

Integrating Sustainability on Campus

Critical Strategies and Lessons Learned

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University of Houston



Kirksey

ARCHITECTURE

48 YEARS | 160 EMPLOYEES | HOUSTON & AUSTIN, TX

Office of Sustainability

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ENVIRONMENT • ECONOMY • EQUITY

Learning Outcomes

- 1. Track key sustainability performance metrics to demonstrate how green buildings provide a prospering student learning environment.**
- 2. Articulate the business case for green buildings that promote resiliency and student wellbeing on your campus.**
- 3. Explain how to design green buildings that introduce sustainable student/community partnerships.**
- 4. Initiate discussions with stakeholders regarding climate resiliency planning for your campus's buildings.**





**INTEGRATED
SUSTAINABILITY**



Your project!



**INTEGRATED
SUSTAINABILITY**

=

LEED Platinum building on campus

Campus climate
action policy

Student-led campus
recycling plan

Sustainable
agriculture course



Nope...

Success!

**INTEGRATED
SUSTAINABILITY**

=



**INTEGRATED
SUSTAINABILITY**

=

**DIVERSE
ECOSYSTEM**

DIVERSITY = SURVIVAL

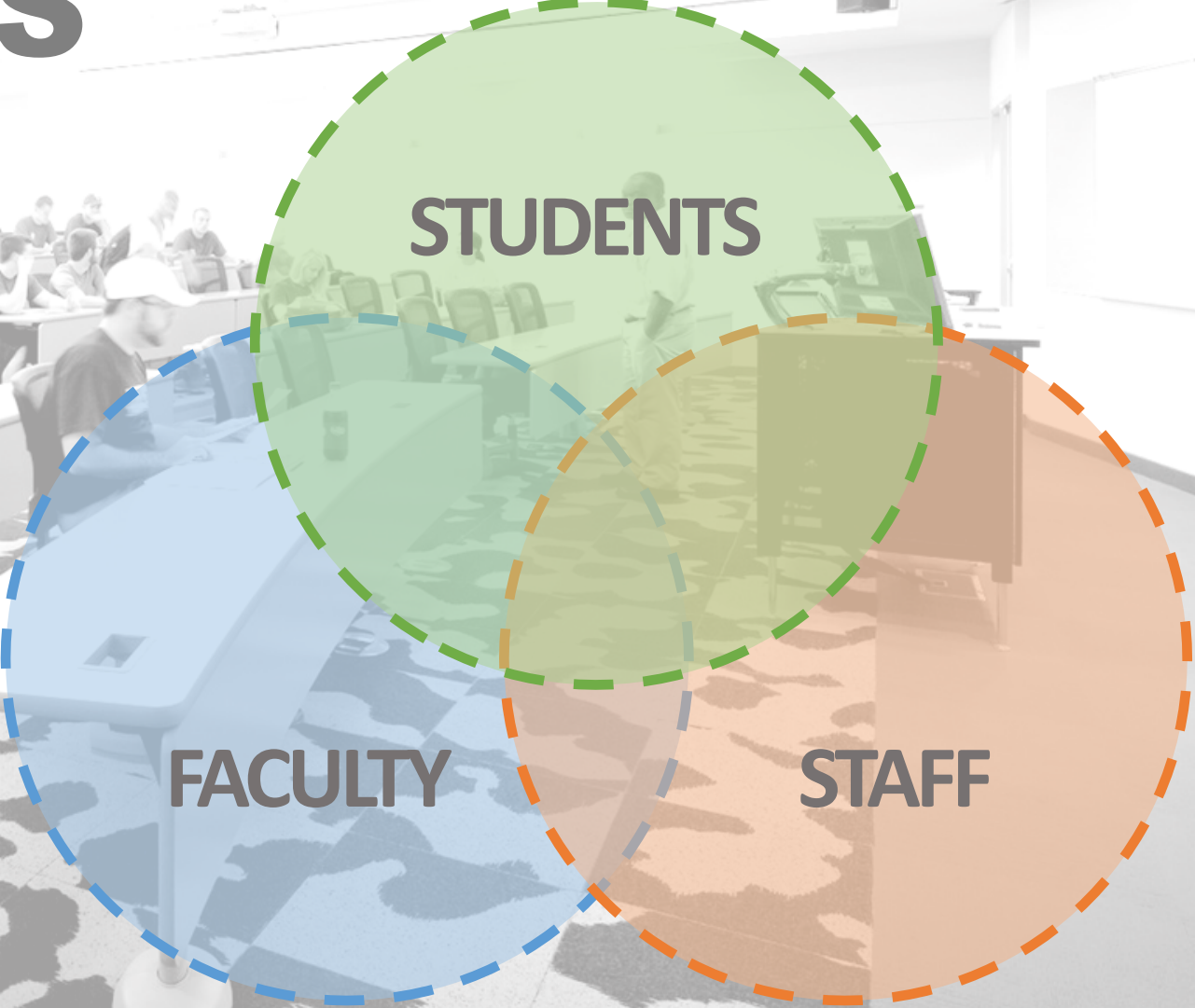


UNIVERSITIES ARE...

MULTI-NODAL



COMPOSED OF DIVERSE STAKEHOLDERS



A grayscale photograph of a large, classical-style building, likely a university building, with a prominent clock tower in the background. The building has multiple stories with arched windows and a balcony. A large tree is on the left side of the frame. The sky is bright with some clouds. The text is overlaid on the image.

LARGELY RISK AVERSE

“As UT pursues sustainability, we are mindful that taxpayer and tuition dollars must be used wisely. The strategies in this plan will be assessed on their return on investment.”

- University of Texas Sustainability Plan



UNDER PRESSURE FROM STUDENTS



College Hopes & Worries Survey - 2019

<https://www.princetonreview.com/college-rankings/college-hopes-worries>

64% of prospective college students:
a college's **commitment to the environment** might
impact their decision to apply to or attend the school.

23% of prospective college students:
commitment to the environment will “strongly” or
“very much” impact their decision to apply to or
attend the school.

In 2009, incoming freshmen became **TWICE AS LIKELY** to select their school based on **sustainability concerns** than entering freshman class from 3 years ago. Level of interest has remained consistent in the 10 years since.



GENERATION Z

59% of college-age Gen Z are enrolled in college.

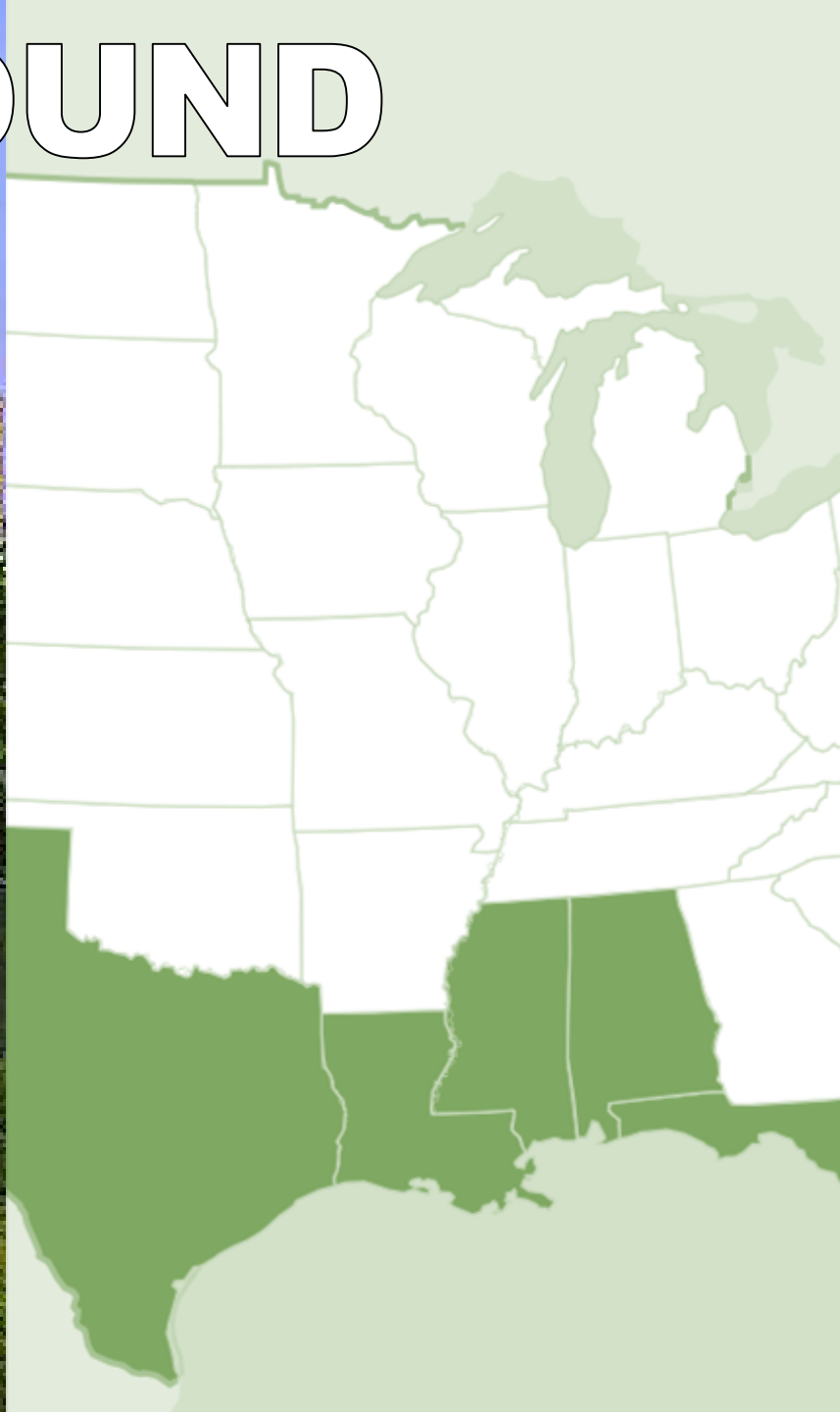
54% of Gen Z believe the earth is warming due to human activity.

