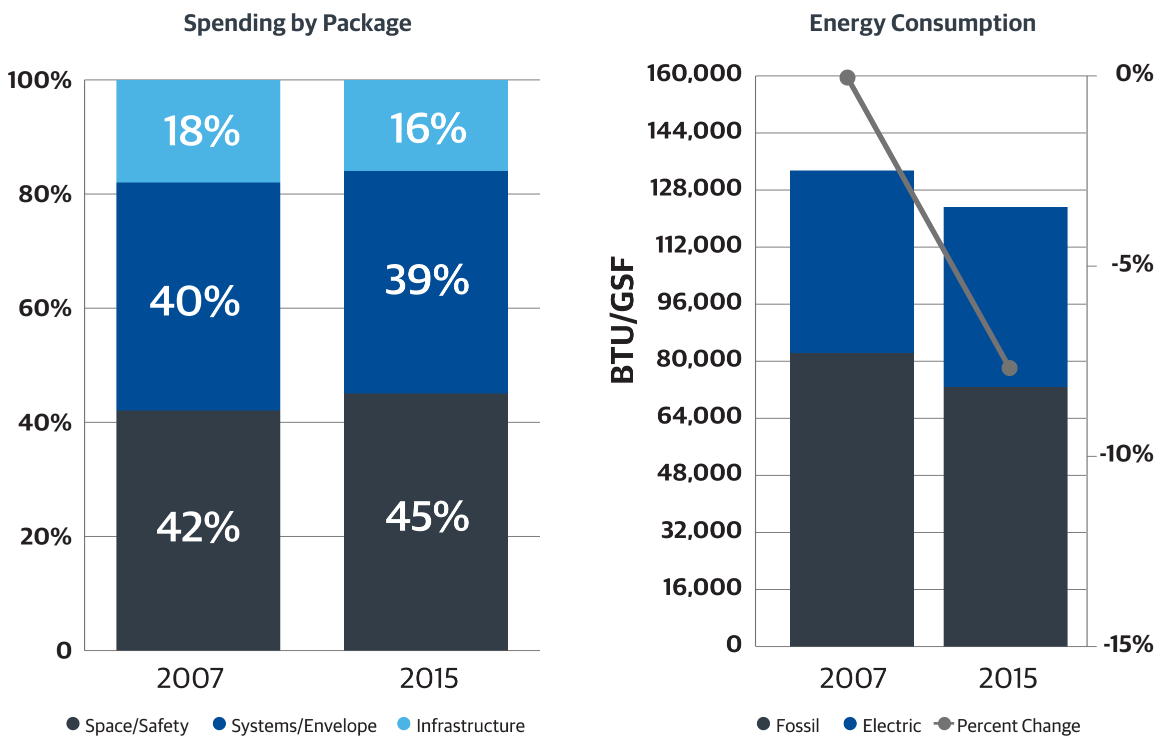


Source: Sightlines

Beyond conducting PM on functioning building components, replacing components that are past-due can also have an environmental impact. Addressing capital needs in underperforming utility infrastructure, building envelope, and HVAC, plumbing, and electrical systems can bring down energy and water consumption by eliminating inefficiencies and leakages. The percent of total capital dollars spent towards utility infrastructure, building systems, and envelope projects was 58% in 2007. In 2015, this value decreased slightly, to 55% of capital expenditures [**Figure 9**]. In 2015, capital spending on space renewal and safety/code projects without a direct environmental impact accounted for 45% of total spending.

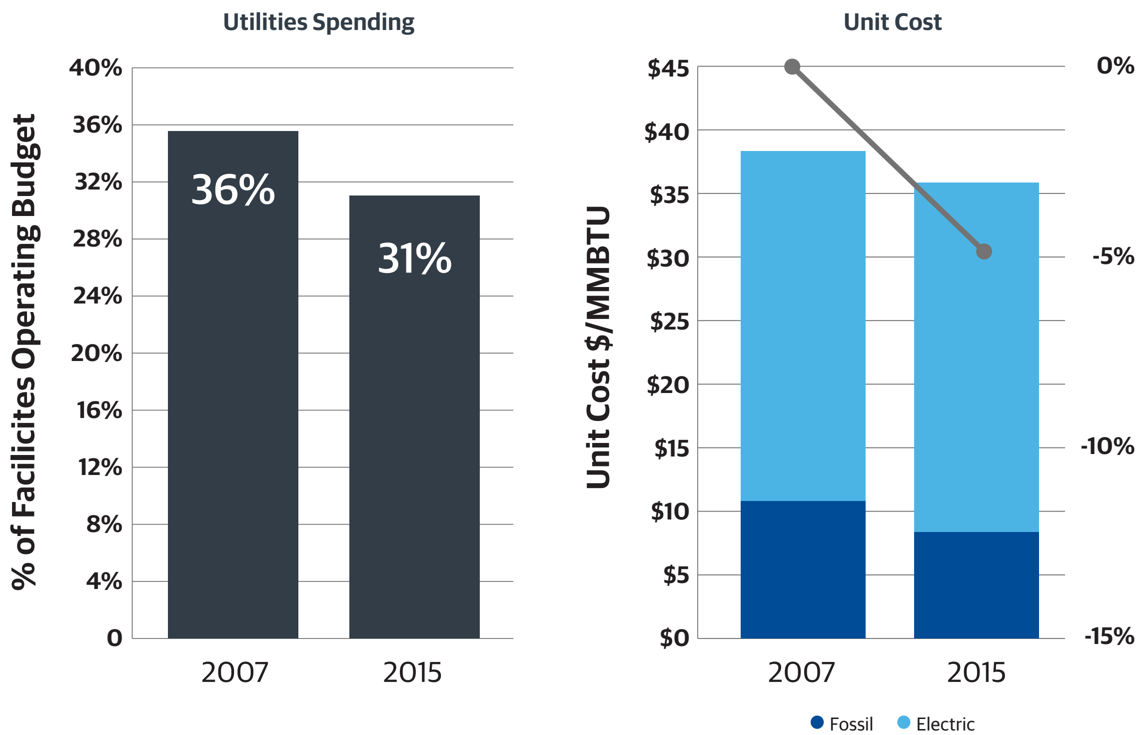
Regardless, institutions are improving energy performance. In 2015, energy consumption per square foot decreased by 8% from 2007 baseline [**Figure 9**]. Fossil consumption has reached

Fig 9. Decreased Spending on Envelope/Systems/Infrastructure
Yet, improvements in energy efficiency



Source: Sightlines

Fig 10. Decreasing Utility Expenditures
Progress reflects energy efficiency improvements & lower unit costs



Source: Sightlines

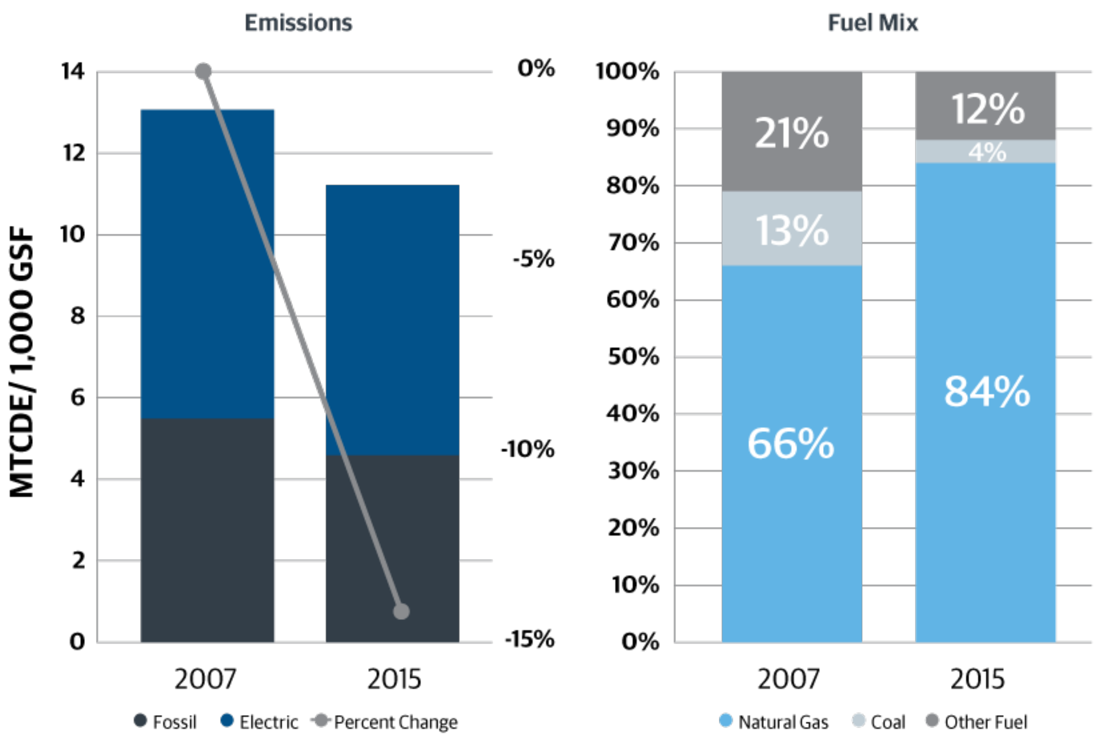
the lowest point since 2012, while electric consumption has reached the lowest point since 2007. This progress has paid dividends, as the Sightlines database has seen a corresponding drop in the percent of total budget spent on utilities in the same time period. Utility costs constituted 36% of total operating costs in 2007, but by 2015, that number dropped to 31% [**Figure 10**]. This trend may be related to a 5% decline in overall energy unit costs from baseline year, although external factors at each institution influencing operating spending are always present. However, the fact that lower unit costs did not result in a corresponding rise in profligate energy consumption indicates a sustained attention to sustainability throughout this time period.

