Sustainable Operations & Maintenance Programs

APPA Institute
Ft. Worth, TX
1/10/23

Edward von Bleichert
University of Colorado B**oulder**

Housekeeping

- Welcome!
- Break
- AIA Continuing Education Credits
- Session Evaluations
  - Please add written comments
- T-shirts

Credit(s) earned on completion of this course will be reported to American Institute of Architects (AIA) Continuing Education Session (CES) for AIA members.

Certificates of Completion for both AIA members and non-AIA members are available upon request.

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Course Description

This course will provide an overview of O&M programs that are striving to be sustainable. This interactive session will explore what sustainability means to facilities managers, review the many questions and challenges presented by sustainability, as well as share practical success stories from around the country. Topics will include how campuses are structuring their sustainable O&M programs, current trends & new initiatives in waste management, water & energy conservation, tree & turf care, green cleaning, pest control, and more. The session will also look at developing appropriate metrics and how to effectively use them in related outreach programs.

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Learning Objectives

1. Explore what sustainability means to facility managers
2. Review the questions and challenges presented by sustainability
3. Learn the current trends and initiatives in waste management, water and energy conservation, tree & turf care, and more
4. Share practical stories from around the country.

AIA Continuing Education Provider

Personal Introduction

- Division of Infrastructure & Sustainability
- Sustainability & Resiliency Program Manager as of 1/1/17
- Formerly the Assistant Director for Environmental Operations
- Oversaw various programs
  - In-house waste collection & processing
    - Recycling, composting, solid waste
    - On campus recycling facility
    - Service contracts
  - Integrated Pest Management
  - Wildlife management
- 24 years in campus operations


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Course Goals

- Explore the definition of ‘Sustainability’
- Link sustainability to accepted / existing practices
- Share examples of initiatives striving for sustainability
- Demonstrate the role of O&M
- Explore challenges and pitfalls
- Review role of certification programs
- Link metrics to outreach

Introduction: Why Should We Care?

1 Billion more people roughly every 14 yrs.

- 1B – 1804
- 2B – 1927 (+123 years)
- 3B – 1959 (+32)
- 4B – 1974 (+15)
- 5B – 1987 (+13)
- 6B – 1999 (+12)
- 7B – 2012 (+13)
- 8B – 2026 (+14)
- 9B – 2042 (+16)

Definition of Sustainability?