<https://www.pewsocialtrends.org/2019/01/17/generation-z-looks-a-lot-like-millennials-on-key-social-and-political-issues/>

LOOKING TO QUANTIFY PERFORMANCE



A TESTING GROUND





Top 50 Green Colleges 2018

1. College of the Atlantic
2. State University of New York – College of Environmental Science and Forestry
3. University of Vermont
4. Dickinson College
5. St. Mary's College of Maryland
6. Colorado State University
7. Pitzer College
8. Cornell University
9. Randolph College
10. Stanford University



Top 50 Green Colleges 2018

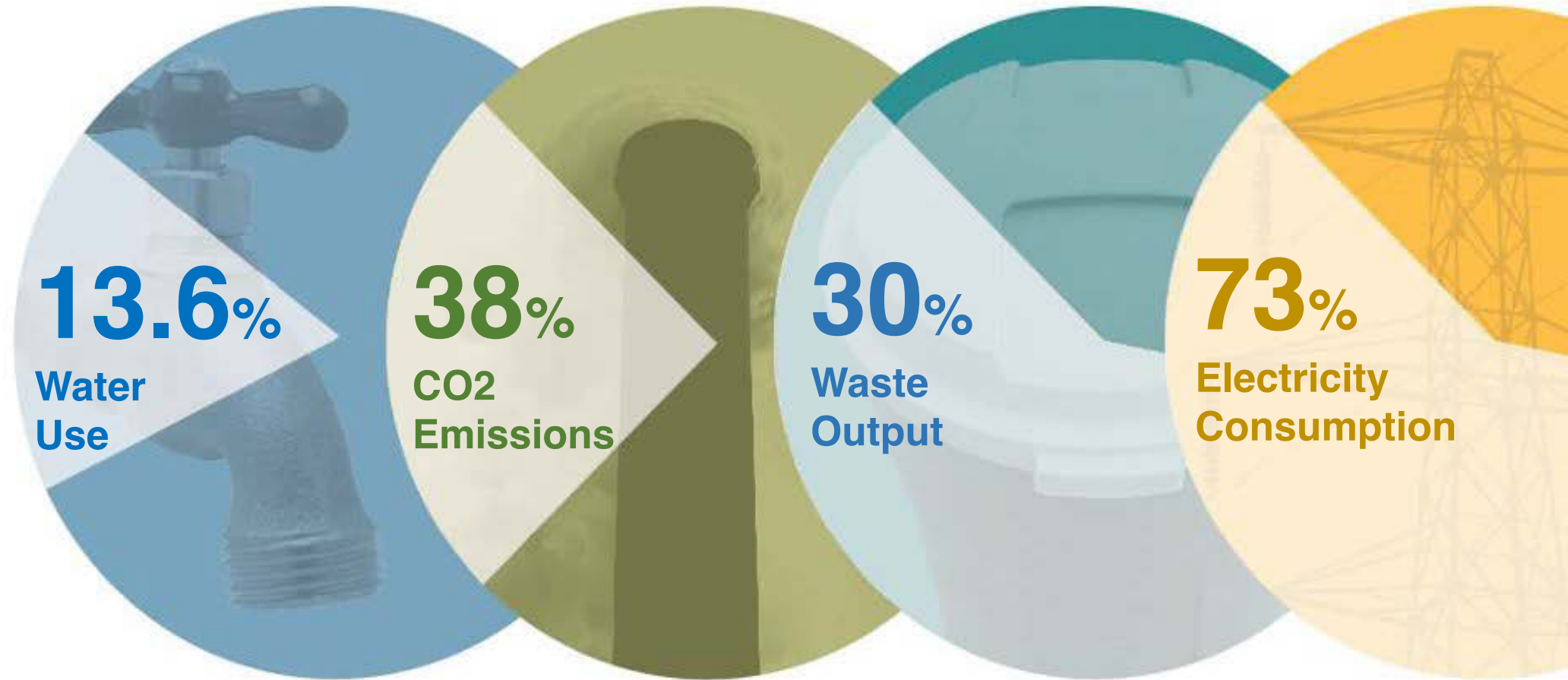
Facts about the "Top 50 Green Colleges" :

- **23%** of their total food purchases are from local sources and/or organic
- **49%** of their waste is diverted from incinerators or solid waste landfills
- **98%** have a sustainability officer and sustainability committee
- **100%** offer a sustainability-focused undergraduate major or degree

PHYSICAL ENVIRONMENT



IMPACT OF BUILDINGS





-  LOCATION AND TRANSPORTATION
-  SUSTAINABLE SITES
-  WATER EFFICIENCY
-  ENERGY AND ATMOSPHERE
-  MATERIALS AND RESOURCES
-  INDOOR ENVIRONMENTAL QUALITY
-  INNOVATION

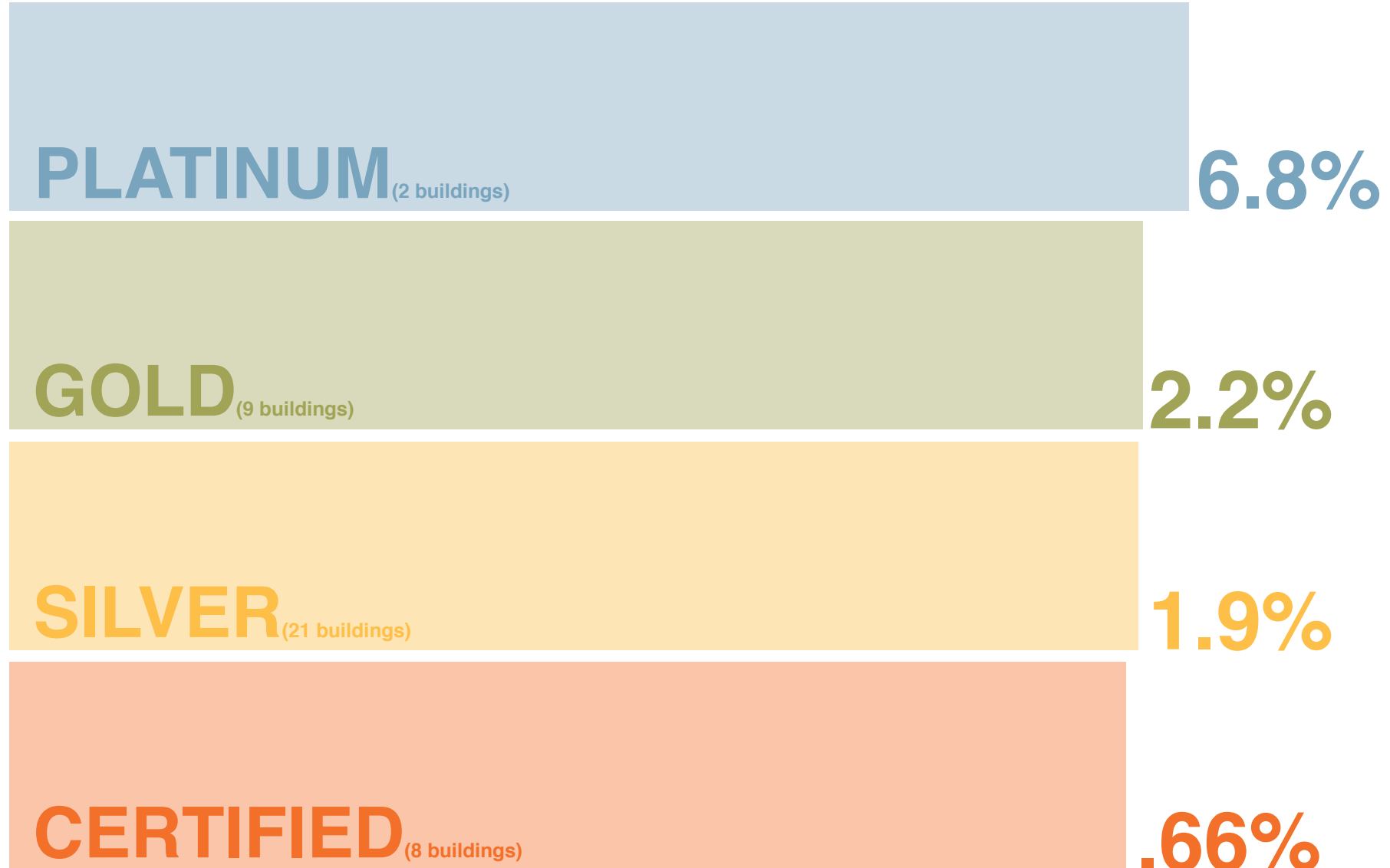
Four Certification Levels

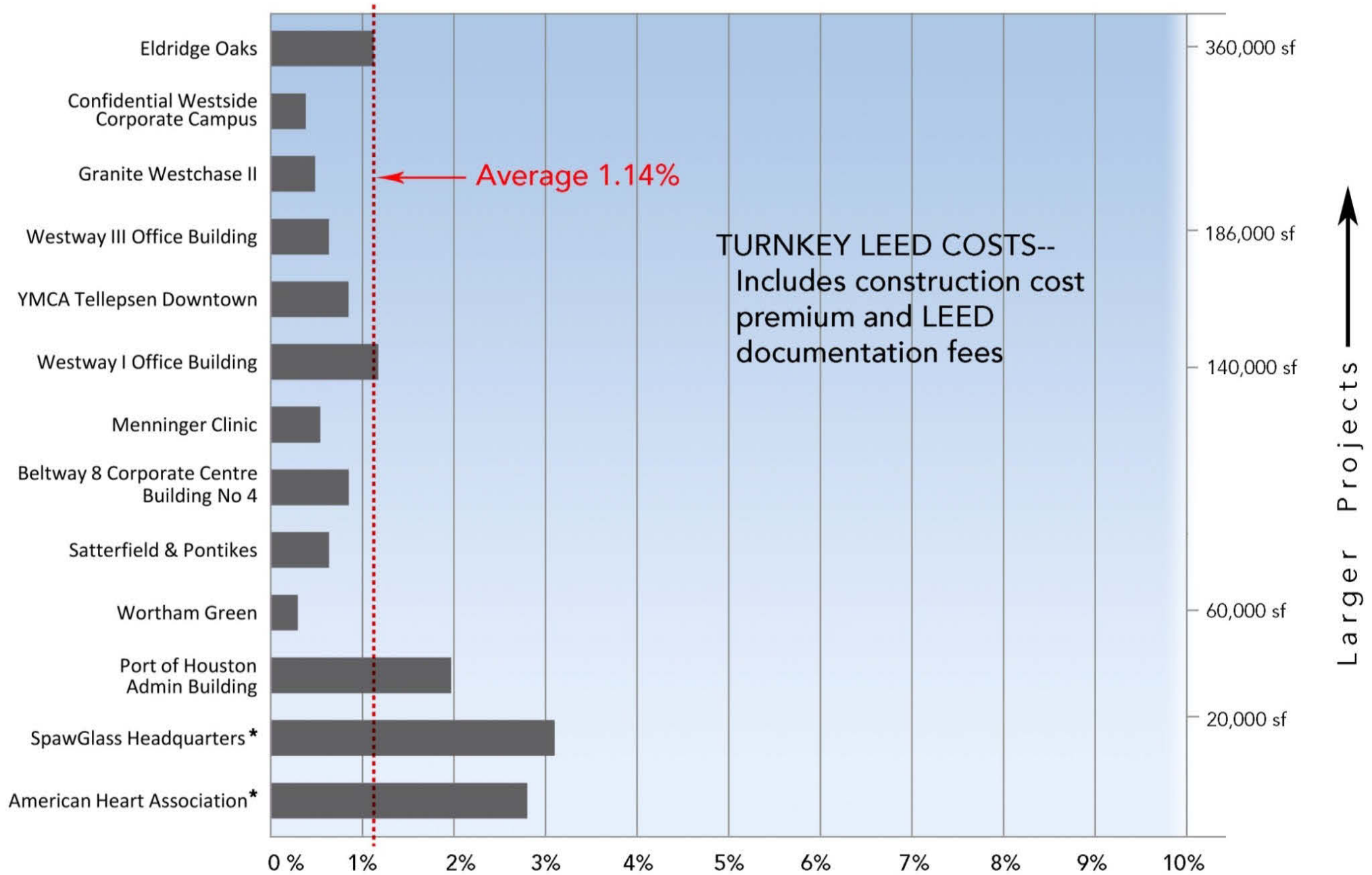


Average for offices and schools, based on 40 buildings

Conventional Building Cost (100%)