Greenhouse gas emissions associated with fossil and electric consumption in buildings have also declined. Emissions, measured in metric tons of CO2 equivalent per 1,000 GSF, have decreased by 14% against the 2007 baseline [**Figure 11**]. The decrease in emissions is due, in part, to the decline in energy consumption. However, as noted in the 2015 report, the decline in fossil emissions is also due to a shift in fuel use in favor of renewable energy,[5] and in favor of natural gas as a replacement for dirtier-burning fuels that have a higher carbon

5 More details available in the AASHE 2016 presentation from University of New Hampshire and Altenex

intensity when combusted. In 2015, the proportion of natural gas purchased increased to 84% of total fossil purchased from 66% in 2007 baseline year [**Figure 11**]. The corresponding proportion of coal and other fuels, primarily propane and oil, continues to decrease. This is a significant shift over an eight-year period, reflecting greater availability and lower cost of natural gas, as well as campus interest in burning cleaner fuels.

Fig 11. Scope 1 Stationary and Scope 2 Emissions
Reductions largely driven by switch to Natural Gas

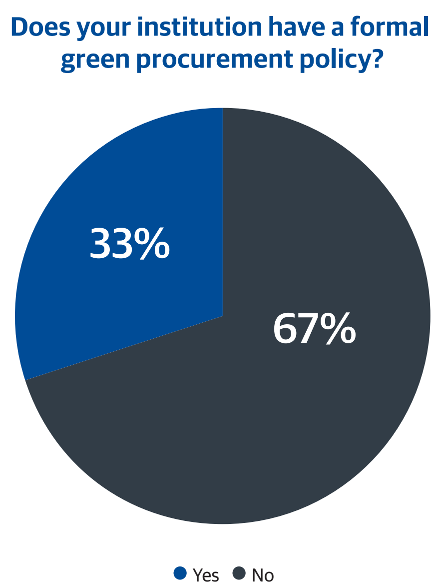


Source: Sightlines

Another major source of operational impact is purchased consumables and services used to support building operations. Despite minimal tracking of procurement emissions in carbon inventories, the results of the 2015 National Association of Educational Procurement (NAEP) "Green Procurement Survey" demonstrate moderate attention to responsible purchasing in higher education. The "Green Procurement Survey" found that 33% of respondents work at an institution with a formal green procurement policy [**Figure 12**]. This is a 9% increase since 2009, the first year NAEP conducted this survey, indicating a gradual shift towards formalized green procurement.

NAEP
National Association of Educational Procurement

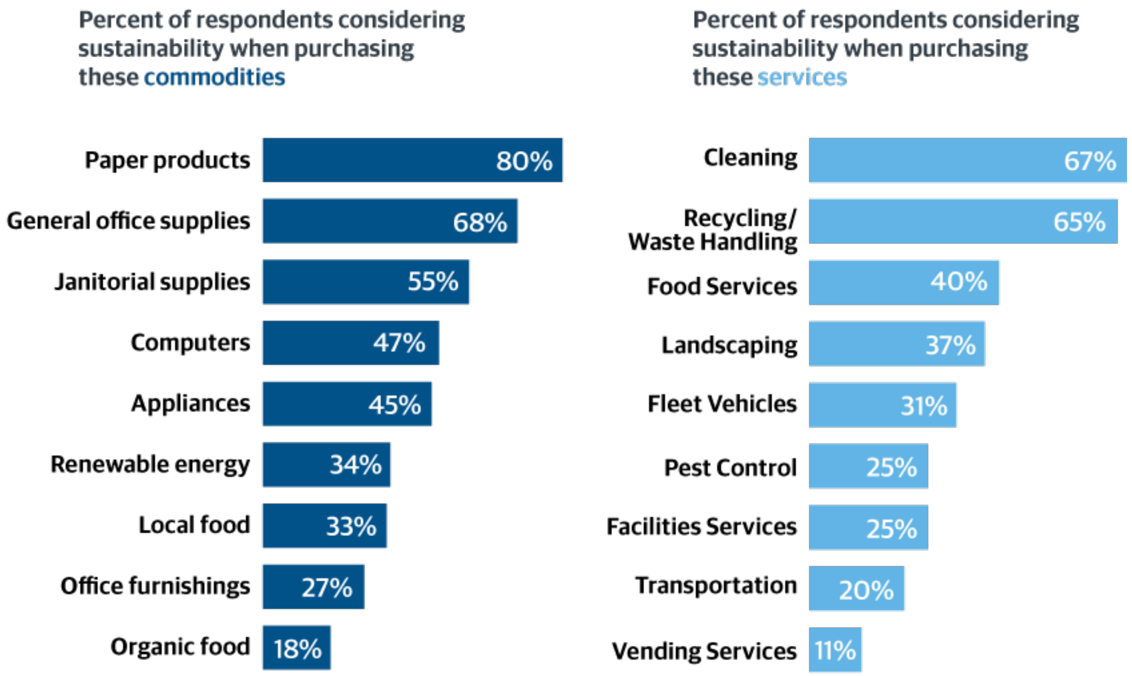
Fig 12. Formal Green Procurement Policies
33% of respondents report policies exist



Source: National Association of Educational Procurement

When looking beyond official policy, NAEP finds much higher rates of informal attention to green procurement. Most institutions consider sustainability in at least one area of procurement [**Figure 13**]. Among commodities, respondents report giving the greatest consideration to sustainability when purchasing paper products (80%), other office supplies (68%), and janitorial supplies (55%). Among services, respondents report the greatest focus on cleaning (67%), recycling/waste (65%), and food services (40%). These reported purchasing habits further support the case that, despite the dearth of formalized policy, sustainability is a consideration in many standard operating practices across higher education.

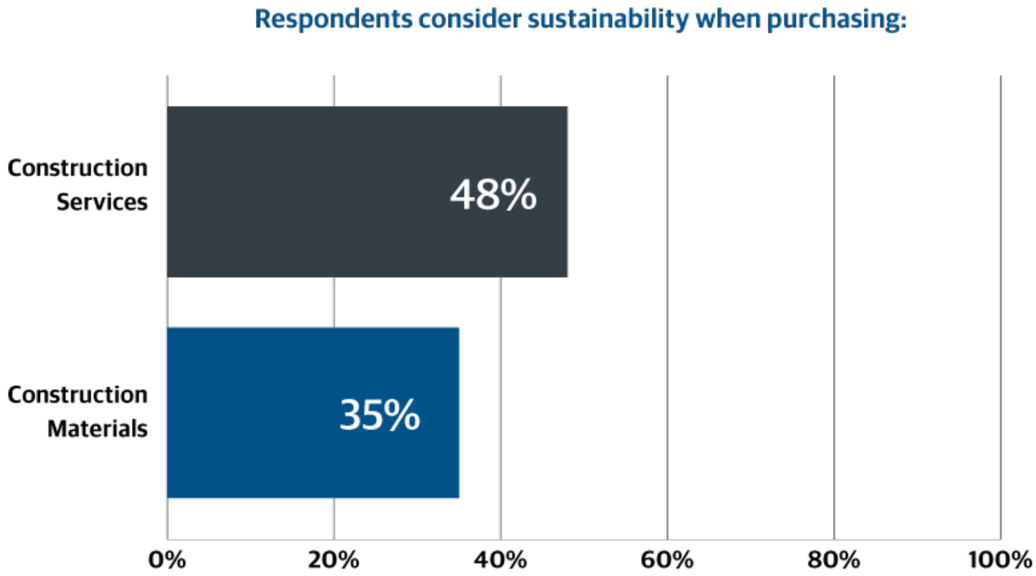
Fig 13. Sustainable Procurement, Commodities and Services



Source: National Association of Educational Procurement

The "Green Procurement Survey" also found that 48% of respondents consider sustainability when purchasing construction services [**Figure 14**]. Thirty-five (35%) percent consider sustainable attributes when purchasing construction materials. Construction procurement occurs across all stages of a building's life cycle, for facilities projects small and large.