Compliance vs. Sustainability

~ Compliance with est. rules, regulations, policies - mandatory

~ Sustainability addresses impacts and issues beyond required compliance

Sustainability Initiatives vs. Sustainable Initiatives

~ Few programs can be considered ‘sustainable’ at this time

~ Many programs are striving for sustainability….difficult to achieve

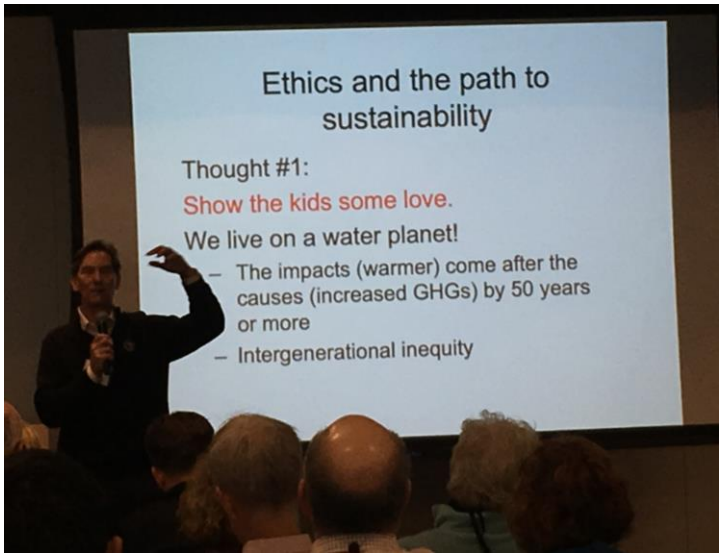
Easier to Define than to Achieve

7th Generation Principle

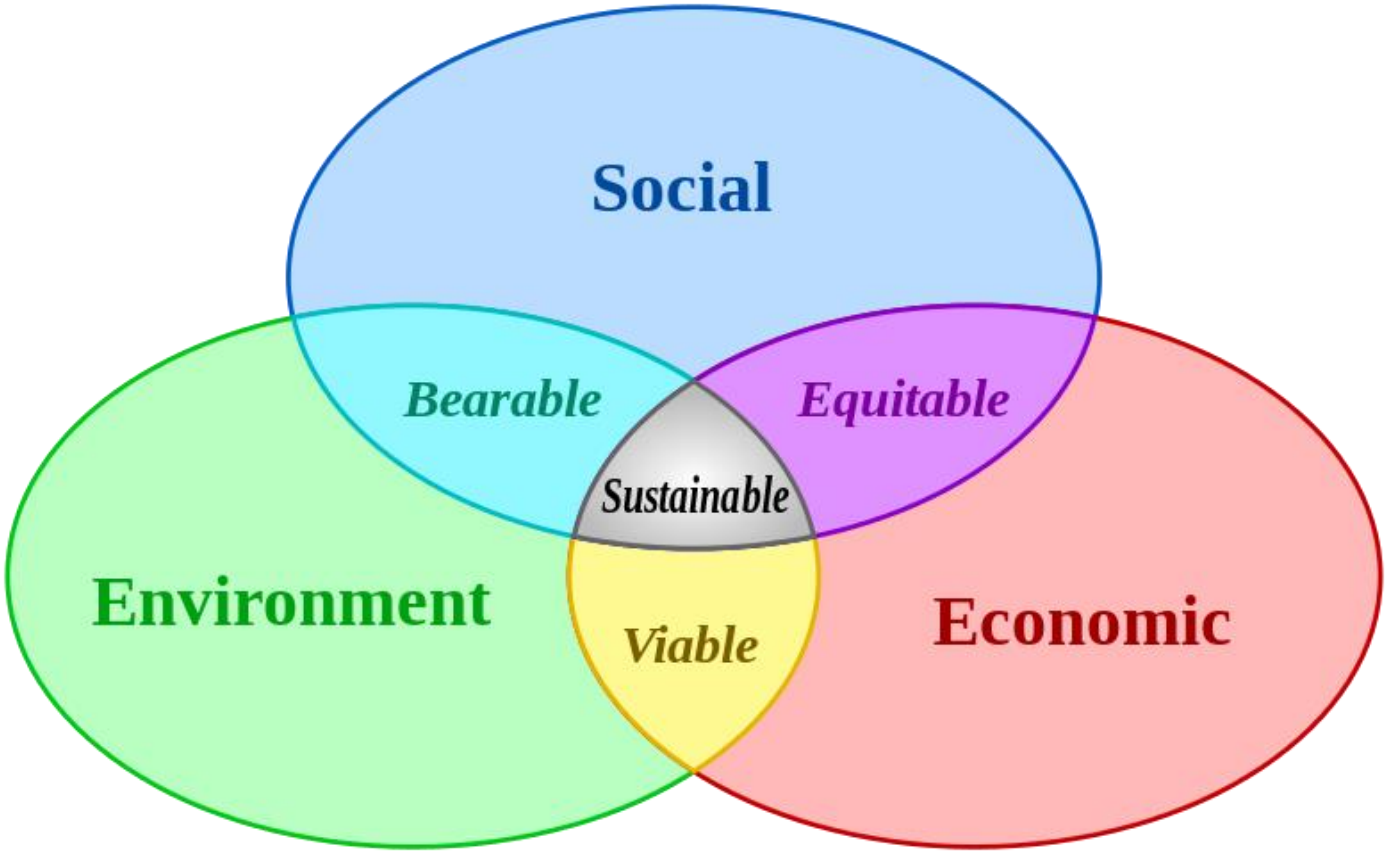
The "7th generation" principle taught by Native Americans says that in **every decision**, be it personal, governmental or corporate, we must **consider how it will affect our descendants** seven generations into the future.

Generally speaking:

Meeting your needs without causing immediate harm or impacting the ability of others to do the same (in the future)



Today's facilities manager must look for balance among the 3 pillars.



Thoughts?

SUSTAINABILITY

Is / Should be About

- Continuous Improvement
- Long term
- Data & metrics driven
- Interconnected
- Everyone's job / responsibility
- Collaborative
- Consistent
  - In effort, not approach
- Adapted to regional conditions / realities


DANGER
DO NOT ENTER
DANGER
DANGER
PRECAUCION

Sustainability as it relates to accepted and applied Terms & Practices

- Total Quality Management (TQM)

- Continuous Improvement (CI)

- Data Driven Decision Making (DDDM)
  - Focus within APPA
  - Used by NACUBO
    - Nat'l Assoc. of College & University Business Officers

- Total Cost of Ownership (TCO)
  - HIGHLY relevant to sustainability
    - Incorporates life cycle costs as well as concept of 'Externalities'
      - examples?
    - Goes beyond compliance

Continuous Improvement as a Driver of Sustainability

- Notion can be daunting
  - Will it ever end?!

- However, also affords a certain freedom and flexibility
  - Can't achieve everything at once
  - Will always be a next phase or second chance of sorts
  - "Under promise and over deliver"

Drivers of Continuous Improvement

- Change
- Time
- Wear & tear: equipment, vehicles, infrastructure
- Changing profile: waste; energy; space; demographics
- Cost of utilities
- Scarcity of resource
- Changing climate: campus; city/county; state; national

- Campus Goals / Initiatives

‘Zero Waste’ Epiphany

- Zero Waste defined as a minimum of 90% landfill diversion
- Athletic Dept. & Chancellor fixated on the last 10%
  - “What will we do with athletic tape?!”