Additional Cost





Transforming to a Sustainable and Resilient Campus:

Large Urban Public University

Michael Mendoza
Sustainability Manager
Office of Sustainability

About the University

- South of downtown Houston
- Founded in 1927
- Fall 2018 Enrollment – 46,355
 - Over 36,000 Undergraduate Students
 - 8,000 Residential Students
- Largest of four universities in the UH system
- Highly Diverse Students



Office of Sustainability

Mission:

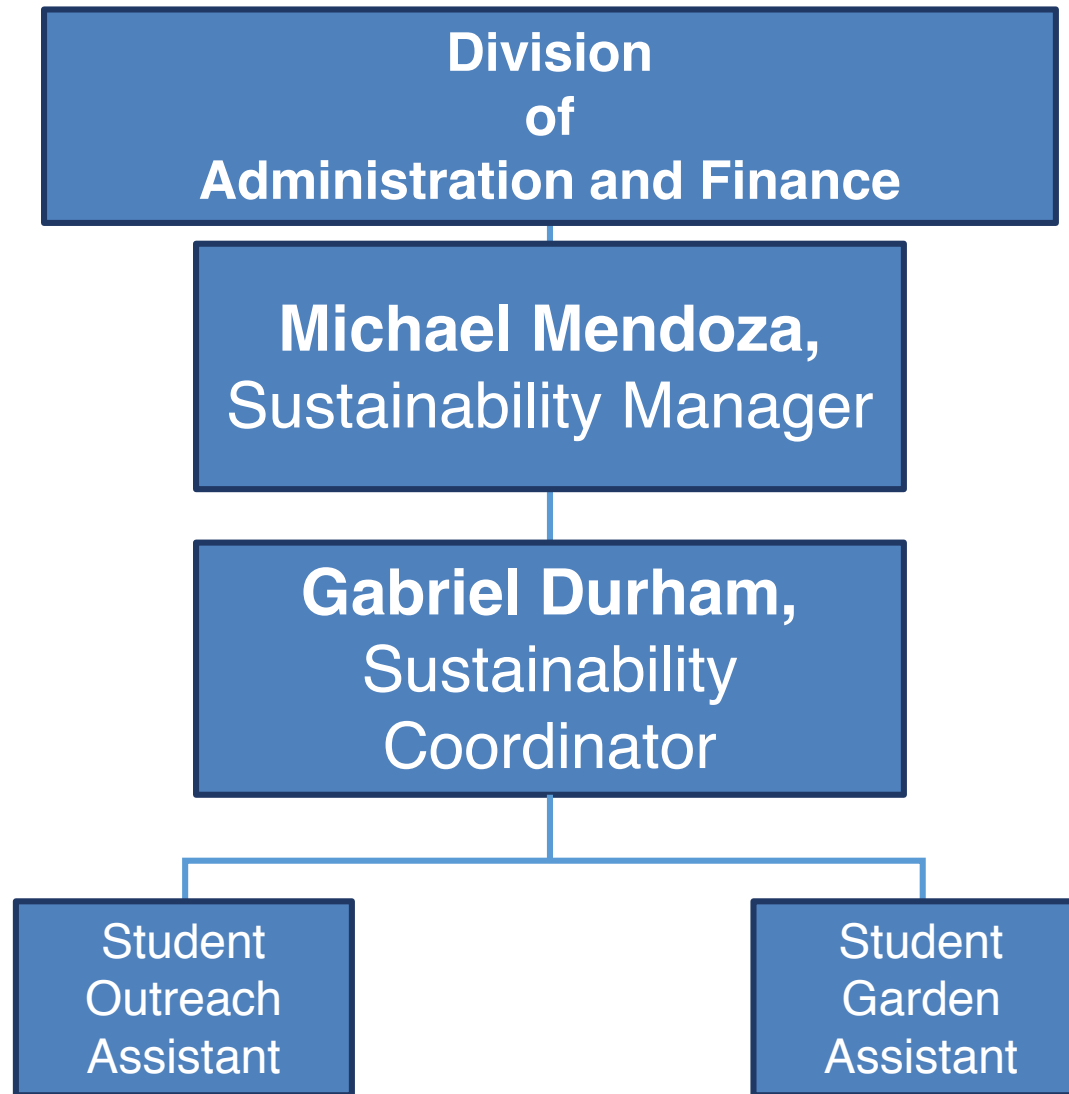
The UH Office of Sustainability's mission is to **cultivate a culture of sustainability** on campus by fostering initiatives, collaboration, education, and engagement to instill sustainable principles within future global leaders.

Vision:

Serve as a centralized **hub for all of the University of Houston's sustainability efforts** in order to improve campus life, engagement, community involvement, and student participation.



Organizational Structure



Office Roles

Roles include:

-Committee governance

- Sustainability Committee

- Data Tracking and reporting

- STARS
- Princeton Review Green Schools Guide
- Annual Greenhouse Gas Inventory

-Management of natural spaces

- UH Community Garden
- Shasta's Pocket Prairie

-Outreach and engagement

- Recyclemania, Meetups, Workshops
- Sustainability Fest and Earth Week

-Foster collaboration and partnerships

- Overseeing UH Sustainability Initiatives



Office History

2008	2009	2011	2012	2013
Est. Sustainability Task Force Began campus wide recycling	Outreach efforts began: Recyclemania, Sustainability Fest, UH Earth Day Festival Campus Community Garden established	Hired dedicated sustainability staff Developed Green UH Campaign AASHE silver rating Solar Array	Office of Sustainability established First LEED building - Cougar Woods Dining Hall	Single stream recycling Water Bottle Filling Stations Energy and Sustainability minor
2014	2015	2016	2017	2018
Sustainability embedded in UH design guidelines	AASHE GOLD-first in Texas	Established Sustainability Campus Policy COAST – Alternative transportation program Est. Pocket Prairie	Hydroponic garden Farmers Market	Houston B-Cycle bike sharing program Recycling and composting in dining halls

Recent Achievements

Multiple Conference Presentations

Zero-Waste Dining Program

Bike Share Program

EPA Award, KHB Awards

LEED Standard – New Construction

**Tree Campus Inventory &
Recertification**



Upcoming Projects and Initiatives

Sustainability and Resiliency Planning

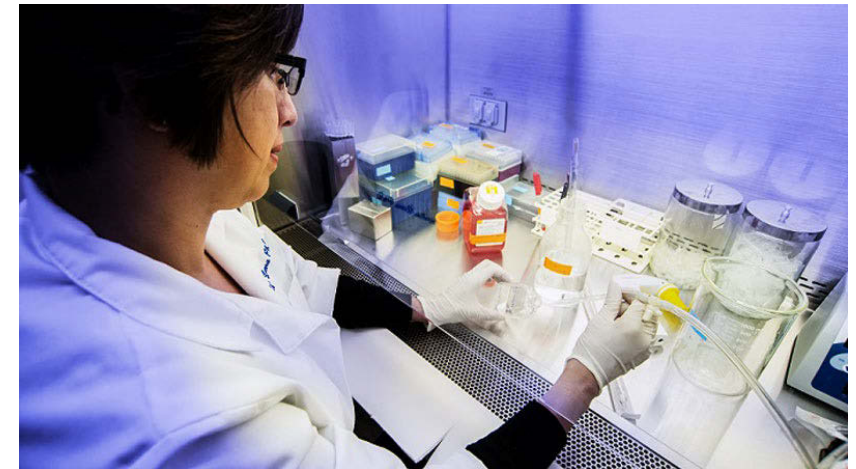
Green Labs and Departments Programs

Sustainability in Academics

Sustainable Master Plan Design Guide

Campus Waste Assessment

Eco-Reps Program



STARS Overview

More than more than 420 higher education institutions have been scored and over 800 use the tool worldwide.