Fig 14. Construction Services & Materials
Do purchasers consider sustainable attributes?

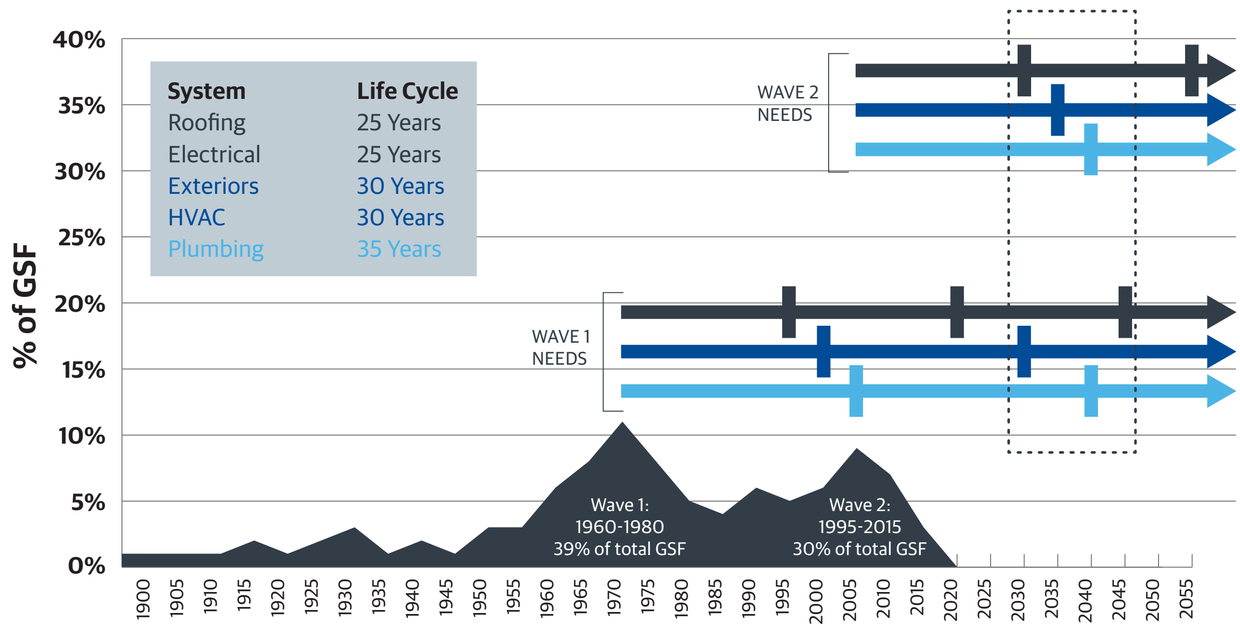


Source: National Association of Educational Procurement

Capital Reinvestment Phase

In addition to ongoing maintenance, buildings require capital replacement and modernization as building components reach the ends of their useful lives or as programmatic requirements shift. Looking again at the two waves of construction across the Sightlines database, [**Figure 15**] indicates when anticipated life cycles will come due in those buildings for each of five major building systems. While other building systems exist, the five systems shown on the next page – Roofing, Electrical, Exteriors, HVAC, and Plumbing – encompass the capital replacement needs that are most expensive and most crucial to a building's functionality. The portion of overlapping life cycles highlighted on the next page indicates that the second cycle of replacement needs for buildings constructed around 1970 (Wave 1) will coincide with the first cycle of replacement needs for buildings constructed around 2005 (Wave 2).

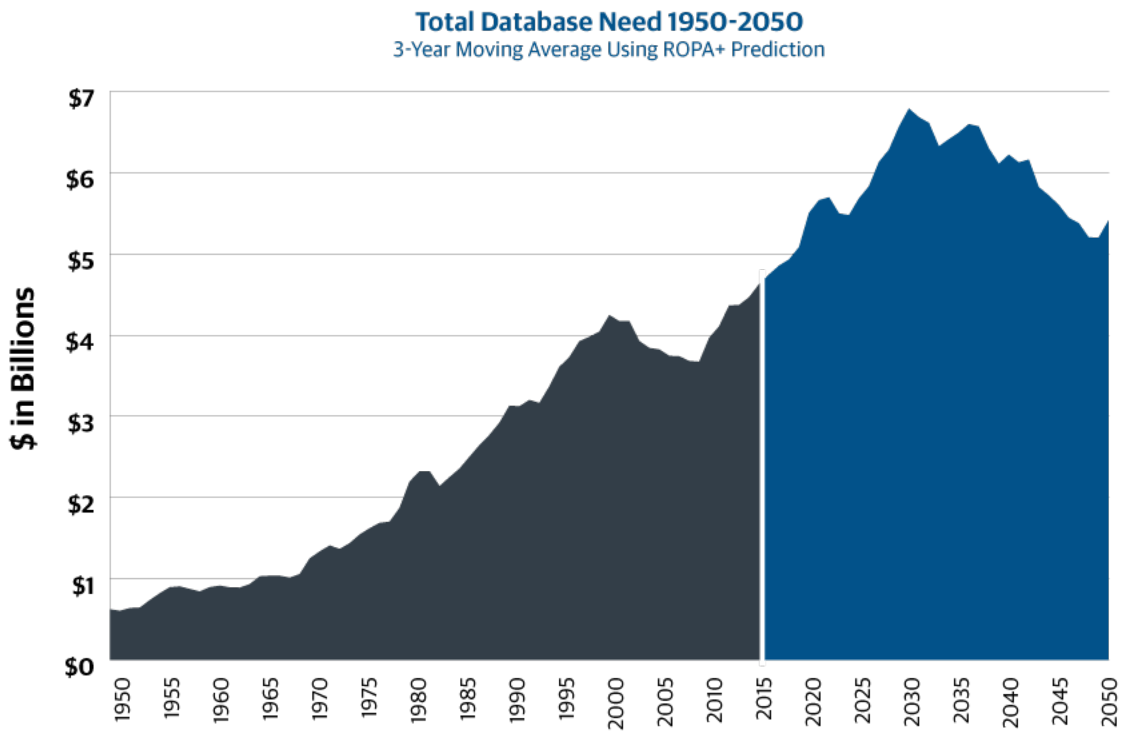
Fig 15. Campuses Must Prepare to Replace Aging Systems
Future systems needs of 2 peaks will coincide in future



Source: Sightlines

The cumulative effect of this overlapping need is shown in [**Figure 16**]. Across the Sightlines database, we are projecting that total capital needs for facilities renewal will exceed $6 Billion annually from 2027 to 2042. This is nearly a 50% increase annually against current levels of capital replacement need. Nationwide, the amount of need would far eclipse this representative sample's alarming $6 Billion figure.