- New approach: equated ZW goal to that of a ‘Zero Accidents’ program on a construction site
  - Becomes part of the daily planning and process

- Zero Waste goals became the driver for Continuous Improvement

Getting Started – aim high but start 'small'

<u>Win – Win – Win</u>

- Financial
- Environmental
- Social
  - Housekeepers
  - Laundry staff

Sustainability Initiatives

- Integrated Landscape Management
- Wildlife Management
- Zero Waste Events
- Energy Management
- M&O Waste / C&D waste

Integrated Landscape Management

<u>Elm Bark Beetle example</u>

- Campus lost hundreds of mature (80+ year old) American Elms in 1980's
- Only 34 remain
- Annual (preventive) spraying of all trees during spring break (regardless of need)

Solution / Results

- Sanitation pruning
  - Dead & dying wood
- Annual inspection (students)
  - Is treatment needed?
- Soil injections instead of broadcast sprays

Soil Injections

Elm Bark Beetle approach Sustainable?

- No loss of trees (due to EBB) since implementation
- Exposure to insecticide drastically reduced
- Volume of insecticide used reduced
- Annual treatment costs reduced

<u>Potential pitfalls</u>

- Application method as effective?
  - Risk of losing high value trees
  - Could ruin credibility
- New method and product potential for impacting groundwater

<u>Potential solution</u>

- Move to trunk injections

Wildlife Management

Research ponds example

- Beavers damming up pond connectors
- Flooding adjacent areas
- Mature trees lost
- Repeated relocations
- Costly

Solution / Results

- ‘Beaver Deceivers’ installed
- Water level stabilized
- Mature trees wrapped and protected
- Relocation unnecessary
- Resource limits regulate population

Sustainable?

Zero Waste Athletic Events

Folsom Stadium example (Pre 2008)

- Recycling only (no composting) outside gates and tailgate lots for decades
- Disposables used throughout stadium
- Significant waste produced each game
- Unserved food thrown away
- Sourcing of products not a concern
- Sponsors and vendors not particularly ‘green’

Solution / Results

- Everything inside security perimeter now 'Zero Waste'
- Established recycling & composting stations; eliminated public trash cans
- Converted most landfill items (low value plastics) to compostable ware
- Expanded use of reusable serving ware
- Contract, sponsor and vendor reform
  - Esp. those selling/serving or giving anything away
- Improved sourcing
  - Food, paper (publications), shirts for volunteers
- Game day diversion rate more than doubled
  - <40% (2007) to >90% (2014)
  - Holding steady at >85%

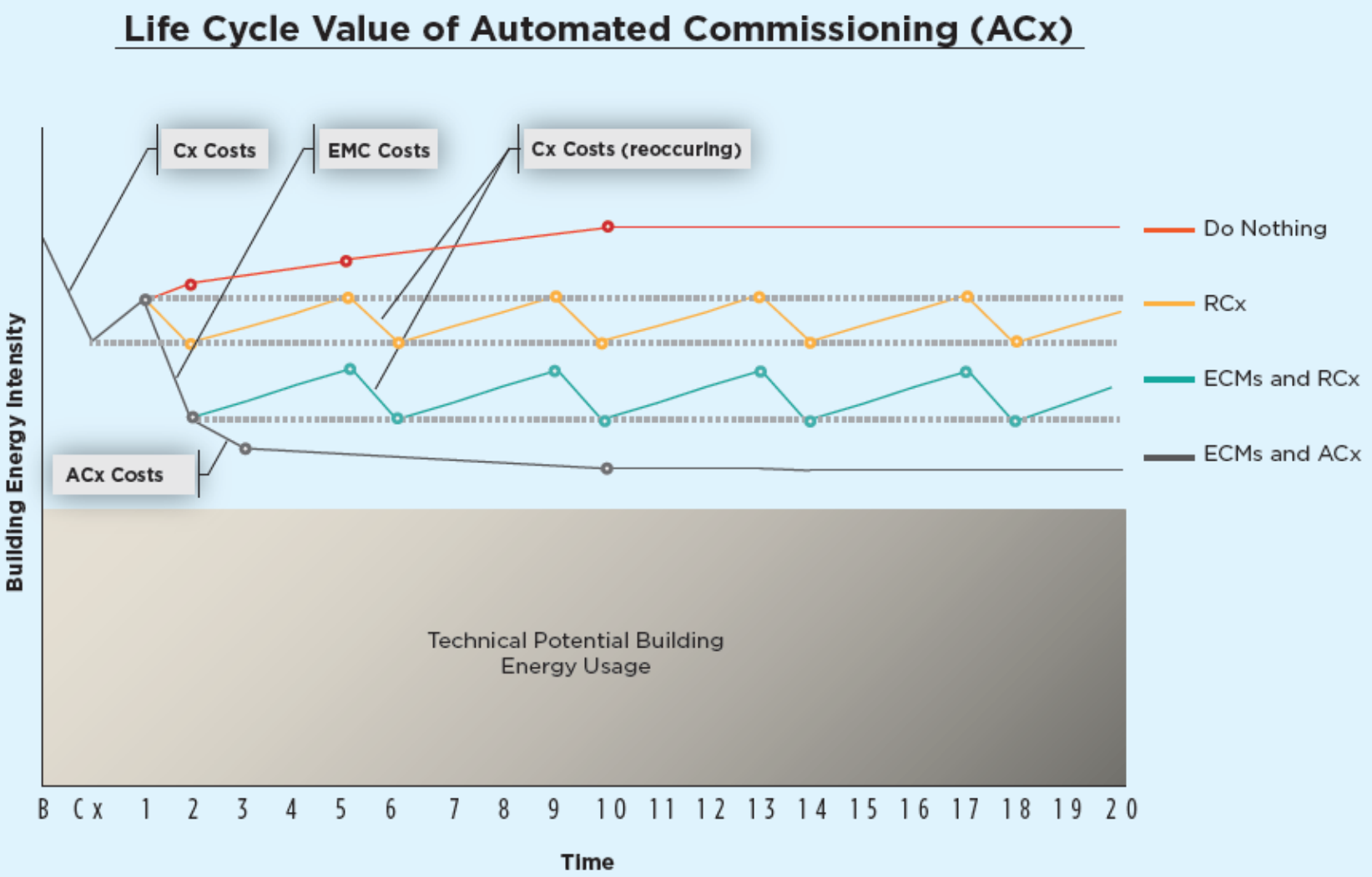
- *Numerous other energy, water, and transportation initiatives*