STARS Rating	Minimum Score Required
Bronze	25
Silver	45
Gold	65
Platinum	85



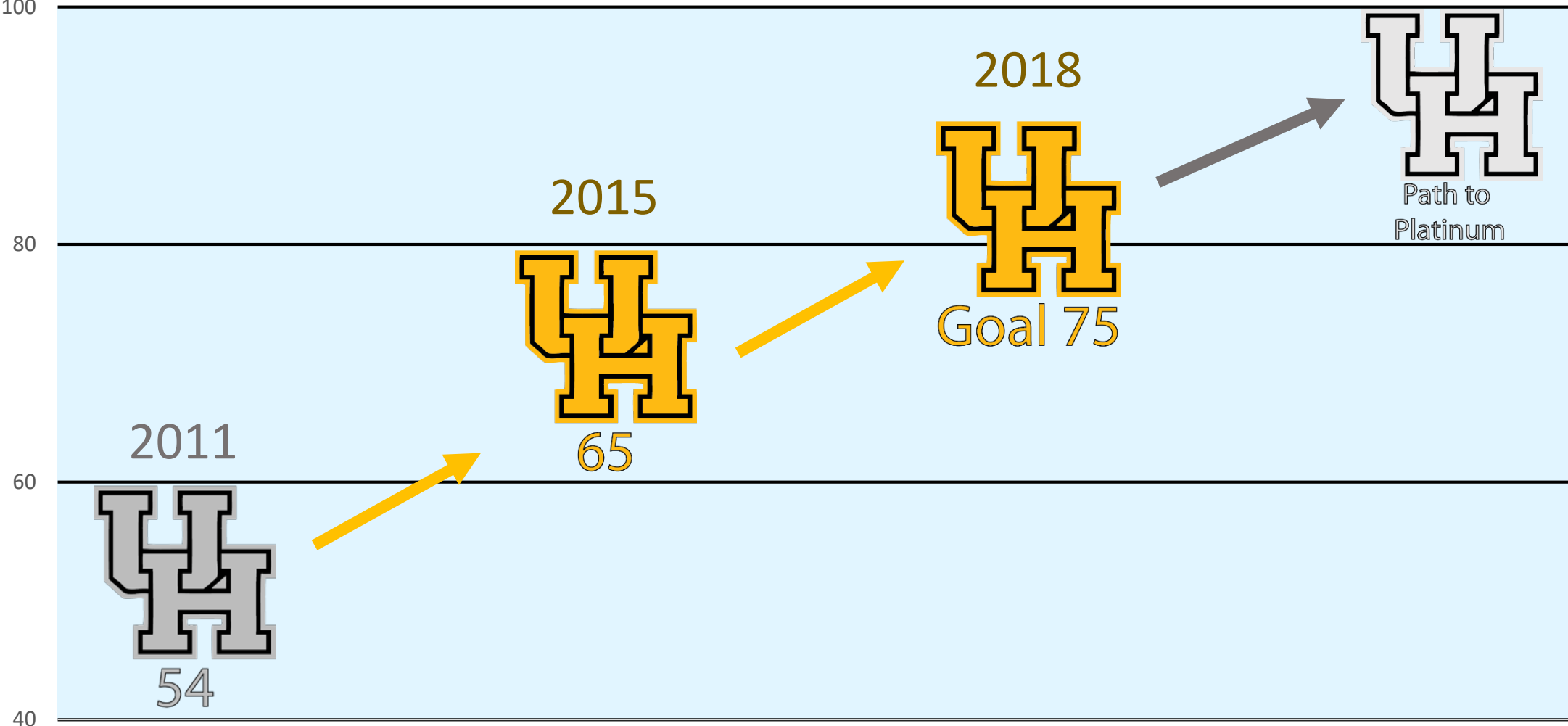
STARS Overview

STARS is organized into four main categories - **Academics (AC)**, **Engagement (EN)**, **Operations (OP)** and **Planning & Administration (PA)** - and an optional “bonus” category: **Innovation & Leadership (IN)**.

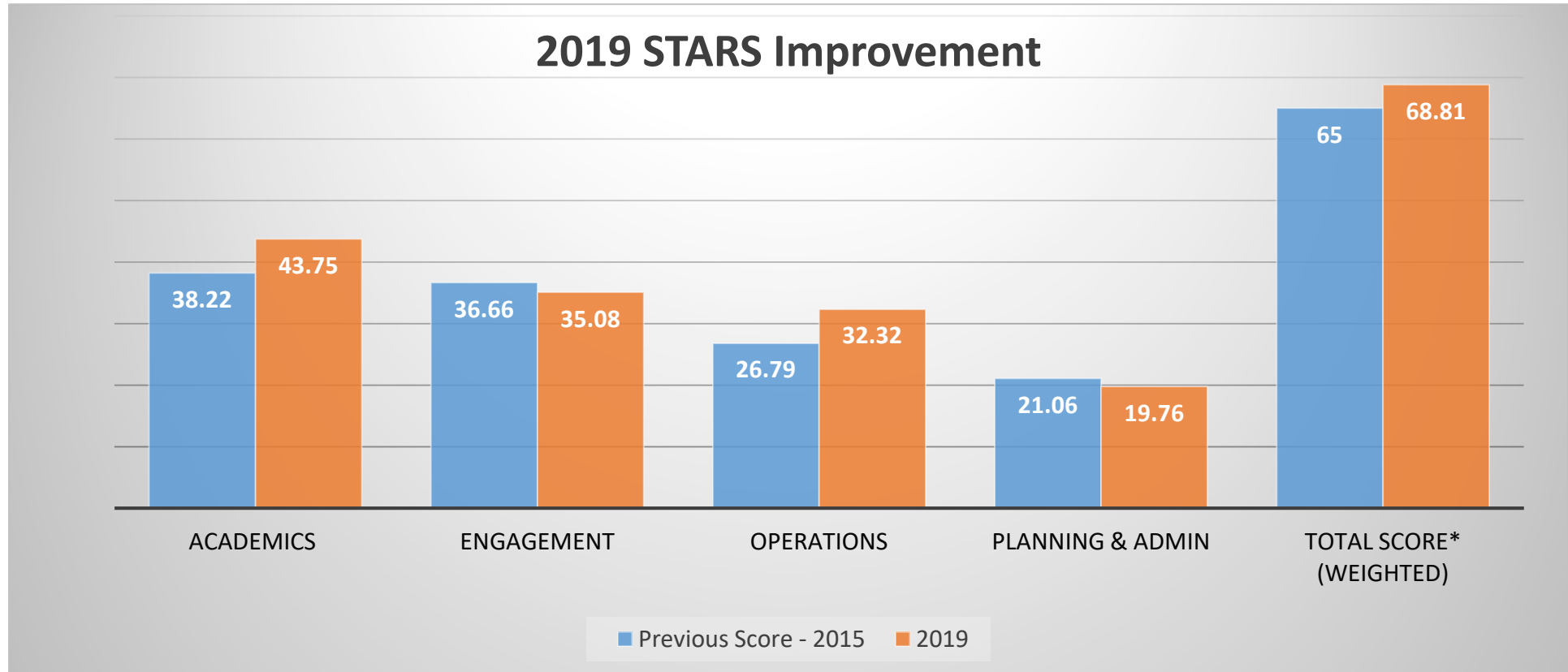


STARS History

Previous STARS Scores



2019 STARS Improvement



Improved Score – **68.81**



What Does Sustainability Activity Look Like On Campus?

Academics

PolarPanel

By Sharinna Byrd



Solar-powered refrigeration has been a winner at business plan competitions across the country, driven by a team from the University of Houston and the business plan the team created to commercialize a technology developed by NASA.

Tech savvy minds transform a shipping container into a solar powered computer lab



Academics

Two NSM Undergraduates Receive Hollings Environmental Science Scholarships



NSM Students Rachel Sanchez-Ruffra and Jacob "True" Furrh at the 2018 NOAA Undergraduate Scholars Orientation in Silver Spring, Maryland.

UH Grad Student Earns NASA Fellowship for Climate Modeling



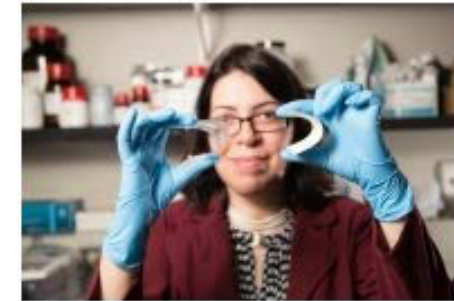
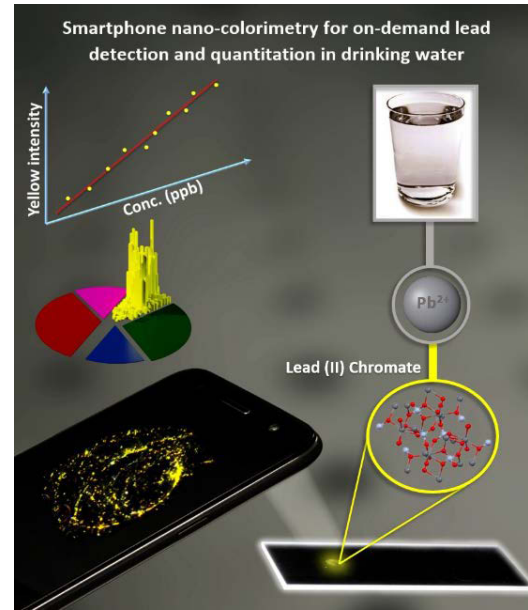
Elizabeth Klovenski, a Ph.D. student in the Department of Earth and Atmospheric Sciences, has received a three-year fellowship from NASA for her work in modeling emissions of biogenic volatile organic compounds.

Research

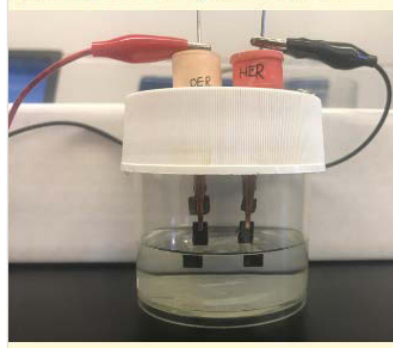
15% Faculty Engaged in Sustainability Research

81% Academic Departments

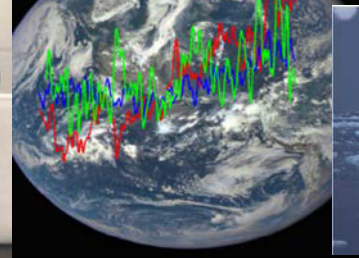
\$43.35 Million in Research



UH Researchers Report Hydrogen Catalyst to Split Water

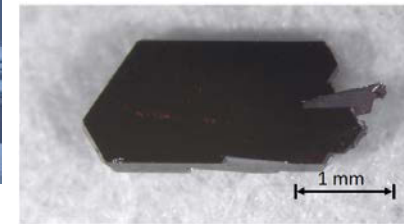


More Efficient Heat Engine for the global atmosphere



Driving the Future
A Scenario for the Rapid Growth of Electric Vehicles

Authored by the Gutierrez Energy Management Institute in collaboration with UH Energy



Researchers have created a crystal grown from two relatively common mineral elements – boron and arsenic – that demonstrates far higher thermal conductivity than any other semiconductors and metals currently in use



UH chemist Jakaah Birgoh has received a NSF CAREER award to improve light-emitting lighting.