Fig 16. Capital Implications of Existing Space
Needs will grow to exceed $6B annually across the Sightlines database

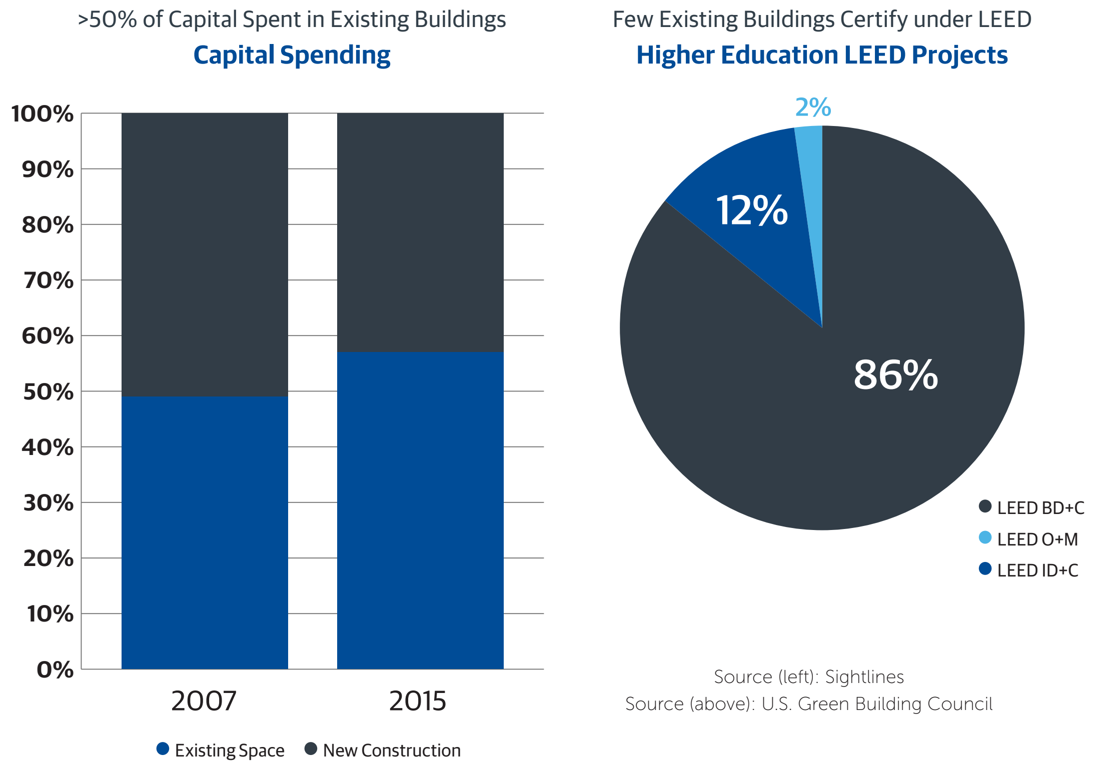


Source: Sightlines

Institutions are already feeling the effects of increased capital replacement needs. In 2007, 49% of capital spending across the Sightlines database was invested into existing space as opposed to new construction projects [**Figure 17**]. In 2015, this capital spending distribution has shifted towards investing more capital (57% of total spending) into existing square footage as institutions try to address capital replacement needs.

Despite this emphasis on reinvestment in existing buildings, there is no evidence of the mainstream adoption of sustainability policies regarding capital projects on campuses. The use of the LEED schemas for existing buildings is rare compared to the relative prominence of LEED BD+C, which accounts for 86% of all LEED certified projects in higher education. Meanwhile, LEED for Interior Design and Construction (LEED ID+C), which focus specifically on rejuvenating aging interiors, account for 12%. Projects certified under LEED for Operations and Maintenance (LEED O+M) – with capital upgrades that target improving building performance - account for only 2% of total certified projects [**Figure 17**]. Because few existing building projects utilize a formal framework, much of the capital replacement in buildings is governed by only informal attention to sustainability—and unfortunately the "premiums" for investing in sustainable renovation decisions can be the first cuts (in spite of the prospect of long-term ROI) when project cost reductions are required.

Fig 17. Capital Spending into Existing Buildings



Source (left): Sightlines
Source (above): U.S. Green Building Council

Demolition Phase

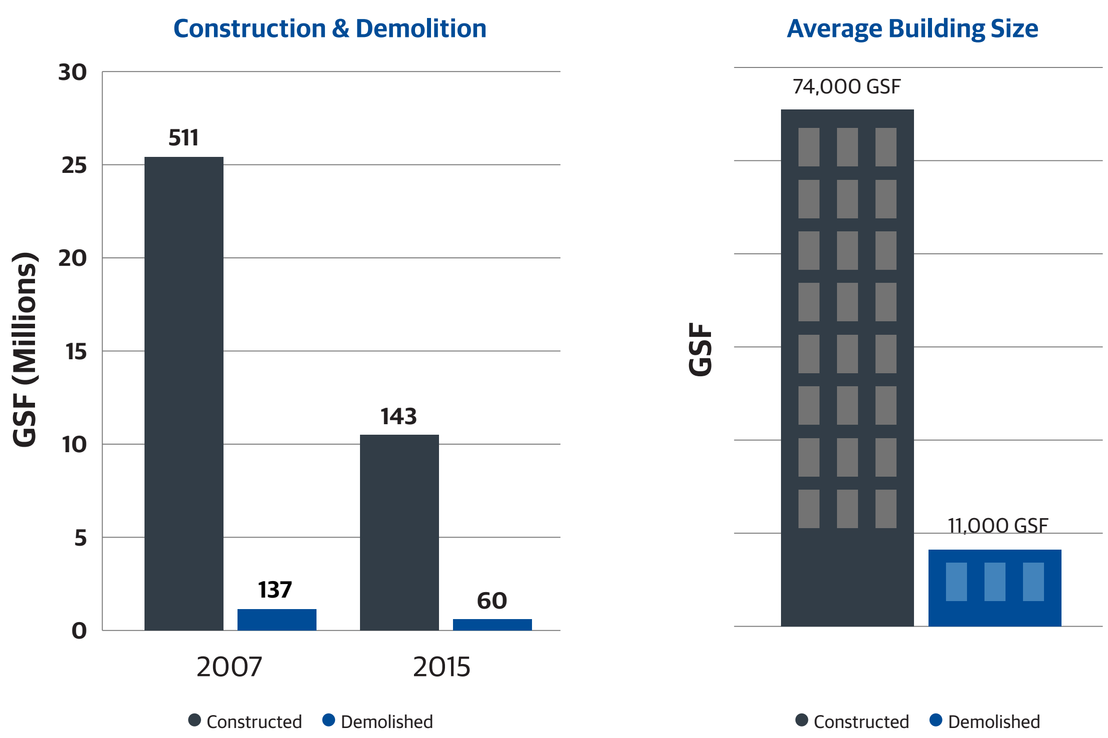
Some buildings will be removed from the operate-reinvest-operate cycle by facilities managers. An institution may choose to remove a building from its inventory for a variety of reasons: it may no longer meet current programming needs; repair may be costlier than wholesale replacement; or it may simply make sense to consolidate and take unneeded space offline to cut operational costs. Whatever the reason, the decision to take a building offline also has environmental consequences. An underutilized building, or an old building no longer functioning at top efficiency, is a long-term carbon leak. Taking such a building offline will minimize its impact in energy, water, and materials usage. However, demolition does involve a spike in carbon emissions associated with the demolition process and the disposal of demolition waste.

The Sightlines database tracks the amount of square footage added and demolished each year at Sightlines member campuses. The dataset for years 2007-2015 reveals a consistent trend: the aggregate square footage added in each year far outweighs the aggregate square footage demolished [**Figure 18**]. In 2015, the average size of new construction buildings was 74,000 GSF, compared with 11,000 GSF as the average size of buildings demolished. [**Figure 18**] also shows the number of individual buildings brought on and offline in the same time period. In each year, the number of buildings added greatly exceeds the number of buildings removed.

Together, these metrics reflect increased strain across higher education facilities operations. Each square foot exerts capital and operations demands; as net square footage grows, so does environmental impact. Likewise, each individual building that is brought online, no matter how large or small, will have its own discrete building components that require upkeep. As the number of online buildings at an institution increases, so does the environmental impact.