Sustainable?

Table exercise – 10 min.

- 5 min w/ group
- 5 min report out

Energy Management Saw-tooth



Energy Production
Heartland BioGas Facility


FEEDING
WASHINGTON
LIFELINE


HS 640
Tiger

Montana State University M&O

Residence Hall Upgrades

- Replacing ~900 platform beds with 'loftable' beds
- Voluminous waste destined for landfill
- Work to commence on graduation day
- Student supported effort

Solution / Results

- Reduced disposal costs
- 100% of metal lofts recycled (15,000 lbs)
- 78% of wood from beds repurposed.
- ~700 mattresses recycled
- Collaborative effort
- Meaningful student involvement
- Leveraged event to collect other items (food, electronics)
- Potential to help underserved community – temporary housing for homeless

Creative Solutions to Everyday Challenges

UCB Outdoor Services – Champions of Sustainability

- Pesticide use reduction
  - Turf – none since 2012
  - Trees – trunk injections
  - Beds – steam machine

- Noxious weed management
  - Goat grazing
  - Insect bio-controls

- Synthetic fertilizer redux
  - Compost tea
  - Dry poultry waste
  - Aggressive cultural practices

- Fuel use reduction
  - EV's
  - E-bikes
  - Handheld tools

- Zero Waste
  - Outdoor ZW stations
  - Organics diversion
- Water conservation
  - Weather based irrigation
  - Leaky head/valve detection
    - Mosquito habitat redux
- Pollinator protection
  - Colony protection & relocation
  - Pollinator gardens

Summary

Your Shop / Trade / Operation doesn't have to have a specific focus on sustainability to implement sustainable practices…

- Recycling as a "Gateway Drug"
  - Aggressive recycling, reuse, repurposing
  - Paint cans, carboys, scrap metal, electronics, pallets
- Purchasing
  - Office supplies, M&O supplies, food
  - Recycled content; packaging
- Green Office:
  - Energy & water conservation
  - Re-usables use
  - Paper use
- Use of less toxic chemicals
  - Cleaning supplies
  - Adhesives
  - Finishes
  - Carpet, composite materials