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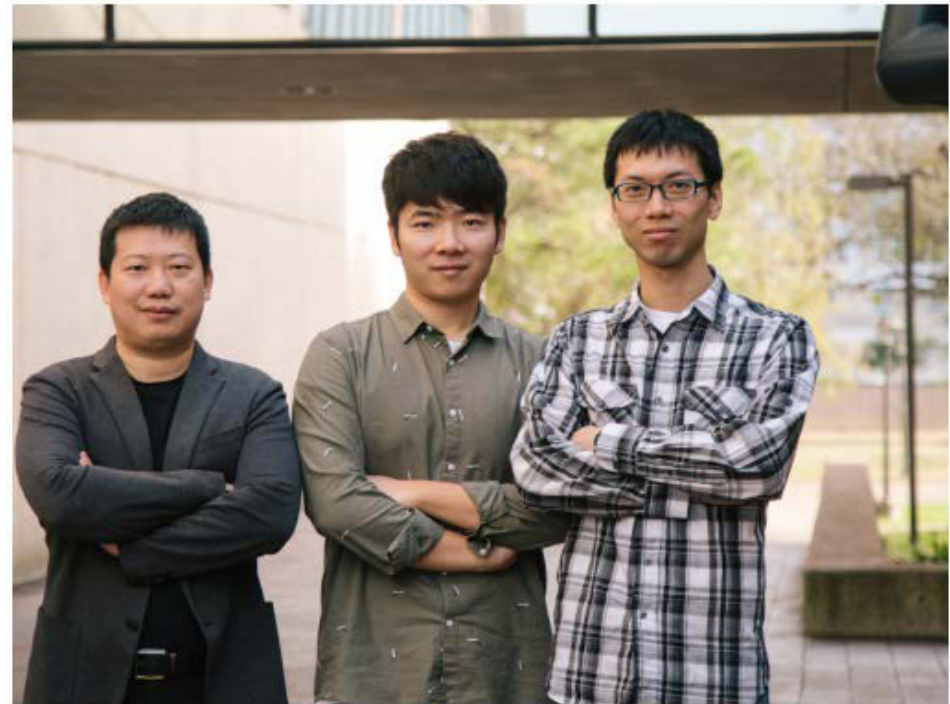
OFFICE OF SUSTAINABILITY

Research

Lean Electrolyte Design is a Game-Changer for Magnesium Batteries



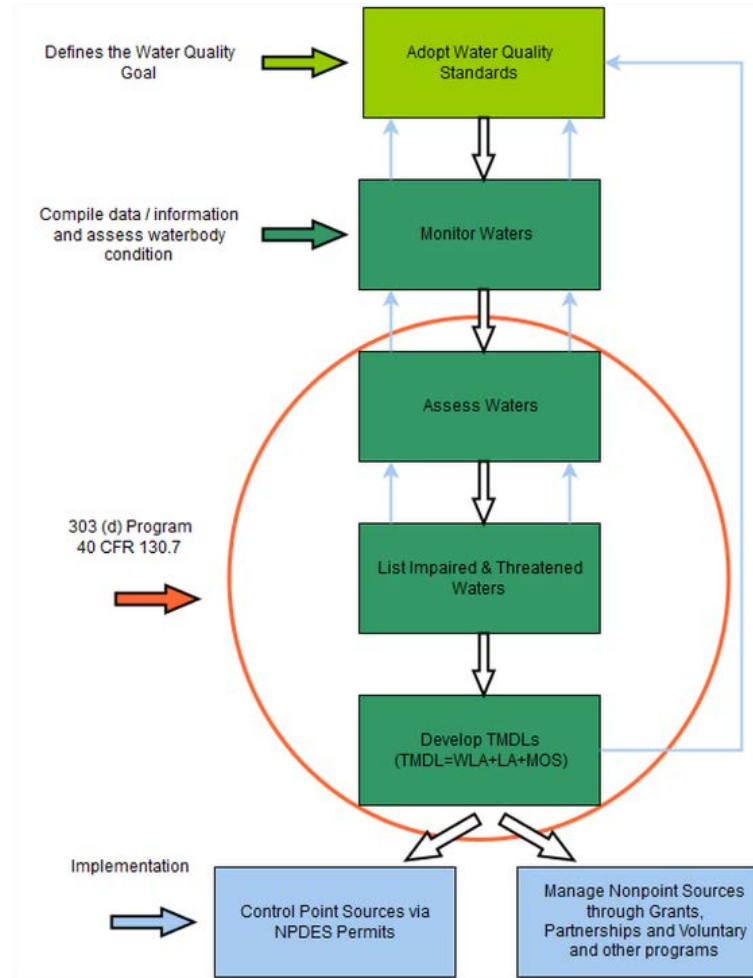
Researchers from the University of Houston and the Toyota Research Institute of America have discovered a promising new version of high-energy magnesium batteries. Photo: Getty Images



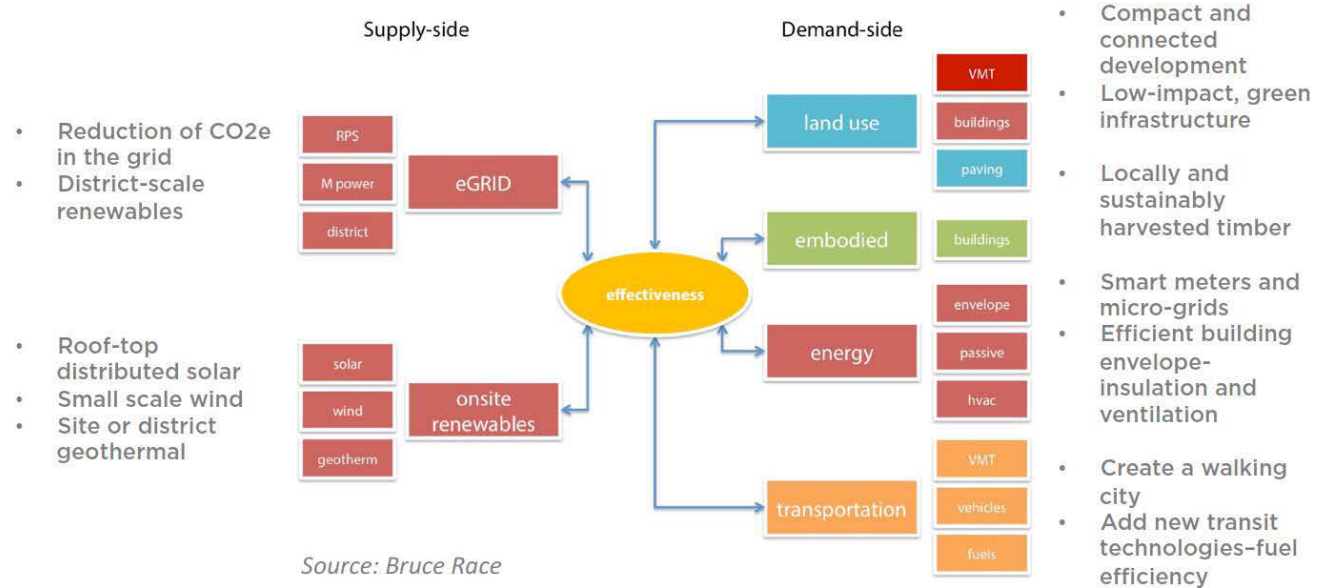
Yan Yao, left, associate professor of electrical and computer engineering, led the project, along with first authors Hui Dong and Yanliang Leonard Liang.

Research

Comprehensive Approach to Managing Pollution



Mitigation Strategies and Smart Cities



Source: Bruce Race

UNIVERSITY OF HOUSTON • CeSAR

Do Campus Activities and Research Translate into Policy and Action for Campus Sustainability?

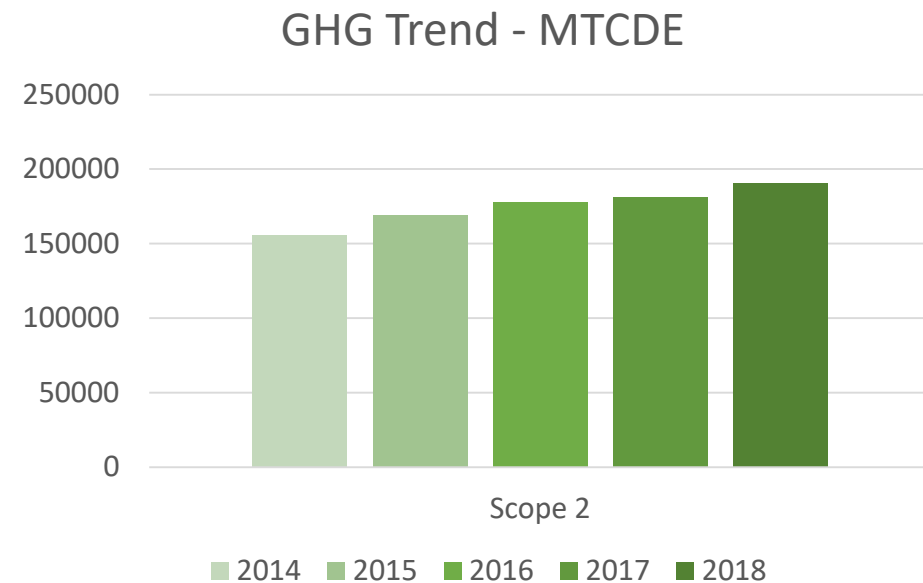
Campus as a Living Laboratory

Air and Climate



Students have been measuring ozone levels around campus, getting a real-life lesson in collecting and analyzing data for a class in the Department of Earth and Atmospheric Sciences.

Policy/Plan	UH
Climate Action Plan	No
GHG Emissions	13.5% Increase

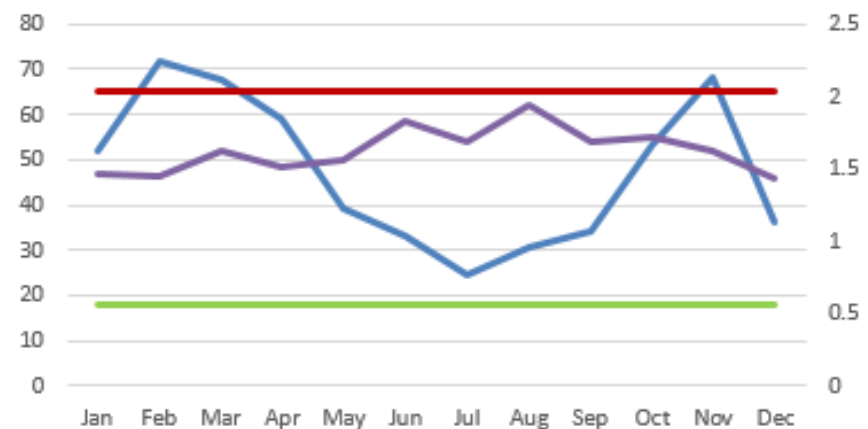


Campus as a Living Laboratory



Policy/Plan	UH
Renewable/Clean Energy Commitment	No Commitment
Energy Reduction Plan	Not Published
Campus Energy Use	5.6% Increase Annually

Energy Performance (Btu/EUI)



Campus as a Living Laboratory

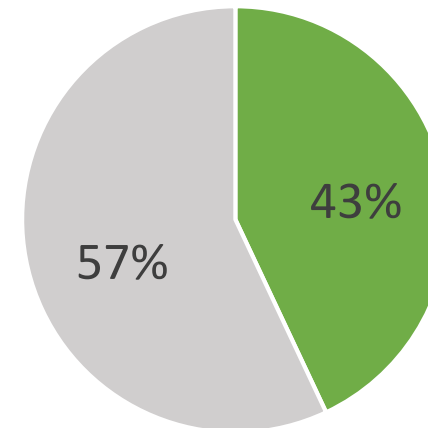
Grounds and Water



Kerri M. Crawford, assistant professor of biology and biochemistry, is studying how interactions between plants and soil microbes will influence plant growth and health in a warming climate.