The disposal of demolition waste is the last contributor to the environmental impact of a building's life cycle. In this analysis, it is clear that

Fig 18. Construction Significantly Outpacing Demolition
"Net Zero Growth" strategies not yet mainstream



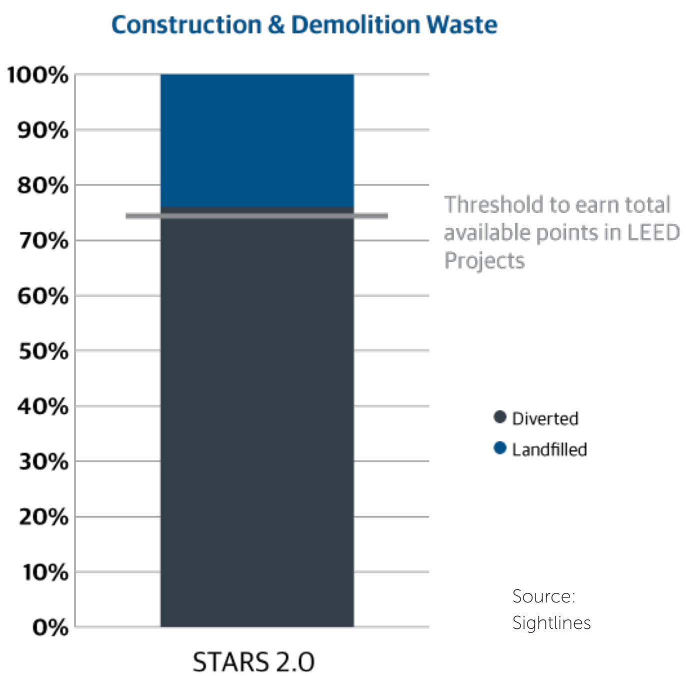
Source: Sightlines

improved tracking is needed, as 37% of STARS v2.0 reporting institutions did not report the amount of C&D waste generated on campus.

Those institutions that provided C&D waste data averaged a 76% rate of diversion from landfill, which just exceeds the 75% diversion rate needed to earn maximum points under the U.S. Green Building Council's LEED rating system. Although regulations concerning disposal of construction and demolition (C&D) waste vary state-by-state, it can be posited that adherence to LEED principles is also a driving force behind this high performance. Therefore, despite the recent decline in LEED-certified construction projects in higher education, LEED standards remain an industry benchmark for sustainability in building demolition. The fact that STARS average performance has now surpassed the LEED diversion rate target may indicate that higher education is ready for more ambitious targets in this area.

aashe member
The Association for the Advancement of Sustainability in Higher Education

Fig 19. Construction & Demolition Waste Diversion
Diversion strong amongst STARS reporters



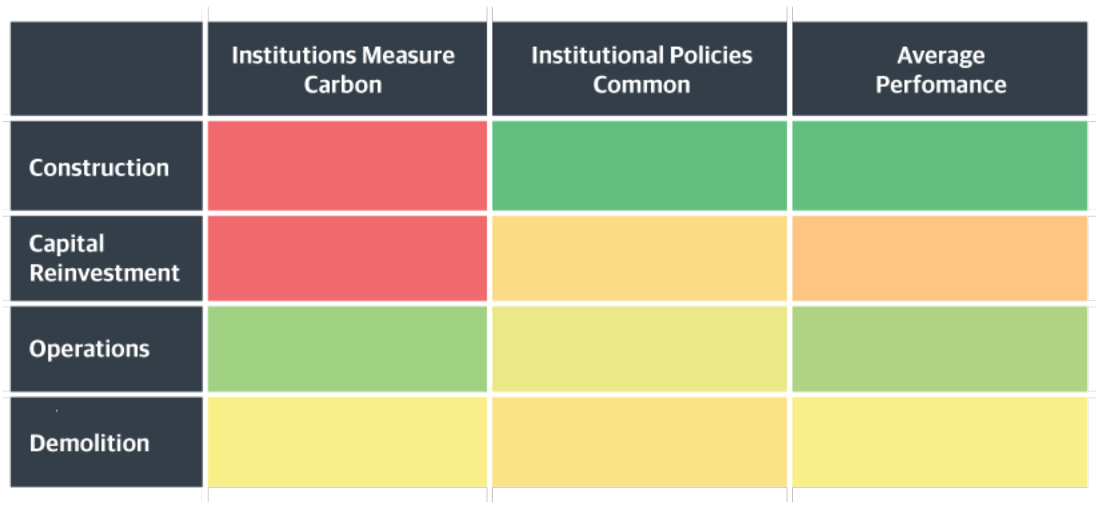
37% of STARS v2.0 reporting institutions did not report the amount of C&D waste generated on campus

Source: AASHE

SUMMARY OF FINDINGS

The matrix below [**Figure 20**] provides an overview of our findings across the various stages of campus facilities' life cycles. Green cells indicate the categories in which our results indicate widespread adoption of best practices and/or measurable improvement in sustainability outcomes. Yellow cells indicate categories in which modest adoption/ improvements were seen, and red cells indicate categories in which results indicate minimal adoption of best practices. The gradation in hue is reflective of numerical measures of "success" quantified throughout the analyses above.

Fig 20. Summary of Key Findings



Key Finding 1: Carbon emissions are significantly underestimated by institutions of higher education

Across higher education, institutions are underestimating the extent of their carbon impact; not all phases of the campus life cycle are currently included in an emissions inventory under standard practice. Emissions from construction and capital reinvestment are not captured, aside from the rare circumstantial capture of construction waste within the larger waste stream going to landfill. Emissions from O&M are more widely tracked, but a standard inventory still omits the impact of those purchased consumables and services needed for daily operations, which constitutes a significant portion of a comprehensive carbon profile. End-of-life emissions from demolition processes remain uncaptured, again aside from circumstantial capture of demolition waste.

Recommendation: Campuses should begin including emissions from procurement (and ideally all Scope 3 emissions) in their carbon profile—and may want to adjust their carbon reduction goals and messages accordingly

Current campus greenhouse gas (GHG) best practices (as outlined in **Figure 2**) were shaped over the last 15 years by UNH/CA-CP (via stewardship of the Campus Carbon Calculator and CMAP tools), Second Nature (via administration of the Carbon Commitment), and AASHE (via administration of the STARS program). The decision to omit certain categories was the result of very practical considerations around data standardization, credibility, and feasibility. However, the dynamics have shifted in recent years. In 2014, the GHG Protocol issued a new standard specifically focused on how to account for all Scope 3 emissions. Thanks to the rapid evolution of the field of life-cycle analysis, enough relevant methodologies and databases exist to make it possible to develop tools for estimating all Scope 3 emissions.

In 2017, a new version of the UNH CarbonMAP tool will be launched that facilitates calculation of all Scope 3 campus emissions for its users. To do so, it will incorporate data from existing national and international LCA databases, and will require input by campus users of total dollars spent on various categories of goods and services (for example, construction and demolition, food, paper goods, etc). It will also allow users to reduce the built-in emissions factors by indicating what percentage of the goods or services in this category are sustainable, based on specific criteria. In this way, campuses can capture the impact of sustainable activities in which they are already engaging and/or evaluate the impact of potential shifts in their procurement practices—including those associated with construction, capital reinvestment, and demolition—to more sustainable options.

As the way we track and report our environmental impact becomes more nuanced and sophisticated, our management of and communication around those impacts will also need to evolve. For example, more than 500 higher education institutions have signed Second Nature's Carbon Commitment, with target dates that range from 2012 all the way to 2099 for achieving carbon neutrality across their Scope 1 and Scope 2 activities as well as Scope 3 commuting, business travel, and study abroad activities. In 2017, Second Nature added other optional categories for Scope 3 emissions to their newly launched reporting system. As these signatory campuses, along with others, begin to use the new version of CarbonMAP to calculate more comprehensive estimates of Scope 3 emissions, and report those emissions publically in the Second Nature reporting system, they may decide that they want or need to re-think the way they develop and communicate their targets. One way to approach such a shift is outlined on the next page by Chris Steuer, who makes the case for separate reporting of Scope 3 greenhouse gas emissions.

Should You Consider Reporting Scope 3 Emissions Separate from Scopes 1 and 2?

Author: *Chris Steuer, Sustainability Manager, Millersville University.*
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Greenhouse gas (GHG) targets are a critical component of any university's greenhouse gas mitigation and action-planning efforts. Targets provide a numerical destination that helps drive GHG reductions and makes a university's mitigation activities tangible to a wide audience.

While it's important to establish targets for scope 1, 2, and 3 GHG emissions, it may be beneficial to evaluate progress toward achieving scope 1 and 2 targets separate from scope 3 targets. This is because:

1) Reducing scope 3 emissions tends to require a different suite of tactics than those used to reduce scope 1 and 2 emissions. Progress made toward achieving scope 3 targets should acknowledge these differences.

2) Scope 3 emission estimates can be less accurate, which can obscure progress made in reducing scope 1 and 2 GHG emissions when they're reported together.

3) Other entities report scope 1 and 2 emissions separate from scope 3 emissions. Combining these emissions within higher education reduces consistency across reporting bodies.