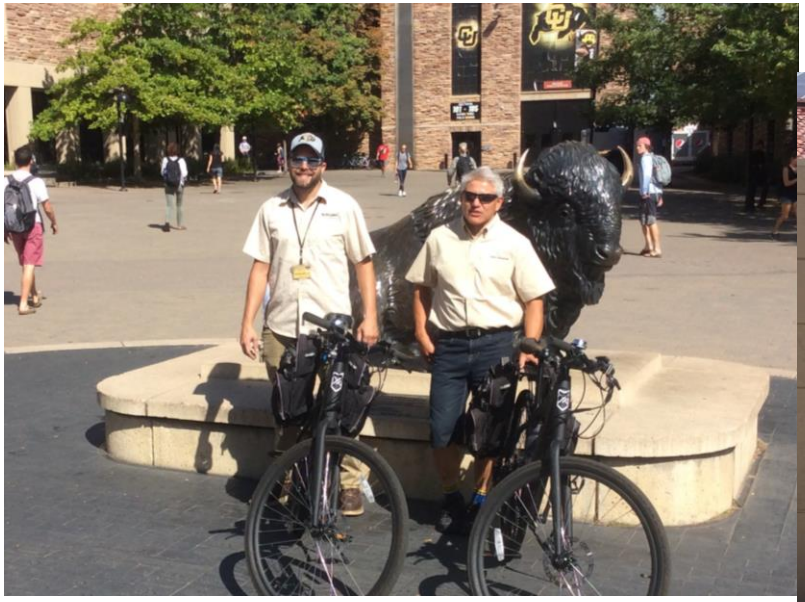
Other Opportunities

- Pesticide use reduction
  - Request IPM for your shop space
  - IPM design standards
- Waste management
  - Co-collections in custodial, grounds, food service
- Travel
  - Bus, shuttle, rideshare, train
  - Carbon offsets
- Vehicle / Fleet
  - Use of E-bikes
  - EVs, PHEVs, Hybrids
  - Bio-diesel, CNG

Win-Win-Win

Financial, environmental, and social benefits!

Elevator and Fire Suppression Technicians



Sourcing is one of the most impactful ways to make strides on the Social leg of the sustainability stool.

~ Applies to both services and purchasing

~ Look at both contract and vendor reforms

- Support of small & medium sized (local) businesses
- Green manufacturing practices
  - Local protection of resources
  - Chemical use
  - Renewable energy use
- Packaging – redux, take-backs
- High performance certifications – i.e., EPA Energy Star ®
- Country of origin – many health & environmental implications

Role of Certification Programs…not to be confused with competitions or challenges

Third-Party Sustainability Frameworks

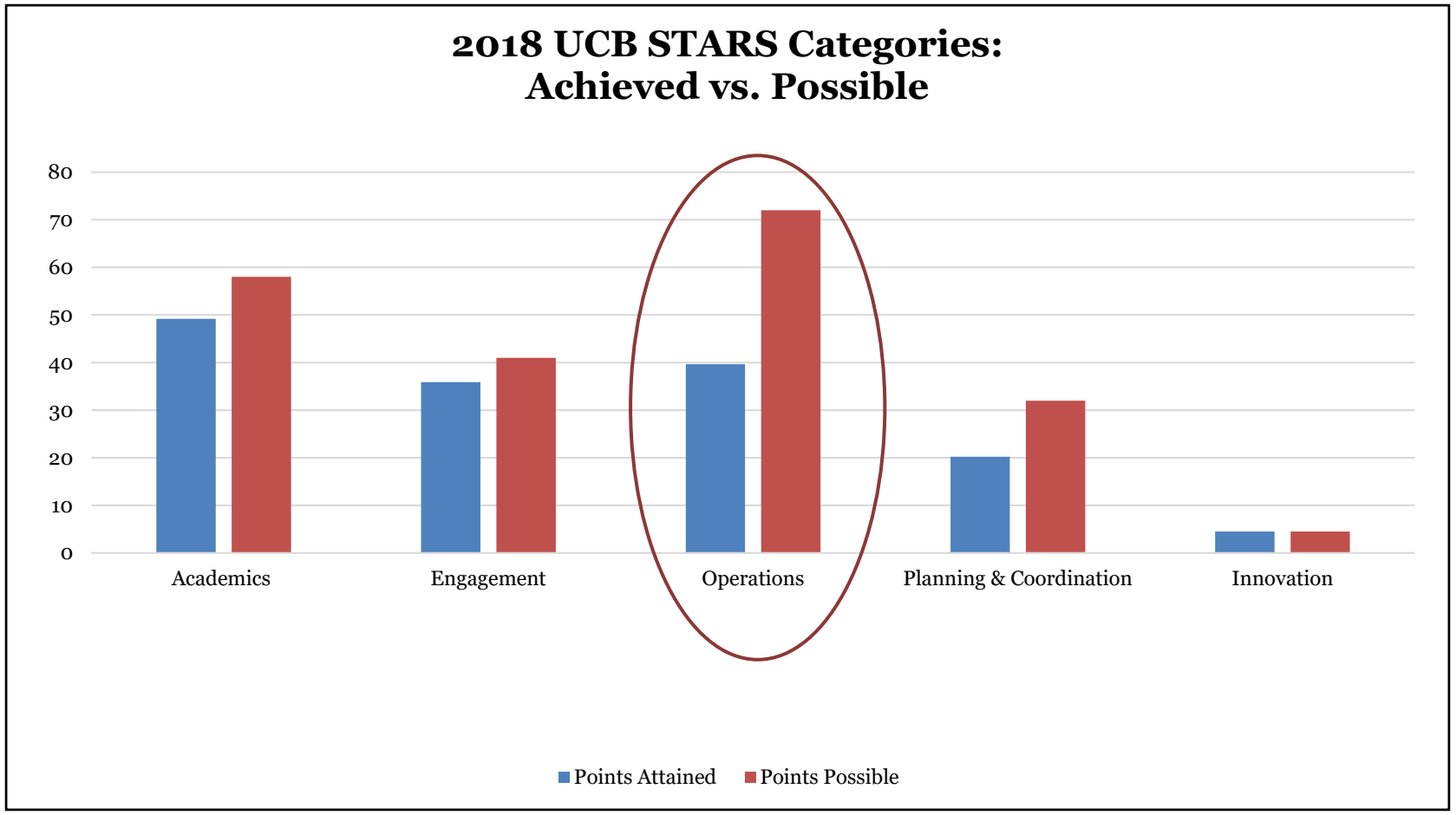
- STARS (Gold 2010, ‘14, ‘18)
  - Academics / Research
  - Engagement
  - **Operations**
  - Planning & Coordination
  - Innovation
- LEED
  - Sustainable Sites
  - Water Efficiency
  - Energy and Atmosphere
  - Materials and Resources
  - Indoor Environmental Quality
  - Innovation / Regional Priority / Pilot