Policy/Plan	UH
Stormwater Plan	No
Water Reduction Plan	No
Campus Water Use	8% Increase

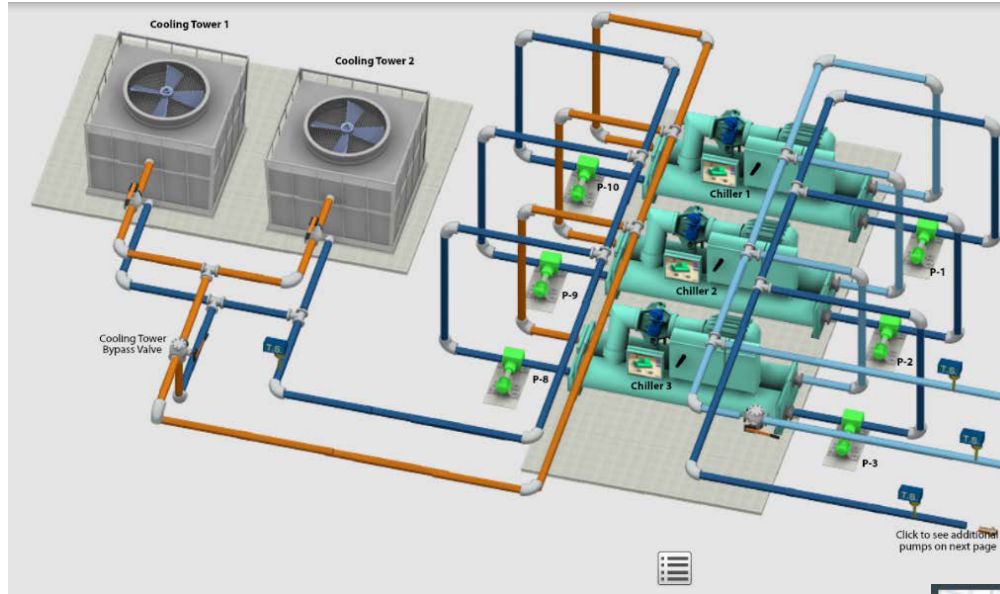
Impervious Vs Pervious



■ Pervious ■ Impervious

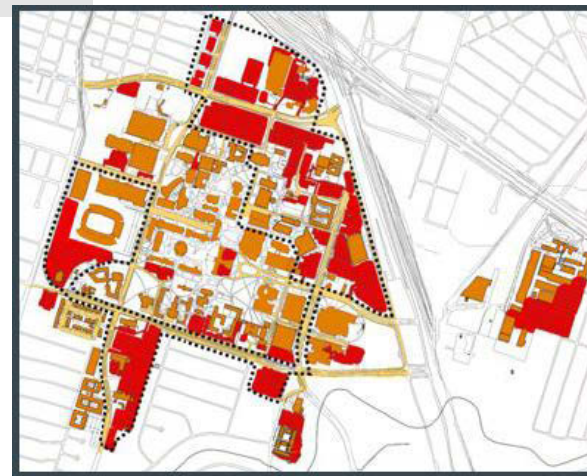
Campus as a Living Laboratory

Buildings



Policy/Plan	UH
Sustainable Purchasing Policy	No
Sustainable Investment Policy	No

Over \$350M in Repairs and Renovations (2019 – 2023)



University of Houston | Heat Islands
Total area: 25M sqft (574 acres)

Heat Island:

- Parking Lots 5M sqft (20%)
- Buildings 5M sqft (20%)
- Car Streets 3M sqft (estimated)
- Permeable 8.5M sqft (estimated)
- Poor shading

Campus as a Living Laboratory

Waste

Materials Research Collaborative

Metals	Polymers	Ceramics	Natural Materials	Hybrids
F-ferrous [40]	C-composites [50]	C-concrete [48]	BP-biopolymers [11]	CC-ceramic/ceramic [9]
NF-non ferrous [64]	E-elastomers [52]	FC-fired clay [18]	EM-earthen materials [22]	CM-ceramic/metal [1]
	TH-thermosets [28]	G-glass [63]	NF-natural fiber [73]	F-fiberglass [7]
	TP-thermoplastics [63]	S-stone [41]	W-wood [122]	MM-metal/metal [0]
				MN-metal/natural [3]
				PM-polymer/metal [6]
				PN-polymer/natural [31]



Policy/Plan	UH
Recycling Policy	Yes
Recycling Percentage	15%
Waste Volume	10% Increase



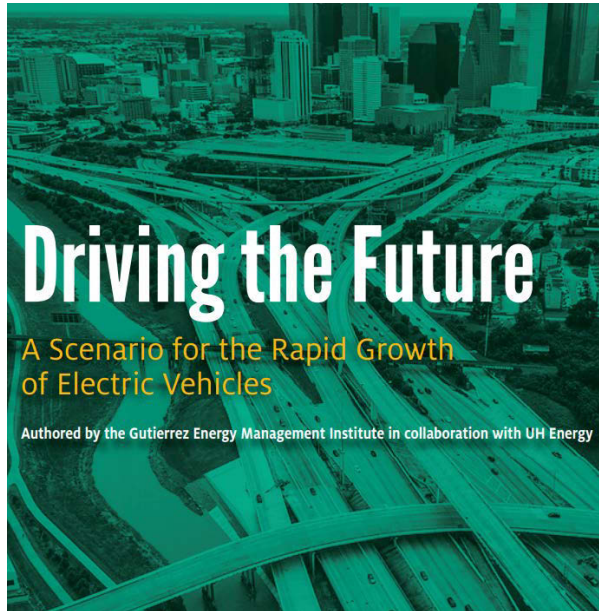
Single Stream
Recycling
Campus-Wide

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Campus as a Living Laboratory

Transportation




83%
Students
ON CAMPUS
ARE COMMUTERS

Policy/Plan	UH
Alternative Transportation	Yes
Smart Parking System	Yes



UNIVERSITY of HOUSTON
PARKING AND TRANSPORTATION SERVICES



Other STARS Participants

PLATINUM



86



88



71



71



72



84



82

GOLD



65



68



68



70

SILVER



41



51



52



56

Leading Institutions



Certifies: All New BD+C And O+M Gold or above	2 Platinum, 16 Gold, 3 Silver, 1 Certified
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Certifies: All New BD+C And O+M Gold or above	3 Platinum, 27 Gold, 16 Silver, 1 Certified
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Certifies: All New BD+C And O+M Silver or above	1 Gold, 4 Silver, 3 Certified
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Certifies: All New BD+C And O+M Gold or above	11 Gold, 2 Silver
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American Athletic Conference



84

**Certifies:
All New BD+C Gold or above**

1 Gold, 6 Silver



68

**Designs to LEED, no formal
certification**

1 Gold, 2 Silver, 4 Certified



65

**Designs to LEED, no formal
certification**

2 Gold, 2 Silver, 2 Certified



51

**Certifies:
All New BD+C Silver or above**

16 Gold, 6 Silver

Schools in Texas



Certifies: All New BD+C Silver or above	6 Gold, 5 Silver
--	-------------------------



Certifies: All New BD+C Silver or above	2 Gold, 3 Silver, 3 Certified
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All UT Schools Certify: BD+C – Silver or above O+M – Silver or above	14 Gold, 3 Silver, 1 Certified
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Designs to LEED, no formal certification	1 Platinum, 3 Gold, 2 Silver
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Making the Case for LEED

UNIVERSITY of HOUSTON | SUSTAINABILITY

MEMORANDUM

To: Christa Rieck, Executive Director
From: Jim Taylor, Campus Architect and Michael Mendoza, Sustainability Manager
Date: July 13, 2018
Re: The Case for Sustainability (and LEED certification)

Now is an opportune time to revisit our approach to sustainable design and third party certification of our projects. As you know, soon we will begin a detailed review and revision of the University's design standards and technical specifications.

Our current guideline calls for projects to be designed to LEED v2009 standards, but without certification. This is an outdated guideline with little benefit, since energy codes now surpass LEED v2009 metrics. Current LEED standard is version 4.1. Without third-party certification, the existing guideline also lacks rigor, credibility, and accountability.

There are several reasons to reconsider the existing guideline and to require LEED certification for our projects:

- **The time is right.** There are several transformative projects ahead of us on campus—including new life science and performing arts buildings, a new medical school, and a new law school. True sustainable design, validated by LEED certification, will enhance the POWER of these project stories and thereby the University's brand.
- **The University IN Houston.** The time also is right in Houston. In a post-Harvey world, the University has an opportunity to become a leading voice for responsible development. Through our projects, the University can demonstrate smart storm water management, energy efficiency, and healthy interiors—in other words, high performance design. In fact, Houston already has 463 LEED certified buildings and the City of Houston requires certification of all its new construction over 10,000 square feet, replacement facilities, and major renovations. By comparison, New York, Chicago, and Washington, D.C. each have more than 800 certified buildings.
- **Alignment with community.** Of the 9,448 student graduates from 2017, 6,545 took at least one course with a sustainability learning outcome. There are 54 academic departments on campus and 49 have at least one faculty member engaged in sustainability research, with total sustainable research funding approaching \$50 million. The campus Sustainability Committee attracts 20 volunteer staff members who are actively seeking increased sustainability on campus. Lastly, the Office of Sustainability conducts an annual campus assessment through STARS; LEED certification will improve our sustainability metrics and allow us to raise the University's STARS rating.
- **Improved competitive position.** Consistent with the Chancellor's strategic goal for national competitiveness, certifying buildings to LEED standards will continue to elevate the



Designs to LEED, no formal certification	1 Silver
--	----------

- Our “competitors” are doing more than us
- Interest from students, faculty, and staff
- Certification provides independent accountability
- Most A&E firms will unlikely charge “additional services”
- Costs are minimal
 - <2.5% of small projects
 - <1% for larger projects
- No impact on project schedule

LEED Moving Forward

- New \$80 million College of Medicine
- 150,000 SqFt.
- LEED Silver or Higher



Centennial Master Plan



167 Buildings

14.4 mil SqFt

9K Residents by 2020

**Over 20 new builds
or major
renovations planned**

Current Master Plan Goals

- **Stewardship of the physical setting** conserves **the legacy** of our first 100 years
- **Growth targets** linked to the **centennial aspirations** support a destination campus
- **Four gateways** created by **curated landmark** buildings improve orientation
- **Pathways** interwoven with **indoor/outdoor gathering** places foster collaboration

Challenges and Opportunities

- Competing Institutional Priorities
- Politics of State-Run Institution
- Departmental Silos
- Bridging the Gap between Academics and Administration
- Sensitivity to Burdens Passed on to Students
- Substantial Change Takes Time

Action without policy is wasted.