Read Mr. Steuer's complete Op-Ed piece in Appendix 3.

Key Finding 2: Formal LEED policies are common for new construction, but not for sustainable capital reinvestment, operations, and demolition

Our survey of data shows that formalized consideration of sustainability for new construction projects is common. Eighty percent (80%) of institutions participating in the Second Nature Carbon Commitment have adopted policies to build all new construction to a minimum of LEED Silver.[6] However, although the cumulative capital replacement need in higher education continues to grow, there is no similar formalization effort surrounding capital projects: no data exists thus far on the adoption of formal sustainability policies for improvement projects in existing buildings. Sustainable O&M policies are also not prominent, as less than half (42%) of STARS institutions report having a formally adopted campus policy. No data exists on policies for sustainable demolition, but

6 Second Nature retired the "Tangible Actions" component from their reporting system in 2015.

37% of institutions reporting to STARS lack the ability to track C&D waste, which points to the dearth of formal sustainability considerations in the end-of-life phase as well.

Recommendation: Adopt sustainability policies that target existing buildings

Most institutions run modestly sized Sustainability Offices, in which professionals have broad responsibilities and limited time available to devote to the myriad of sustainability-related facilities projects that occur across campus. Creating robust policies, such as those that normalized LEED BD+C for new construction on campuses, can help create a culture in which best practices are normalized and standardized. Below we provide 2 examples of institutional policies that outline best practices for sustainable capital reinvestment, operations, and demolition of space.

The University of Illinois adopted a "no net space growth" policy in 2015. Under the policy, the Provost's Office will manage available square footage, which enters a bank whenever demolitions occur or leases terminate. New construction projects must then withdraw square footage from this bank. This initiative is a key component of the institution's Climate Action Plan to achieve carbon neutrality by 2050.

The University of California adopted robust policies that govern the capital reinvestment and operations of existing facilities state-wide. Major gut renovations must follow regulations similar to those for new construction projects, capital projects with expenditures over $5M must pursue LEED ID+C designations, and all campuses are encouraged to pursue LEED O+M certification for eligible spaces. The Sustainable Building Operations program is similarly robust. Campuses must adhere to policies related to clean energy, sustainable transportation, waste reduction and diversion, environmentally preferable purchasing, and sustainable water systems. Language within these policies sets specific performance objectives, outlines a framework for implementation, and assigns accountable parties.

USGBC has recently shifted more focus to tools and frameworks that will assist institutions in managing the complex sustainability challenges associated with existing buildings, Gautami Palanki outlines these initiatives on the next page.

Performance Score: the data driven path to LEED certification for Existing Buildings
Author: *Gautami Palanki, LEED AP BD+C Director, USGBC.*

You may have heard the phrase, "The greenest building is the one already built." Technology has enabled buildings of all sizes and types to operate more efficiently and report with greater depth. The Sustainability and Reporting 2025 project from The Global Reporting Institute projects that the future of sustainability data will be digital.

LEED v4 mirrored this pivot toward heightened transparency, asking project teams to go deeper by ensuring best practices within their supply chains. LEED-certified buildings consume less energy and fewer resources than conventional buildings, and according to the Green Building Economic Impact Study, between 2015 and 2018, LEED-certified buildings in the U.S. are estimated to save $1.2 billion in energy, $149.5 million in water, $715.2 million in maintenance and $54.2 million in waste.

Most recently, USGBC and GBCI launched Arc, a digital platform that allows any building – including higher education institutions – to start making incremental progress toward more efficient, healthier and regenerative spaces through a data-centric approach. By analyzing current performance, teams can identify what green building strategies are the most applicable to their space type and determine the most appropriate time to implement. Arc also enables the new performance path to LEED certification for existing buildings, which uses a building's performance score to determine its LEED certification level.

Existing buildings hold a lot of promise, outnumbering new buildings by more than 100 to one. Consider it can take up to 80 years to make up for the environmental impacts of demolishing an old building, even if the new building is extremely energy efficient. While many older buildings can be energy and water inefficient, with keen attention to building operations that can change drastically. A recent McGraw-Hill study found that 80 percent of higher education institutions have conducted at least some green retrofits and operational improvements. And, worldwide there are currently 442 higher education projects participating in LEED using the Operations and Maintenance rating system. Universities worldwide, use programs such as LEED Lab to involve students in sustainability efforts.

Higher education institutions that commit to LEED certification and green learning environments foster future generations of global sustainability citizens who understand how their personal and professional choices impact their communities, who create solutions that allow people and the environment to thrive.

Key Finding 3: Campuses have measurably improved sustainability performance, particularly in the construction & operations life cycle phases

There is strong use of established sustainability frameworks for new construction across campuses. Over 2,700 new construction projects have been certified under LEED since 2002, and a handful of institutions are pursuing certification under the Living Building Challenge rating system. Attention to formal sustainability frameworks for capital reinvestment, however, is wan. Only 14% of all LEED certified projects in higher education are dedicated to improving building systems and interiors to impact existing building performance. Operations performance is a more positive story: when normalized for space growth, energy consumption is down 8% in spite of reduced unit costs and related emissions are down 14% from 2007 baseline as campuses continue to move toward lower-carbon fuels. Institutions are also making slow but steady headway in other aspects of O&M, considering sustainability when purchasing some day-to-day commodities and services, for example, as well as investing more in planned maintenance to prevent wasteful consumption and extend the lifecycles of building components. Sustainability performance in end-of-life is mixed. Those STARS reporters that track C&D waste average a 76% rate of diversion from landfill. However, new construction continues to greatly outpace demolition across higher education, and although each new square foot exerts additional environmental impact, there is no current widespread movement towards limiting net space growth on campus.

Recommendations: Seek continuous improvement in sustainability performance

Throughout this report, we discuss the life-cycle of a single building as a framework for considering the sustainability impact of an institution's built environment. But in reality, most campuses include a complex array of spaces that vary in age, function, technical complexity, and programmatic significance. All buildings on a campus must be managed sustainably, throughout their life-cycles, in order to achieve continuous improvement in sustainability performance at the campus level. How can sustainability officers seek continuous improvement? First and foremost, it is imperative that performance be quantified reliably and regularly. Secondly, it is imperative to communicate past successes and future opportunities to key decision makers on campus.

On the next page, Rudy Sturk makes the case for using data to communicate about sustainability goals across the institution, from the board room to the boiler room.

Data & Sustainability: 4 Ways Data Creates a Path to Progress
Author: *Rudy Sturk, Brand Associate, Sightlines*

Today, many sustainability officers are stretched thin by their duties, which includes a heavy workload of measuring and reporting data, both internally and externally. Unfortunately, this limits the time these officers can spend advocating for policy change and making significant improvement on campus. Despite this potential drawback, data is not the enemy of sustainability leaders. In fact, the collection and proper use of data can provide opportunities for building a sustainability case and outlining opportunities for future improvements.

Four ways data can improve sustainability leaders' progress towards strategic goals are:

1) Establishing a campus baseline

2) Identifying opportunities by using peer comparisons

3) Building campus support through communication & transparency

4) Tracking progress & looking towards future targets.

Read complete Op-Ed piece at this link.

CONCLUSION

Higher education business, facilities, and sustainability officers have invested a great deal over the past decades in reducing the institutional environmental footprint—and reaped the rewards in terms of improved efficiency in operations, advantages in recruitment and retention, and the satisfaction of knowing they are being good stewards of the campus facilities entrusted to their care. It's clear that these investments pay dividends, both tangible and intangible.

Likewise, we've invested as campus leaders in efforts to measure and communicate the impacts of our environmental efforts. As a result, we have a large and growing body of objective data that provides clear signals to the sector as a whole about how to move forward. Now, we need to implement the lessons this data teaches us—about the gaps in policies for effectively managing and incentivizing sustainable capital reinvestment, demolition, and procurement across the board; about the need to take a hard look at our growth and space utilization; about the ways in which we are succeeding in controlling energy consumption and reducing emissions even as energy unit prices drop; and about the significant and under-reported role of campus procurement in driving our environmental impact. In embracing these lessons, we can ensure that our institutions continue to pursue sustainability--not only minimizing their environmental impact, but maximizing their financial health and positive social impact.