The Sustainability Tracking, Assessment & Rating System™ (STARS®)

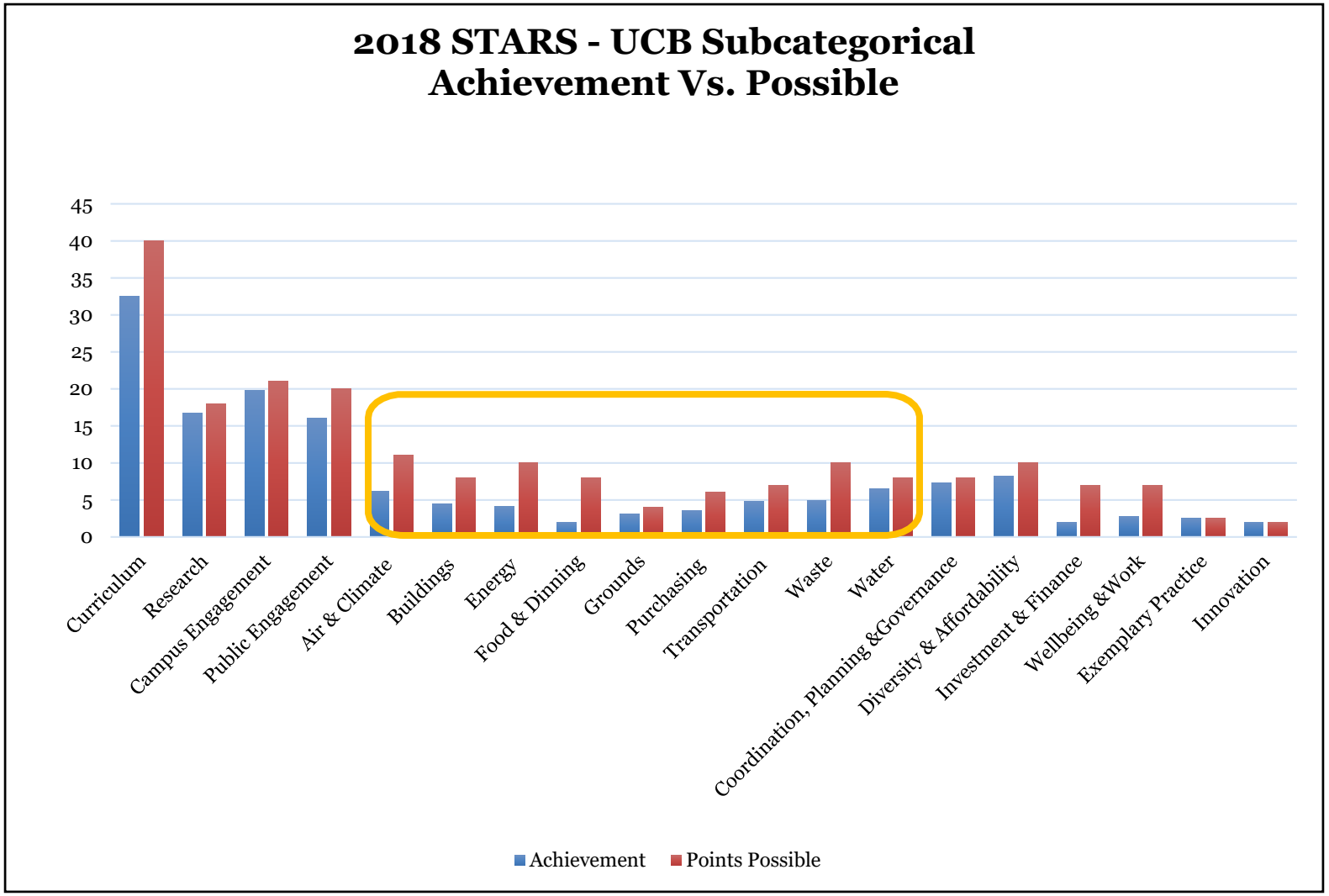
A transparent, self-reporting framework for colleges and universities to measure their sustainability performance.