DINING HALL



"As a university system, we are committed to building campuses that minimize the use of natural resources and don't harm the environment. We want to provide all students, faculty and staff members on our campuses with buildings that are first class in every way, including reduced environmental impact."

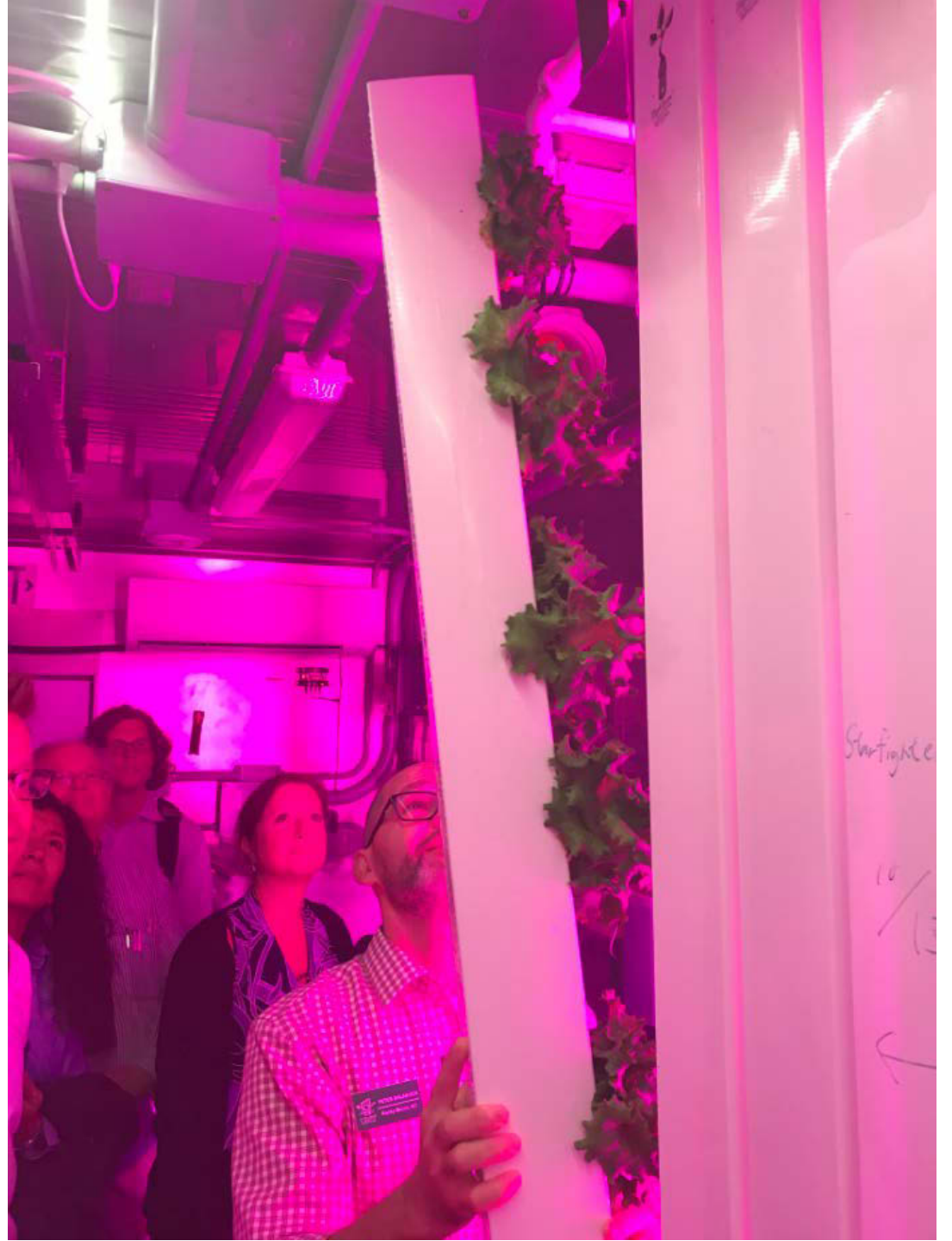
Energy: increased density, building standards

Transportation: pedestrian, bicycle and transit alternatives; increased on-campus housing; parking demand management strategies

Waste and recycling: facility and landscape standards

Campus practices and operations: master planning, building and landscape standards

Renewable energy and carbon offsets: identifying locations for future wind and solar power





Initial goal: LEED Gold









**COMPOSED OF DIVERSE
STAKEHOLDERS**

RISK AVERSE





...Silver





...Certified?



design to LEED standards















RESEARCH

**CROSS
POLLINATION**

LABORATORIES

OFFICES

CROSS POLLINATION

College of Sciences & Technology



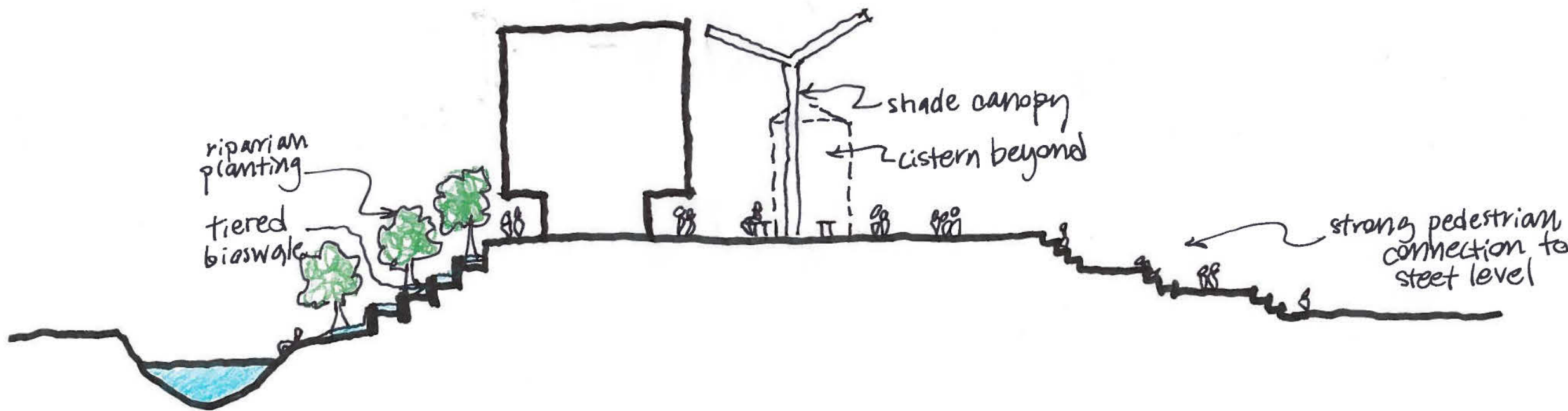
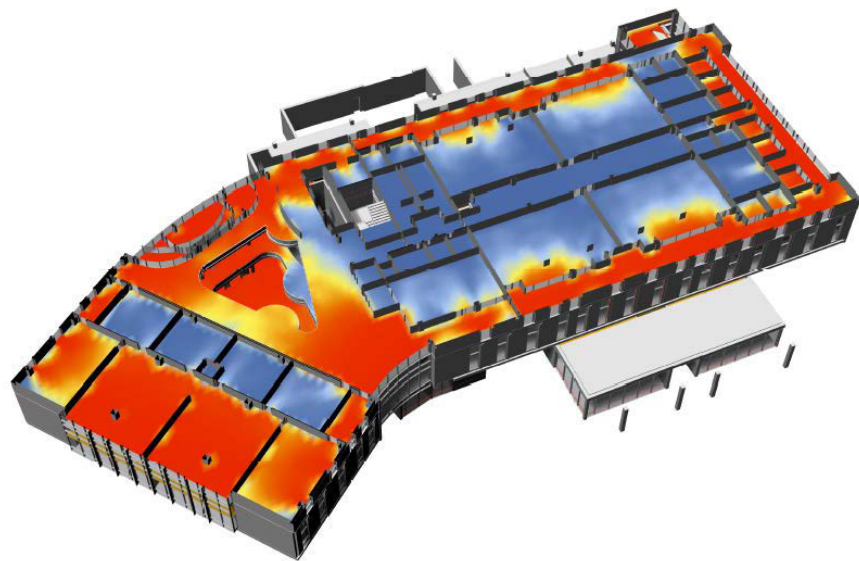
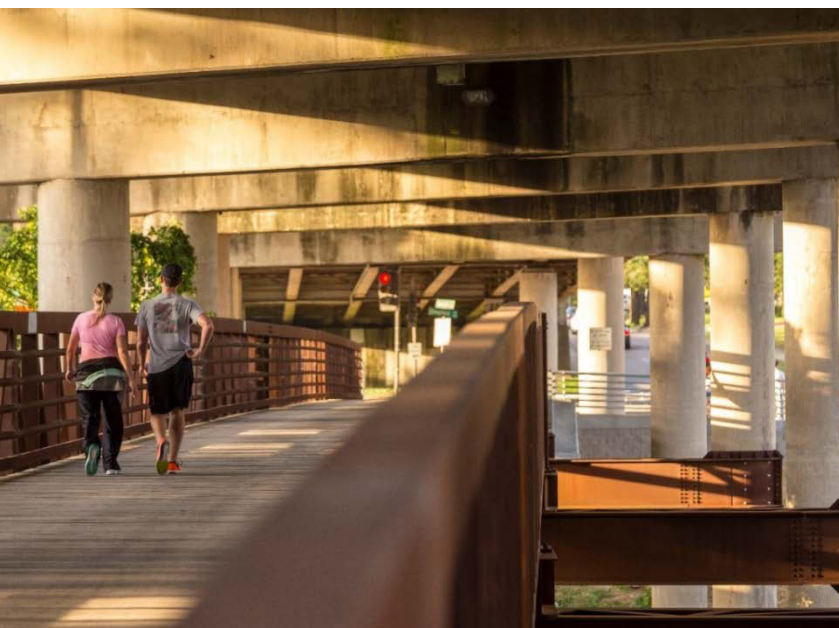
Akif Uzman
Dean