ACKNOWLEDGEMENTS

This report was a collaborative venture. From conception to first draft, through revisions and final production, it benefited from a great deal of perceptive input by leaders throughout the higher education community. Hearty thanks to all who offered their valuable time, energy, and thoughtful engagement to this process.

It is our hope that the report will help inform, prompt dialogue, and inspire leaders on campuses everywhere who are seeking to “raise the bar” further when it comes to campus leadership on climate change solutions.

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Second Nature

Living Building Institute

APPENDIX 1: GLOSSARY

Blackwater treatment	Process by which raw sewage is treated to a standard clean enough for non-potable uses such as irrigation and flushing toilets
Building systems	In the Sightlines classification system of capital projects, the category for projects that address the building mechanical systems, including HVAC, plumbing, and electrical
Capital replacement	Process by which major building components that have reached the end of their useful life are either replaced in-kind or upgraded
Carbon intensity	For energy sources, the amount of carbon dioxide equivalent that is produced per unit of energy produced; e.g. MTCDE per 1,000 MMBTU
Carbon neutrality	The state of producing no net greenhouse gas emissions, achieved by a combination of reducing gross emissions and creating or purchasing and retiring offsets
Carbon profile	In greenhouse gas accounting, the distribution of inventoried greenhouse gas emissions across the three reporting categories, or "scopes"
Construction and demolition waste	Solid material produced while constructing or demolishing a structure, not including any furniture or building components salvaged for re-use
Envelope	In the Sightlines classification system of capital projects, the category for projects that address the building foundation, exterior shell, roof, and windows and doors
Green procurement	Purchasing program that explicitly prioritizes vendor, service, and product choices with a proven lesser environmental impact

APPENDIX 1: GLOSSARY

LEED framework
LEED, or Leadership in Energy & Environmental Design, is a globally recognized symbol of excellence in green building. LEED certification ensures electricity cost savings, lower carbon emissions and healthier environments for the places we live, work, learn, play and worship. LEED's global sustainability agenda is designed to achieve high performance in key areas of human and environmental health, acting on the triple bottom line - putting people, planet and profit first. LEED credits are awarded by third party technical reviewers; are applicable to all building types throughout a building's lifecycle; and are developed through several rounds of public comments and in collaboration with the U.S. Green Building Council's (USGBC) board, broader membership and staff.

Life cycle analysis
Method for environmental impact assessment that considers all stages of a process or product's life from cradle to grave

Living Building Challenge
Rating system developed by the International Living Future Institute to certify buildings for sustainable performance according to cutting edge rigorous standards

Net-positive energy and water usage
The state in which a building produces more usable energy and water than it consumes over the course of a year

Preventative maintenance
Regularly scheduled maintenance activities, including planned inspections, oil and filter changes, and small repairs, for the purpose of anticipating and preventing major equipment failure

Safety/code
In the Sightlines classification system of capital projects, the category for projects that address safety concerns or compliance with building and accessibility codes

Scope 1
In standard protocol for greenhouse gas accounting, the category of emissions from sources directly owned or controlled by the reporting organization

APPENDIX 1: GLOSSARY

Scope 2	In standard protocol for greenhouse gas accounting, the category of emissions from the generation of any energy purchased by the reporting organization
Scope 3	In standard protocol for greenhouse gas accounting, the category of emissions from sources related to the operations of, but not directly controlled by, the reporting organization
Second Nature Carbon Commitment	Formerly the American College and University Presidents' Climate Commitment, a voluntary pledge for higher education institutions in which signatories submit annual greenhouse gas emissions inventories and create and implement climate action plans with the purpose of achieving a self-designated carbon neutrality goal
Space renewal	In the Sightlines classification system of capital projects, the category for projects that address the interior shell, furniture, and finishes of a building
Sustainability Tracking, Assessment, and Rating System	Rating system developed by the Association for the Advancement of Sustainability in Higher Education for colleges and universities to measure holistic sustainability performance using self-reported data
Sustainable operations and maintenance	Program through which some or all aspects of a building's daily function are governed and evaluated using sustainability considerations and goals
Technical complexity	Sightlines classification system of buildings by the sophistication of their HVAC equipment and air handling capacity
Utility infrastructure	In the Sightlines classification system of capital projects, the category for projects that address the utility distribution system connecting to buildings and, when applicable, a central plant

APPENDIX 2: STUDY METHODOLOGY

Sightlines Data

Sightlines maintains the largest third-party verified database of higher education facilities data in North America. Much of this study is based on data from these 377 colleges and universities. These institutions have a collective 1.5 billion gross square feet (GSF) of facilities assets. They represent different Carnegie classes, representing all geographic regions of the country. The database is comprised of 59% public institutions and 41% private institutions. Its breakdown is 34% comprehensive institutions, 26% research institutions, 32% small institutions and 8% community colleges. With the exception of community colleges (which are underrepresented), the database reflects the composition of higher education institutions in the US as a whole.

In this report, we analyze trends from fiscal year 2007 through fiscal year 2015, because that is the data range for which the most complete data are available. Data are collected directly from institutions that use Sightlines' proprietary ROPA process. Inputs are updated yearly, and verified using a standard process to ensure consistency across institutions. This process quantifies data from source documents (such as energy bills), qualifies data by benchmarking against campuses, and verifies the results by reviewing them with campus facilities and sustainability staff.

The following metrics are collected to analyze construction, usage, capital spending, and operational spending trends:

- New construction & demolition
- Building Function
- Building age profile
- Campus user statistics
- Capital spending
- Ten-year forward-looking projection of capital needs
- Operating budget expenditures including:
    - Preventative Maintenance
    - Utility Costs

The following metrics are collected to analyze energy & emissions trends:

- Energy consumption
- Energy cost
- Fuel type data

Most space, energy, and spending trends are analyzed using Sightlines' internal data processing tools. Emissions from purchased fossil fuels and purchased electric are calculated using the methodology established by the industry-leading Campus Carbon CalculatorTM v.9.0.

NAEP Data

The National Association of Educational Procurement (NAEP) conducts an annual member survey called "The Green Procurement Survey". The survey first launched in 2009, and is now on its 7th installment. This 2015 survey was distributed via email to 884 procurement professionals. Eighteen percent (18%) of NAEP membership responded, or 163 individuals. The survey consists of the following

APPENDIX 2: STUDY METHODOLOGY

categories: General Questions, Institutional Challenges & Priorities, Procurement Processes, and Campus Sustainability Policies. NAEP staff collect responses via a web-based survey management tool and analyze findings internally. The questions asked in the annual Green Procurement survey can be found here:
NAEP Green Procurement Survey

NAEP releases a comprehensive report of findings each year. In this report, we highlight a selection of the findings that specifically relate to:

- **Construction Services & Materials**
- **Operations/Maintenance Commodities & Services**

AASHE STARS Data

AASHE provides public access to STARS data for the purposes of research, reports, comparison, and other uses that meet the organization's "Data Use Guidelines", via the below website:
AASHE STARS Data

We analyzed data from 242 United States & Canadian institutions that reported under v2.0 of the STARS rating system. This data set is comprised of 7% Associate, 32% Baccalaureate, 19% Masters, and 42% Doctorate terminal-degree granting institutions. In this report, we analyzed data concerning the following topics:

- **Sustainable Operations and Maintenance Policies**
- **Construction & Demolition Waste Policies**
- **Construction & Demolition Waste Diversion**

USGBC Data

The U.S Green Building Council (USGBC), provides a publically available list of LEED Higher Education projects, via their website:
Higher Education LEED Project List

For this report, we filtered the list to include only projects from the United State and Canada, and analyzed longitudinal trends in certification.

Living Building Challenge Data

The staff of the International Living Future Institute shared data via email. Case studies for the certified projects can be found on the organization's website:
Living Future Institute Certified Projects

In this report, we present data concerning the count of certified & registered projects for the Living Building Challenge, Petal Challenge, and Net Zero Energy Building Certification.

Second Nature Data

Historically, Second Nature asked all institutions that signed the Carbon Commitment (formerly known as the American College and Universities President's Climate Commitment or ACUPCC) to commit to a series of "Tangible Actions". This practice has since been eliminated, but the historical data remains available at the following website:
ACUPCC Tangible Actions

We used this data to understand the commitments that 2007-2015 signatories made towards LEED construction policies & waste minimization strategies.

APPENDIX 3: EMISSIONS REPORTING OP-ED

Should You Consider Reporting Scope 3 Emissions Separate from Scopes 1 and 2?