STARS is designed to **Provides a Roadmap**

STARS: UC Boulder Gap Analysis



STARS


2018 STARS - UCB Subcategorical
Achievement Vs. Possible
45
40
35
30
25
20
15
10
5
0
Curriculum
Research
Campus Engagement
Public Engagement
Air & Climate
Buildings
Energy
Food & Dinning
Grounds
Purchasing
Transportation
Waste
Water
Coordination, Planning &Governance
Diversity & Affordability
Investment & Finance
Wellbeing &Work
Exemplary Practice
Innovation
Achievement
Points Possible

LEED

Leadership in Energy and Environmental Design (LEED) is a third-party certification program and the nationally accepted benchmark for the design, construction and operation of high performance green buildings.

Sustainable Site

Water Efficiency

Energy & Atmosphere

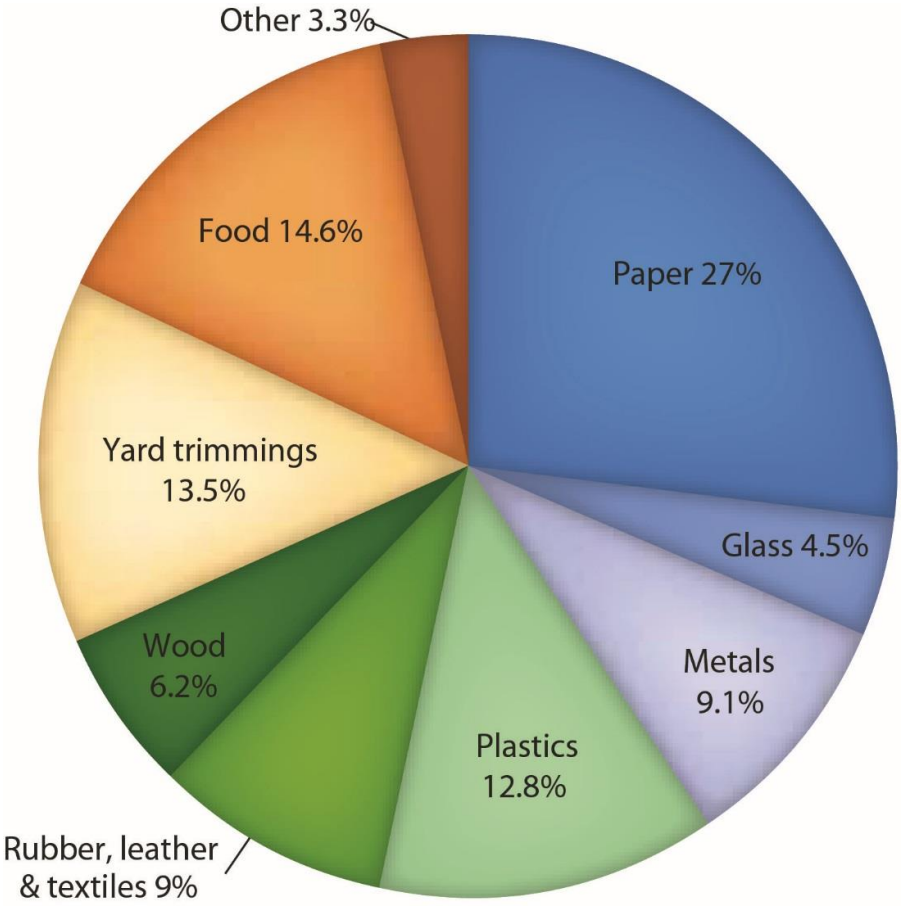
Materials & Resources

IEQ

Innovation / Regional

Images from USGBC

Metrics 101


Other 3.3%
Food 14.6%
Paper 27%
Yard trimmings 13.5%
Glass 4.5%
Wood 6.2%
Metals 9.1%
Plastics 12.8%
Rubber, leather & textiles 9%

Foundational Metrics

- Begin with the end in mind
  - Have a vision for your metrics
    - What do you hope to demonstrate?
  - Build room for expansion, evolution

- Establish minimum data collection needs in the core areas:
  - Environmental
  - Social
  - Fiscal

- **Good metrics will provide clarity, confidence, and justification in decision making**
  - **Examples?**

Metrics as a driver of Sustainability & Engagement

- Can provide another alternative to formal certifications
  - Must be robust, consistent, and credible
- Benchmark against peer institutions
  - Use as basis for your plan
- Tailor outreach & education programs to focus on deficiencies
  - Acknowledge you are not perfect

Key Facilities Metrics Survey

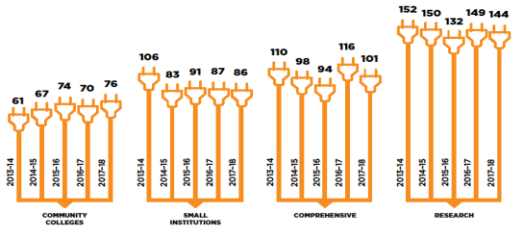
EVERY CAMPUS LEADER SHOULD KNOW THESE SIMPLE METRICS!