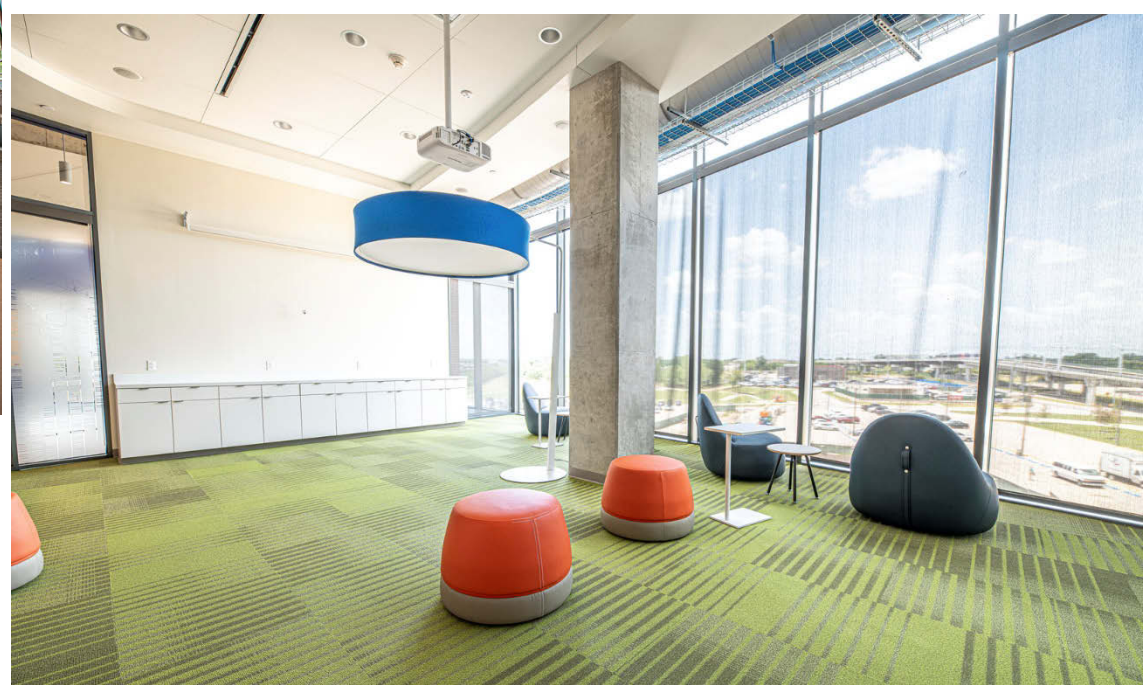


Lisa Morano
Dir. Center for Urban
Agriculture & Sustainability



Phil Lyons
Biology faculty,
Department Chair









Native Plants

Event Lawn

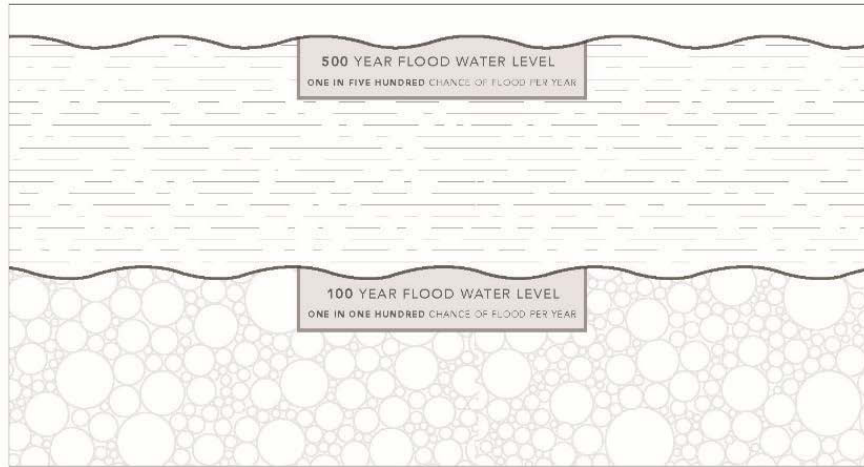
Porch

Bridge

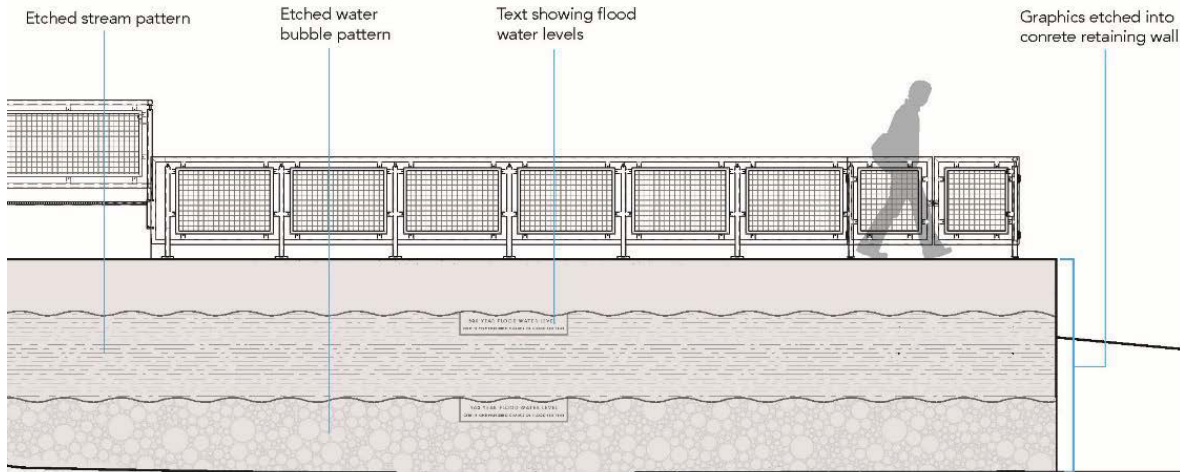
Cistern and
Urban Gardens

Connection to trail

Rain garden



Graphics Detail
Scale 3/4" = 1'-0"



LEARNING | HEALTH & WELLNESS



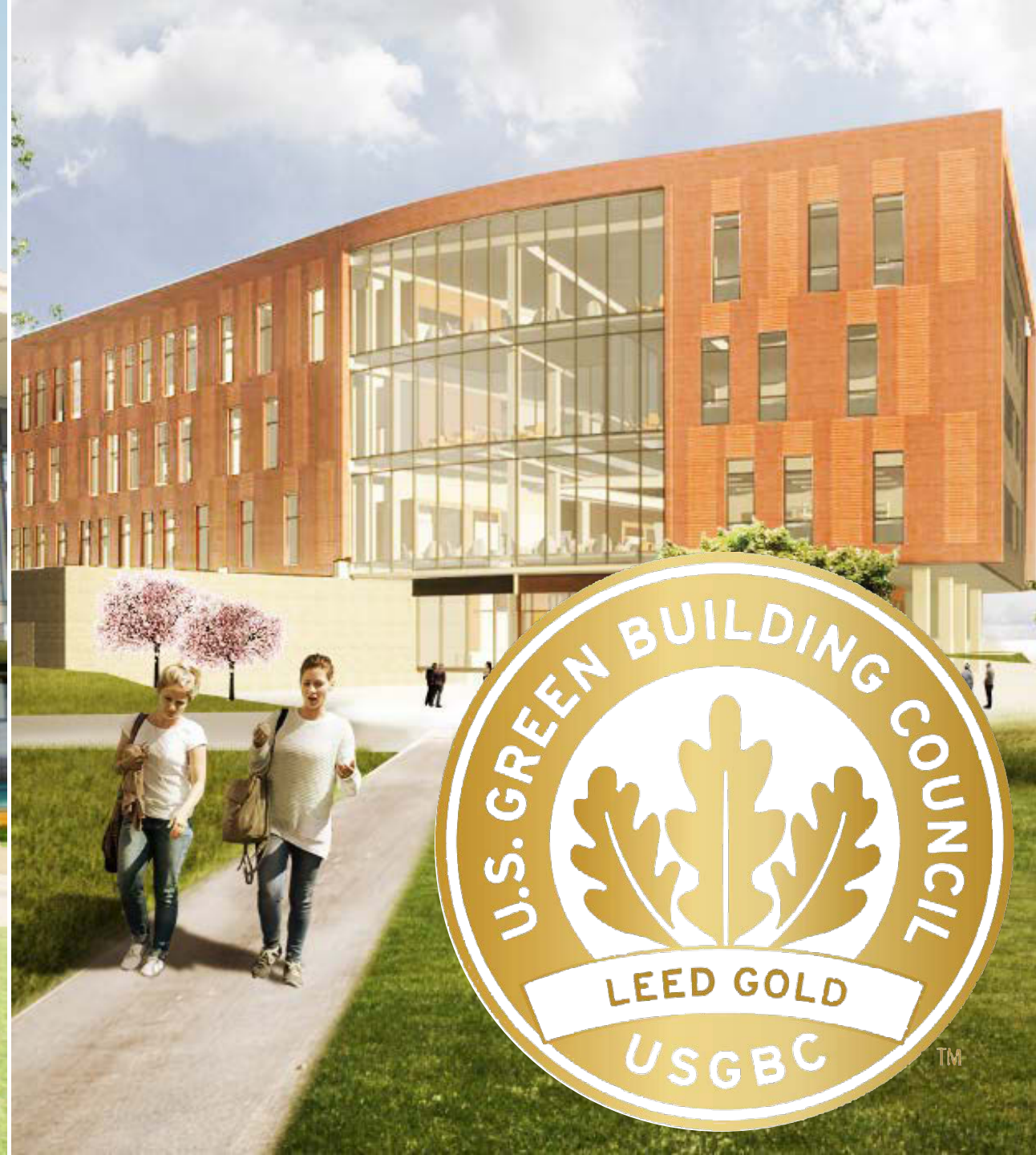
Design strategies that promote human health and comfort are critical to creating an optimal environment for learning and working for UHD students and employees. These considerations extend from the exterior and the relationship of the building and site to its surroundings, all the way to the interior spaces and their lighting, layout, and materials. A heavily urban site provides opportunities for pedestrian and bike-friendly designs that increase walkability and promote healthier, environmentally friendly means of transportation. Access to natural light is balanced with glare management strategies and help regulate the body's natural circadian rhythms. Finally, opportunities for connection to nature benefit occupant emotional and psychological health, having been shown to impact mood, satisfaction, and productivity. UHD's urban agriculture program provides a unique opportunity for outdoor spaces that link building occupants to nature.

LEARNING | MATERIAL



Materials for this project were selected to minimize environmental impacts, reduce the presence of toxic chemicals, and support the local economy. More than 20% of the materials were extracted and manufactured within 500 miles of Houston, resulting in a significant reduction of the emissions required to transport materials. One example is the bricks used on the exterior, which were made in Athens, TX, out of the local red clay. In addition, more than 15% of materials used on the project are recycled or reused, reducing the need for virgin materials and lowering the project's overall environmental footprint. For example, the stones used to help filter storm water in the bioswale were once a nearby concrete sidewalk. Finally, low-emitting materials were specified for the interior, reducing the presence of volatile organic compounds that negatively impact air quality.







3 BUILDINGS NEED CHAMPIONS



1

DIVERSITY = SURVIVAL

2

ACTION WITHOUT POLICY IS WASTED

3

BUILDINGS NEED CHAMPIONS

Questions?

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