Author: *Chris Steuer, Sustainability Manager, Millersville University.*
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Greenhouse gas (GHG) targets are a critical component of any university's greenhouse gas mitigation and action-planning efforts. Targets provide a numerical destination that helps drive GHG reductions and makes a university's mitigation activities tangible to a wide audience.

While it's important to establish targets for scope 1, 2, and 3 GHG emissions, it may be beneficial to evaluate progress toward achieving scope 1 and 2 targets separate from scope 3 targets. This is because:

1) Reducing scope 3 emissions tends to require a different suite of tactics than those used to reduce scope 1 and 2 emissions. Progress made toward achieving scope 3 targets should acknowledge these differences.

2) Scope 3 emission estimates can be less accurate, which can obscure progress made in reducing scope 1 and 2 GHG emissions when they're reported together.

3) Other entities report scope 1 and 2 emissions separate from scope 3 emissions. Combining these emissions within higher education reduces consistency across reporting bodies.

If you've prepared a GHG emission inventory or looked closely at the results of one, you know that inventory compilers classify GHG emission sources differently. Direct emissions that occur from sources a university owns, such as a university owned and operated steam plant, are scope 1. Indirect emissions that occur due to university activities, but from sources owned by another entity, such as landfilled solid waste, are scope 3. Scope 2 is reserved for indirect emissions from purchased electricity and steam, which, while not within the university's direct control, are arguably easier to reduce than other indirect emissions.

Scope 3 emissions, by definition, are outside of a university's direct control. Reducing them can require a different set of tactics (e.g., education and outreach, enhancing contractual terms, establishing partnerships) than those used to reduce scope 1 and 2 emissions, which are often primarily investment-based. These tactics can require a longer timeline to implement as the university waits for messaging to take root, contracts to come up for renewal, or partnerships to develop. Long periods of seeming inactivity may be punctuated by dramatic reductions as tactics take effect. In some cases, tactics may fail due to events that are outside the university's control. As a result, achieving a scope 3 target may follow a different and less predictable path, which should be taken into account when evaluating progress.

Additionally, while the types of data used to estimate scope 1 and 2 GHG emissions is often measured, the data used to estimate scope 3 emissions is often approximated, which can introduce uncertainty and variability into the scope 3 emission estimates and obscure progress made in reducing scope 1 and 2 emissions. Scope 1 and 2 emissions such as building and fleet fuel use and purchased electricity, for example, are all measured through meters—either by the utility, at the pump or through submetering. The data that underlies scope 3 emission estimates; however, are often approximated using survey information or assumptions based on other datasets. For example, to estimate commuting emissions, universities typically know the number of commuters based on information such as the number of parking permits provided; however, information on commuting frequency, mode of travel, and vehicle occupancy are likely approximated (ideally by using survey data). Travel distance is likely modeled using zip code data for faculty, staff and student addresses and vehicle fuel efficiencies are based on national averages. Activity data that is approximated rather than measured has an inherently higher degree of uncertainty. That is, we can be reasonably certain that purchased electricity data reflects actual consumption, but we're less certain that the commuter data reflects the actual vehicle miles traveled by mode.

The uncertainty baked into individual emission estimates can impact your university's total emission estimate. As an example, at Millersville University our scope 3 emissions account for approximately 30 percent of our overall GHG emissions. At that level, a 20 percent swing in the scope 3 GHG emission estimate brought on by uncertainty in the underlying calculations can affect the total GHG emissions estimate by more than 5 percent. Significant reductions in scope 1 and 2 GHG emissions made through investments in energy efficiency or renewable energy could be obscured by artificial emission increases that are simply due to uncertainty in the calculations.

Acknowledging uncertainty in emission estimates is so important that, beginning with the 2006 Guidelines for National Greenhouse Gas Inventories, the Intergovernmental Panel on Climate Change (IPCC) called for quantifying and disclosing uncertainty when preparing national GHG emission inventories.[7] The United States and other Annex I countries adhere to these protocols when reporting national greenhouse gas emissions to the United Nations Framework Convention on Climate Change (UNFCCC).

Performing a robust uncertainty analysis is outside of the scope of what most colleges and universities are likely to be able to do given resource constraints and other priorities, but it does pay to have some understanding of the uncertainty that's baked into your emission estimates and to convey those to the university administration or other stakeholders when reporting on progress toward meeting GHG goals. Higher uncertainty in estimating scope 3 GHG emissions means the estimates are likely to vary more from year to year. That variability can raise questions about the effectiveness of mitigation activities and weaken your position when it comes to demonstrating progress toward achieving emission reduction goals.

7 IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 1, Chapter 3: Uncertainties. http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_3_Ch3_Uncertainties.pdf

APPENDIX 3: EMISSIONS REPORTING OP-ED

Notably, outside of higher education, entities tend to keep scope 1 and 2 GHG emissions separate from scope 3 emissions. As an example, the World Resource Institute and World Business Council for Sustainable Development only require reporting scope 1 and 2 GHG emissions in the Corporate Accounting and Reporting Standard.[8] Scope 3 emissions are treated as optional reporting for companies that choose to go further. Increasingly the expectation is that companies will go further, but reporting, such as through the Carbon Disclosure Project, keeps scope 1 and 2 GHG emissions separate from scope 3.[9] Similarly, since President Obama released Executive Order 13514 in 2009, federal agencies have set separate goals for reducing scope 1 and 2 emissions and for reducing scope 3 emissions.[10]

Colleges and universities demonstrated leadership by incorporating scope 3 emission sources into GHG inventories beginning with the early days of GHG accounting in higher education. To maintain a leadership position, colleges and universities will need to continue to demonstrate progress in mitigating GHG emissions. If you find that your university's GHG inventory results don't seem to reflect the progress being made, you may want to take a close look at how the scope 3 emission estimates affect your overall trends and consider reporting progress separately. Doing so not only increases consistency with the broader GHG accounting community, but may also provide a more accurate representation of progress in key performance areas.

8 WRI/WBCSD, The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard. http://www.ghgprotocol.org/standards/corporate-standard

9 CDP, CDP's 2016 Climate Change Information Request. https://www.cdp.net/CDP%20Questionaire%20Documents/CDP-Climate-Change-Information-request-2016.pdf

10 Executive Order 13514. https://www.fedcenter.gov/programs/eo13514/

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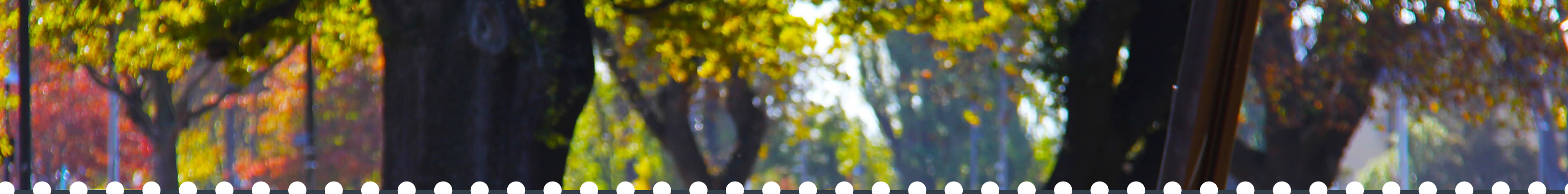

About Sightlines

Founded in 2000, Sightlines, a Gordian company, gives colleges and universities the independent data and perspective they need to make critical decisions about their most valuable assets – their facilities. Sightlines stewards the industry's most extensive verified database, allowing more than 450 institutions across the U.S. and Canada to benchmark an institution's facilities against universities and colleges across the nation. Sightlines' flagship offering for members is ROPA+, a fully integrated solution for facilities intelligence that leads members through a comprehensive process of facilities benchmarking and analysis. Other Sightlines solutions provide higher ed executives with insights to assist with capital planning, space management and campus sustainability initiatives. For more information, please call **203.682.4952**, go to **http://www.sightlines.com** or email **insights@sightlines.com**.

About UNH Sustainability Institute

The UNH Sustainability Institute facilitates integration of diverse perspectives, disciplines and knowledge to address sustainability's grand challenges. As a university-wide institute, it supports innovation across curriculum, operations, research and engagement. The institute acts as a cultivator and champion of sustainability on campus, in the state and region, and around the world, and is recognized for its unique, creative approach and thought leadership. Learn more at **www.sustainableunh.unh.edu**.