THESE METRICS ARE A GATEWAY TO BETTER PLANNING AND DECISION-MAKING FOR YOUR CAMPUS.

To view median results from five years of surveys regarding BTU/EUI (energy), kilowatt (electric), water, waste, and carbon footprint — visit www.nacubo.org/KeyFacilitiesSurvey. To analyze for your specific campus needs with different ratios - visit www.appa.org click on "Services".

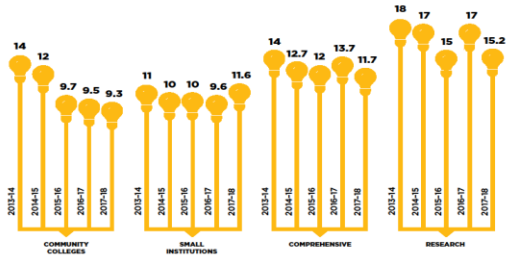
ENERGY BTU = EUI

MEDIAN KBTU/PER SQUARE FOOT ANNUALLY
EUI = ENERGY INTENSITY USE



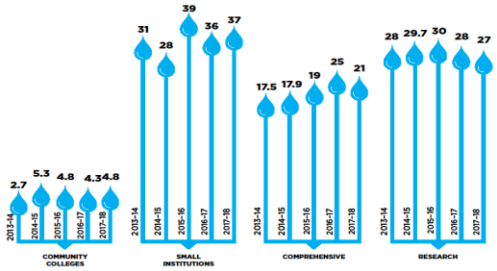
ELECTRICAL

MEDIAN KILOWATT-HOUR
ANNUALLY PER SQUARE FOOT



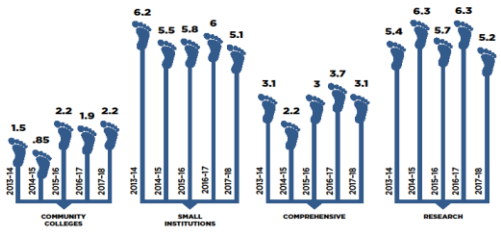
WATER

MEDIAN GALLONS OF USE ON A DAILY BASIS
ESTIMATED ANNUALLY PER FTE STUDENT ENROLLED



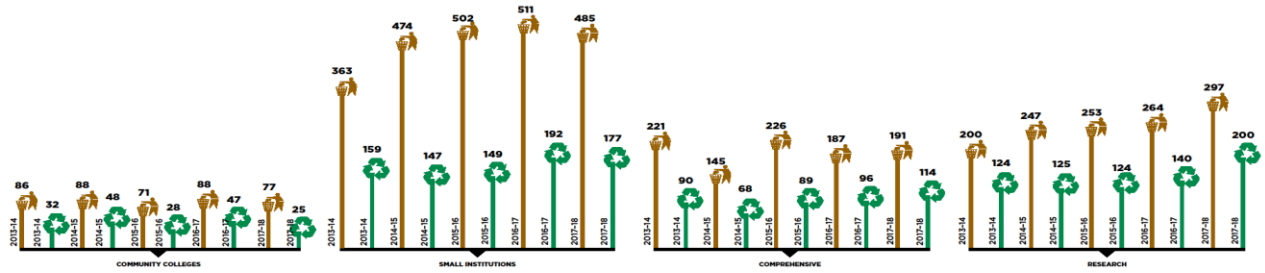
CARBON FOOTPRINT

MEDIAN IN METRIC TON CO_2 ANNUALLY
PER FTE STUDENT ENROLLED



GARBAGE/ RECYCLED WASTE

MEDIAN WASTE IN POUND ANNUALLY PER FTE STUDENT ENROLLED
MEDIAN IN POUNDS ANNUALLY PER FTE STUDENT ENROLLED



Benefit YOUR campus and collect this data! Fill out by Dec 13, 2019 for the 2018-19 academic year.

Open to all! Results available at no charge.

"This Key Facilities Metrics data is relevant and straightforward—and can be especially helpful to smaller institutions, which may lack the resources and capacity to otherwise generate such simple, comparable, and actionable information."

Eric Runestad, vice president for finance and administration, Luther College

"Our Vice President consistently wants us to simplify metrics so we can hone in on improving, and the Key Facilities Metric survey gives us this basic, simple platform to evaluate our progress. Leadership needs to have simple metrics to remember and relate to, and while we have a great deal of data, we consistently go back to these simple Key Facilities Metrics."

Jessica Rose, LEED GA, associate director, analytics and communications, facilities management, Georgia Institute of Technology

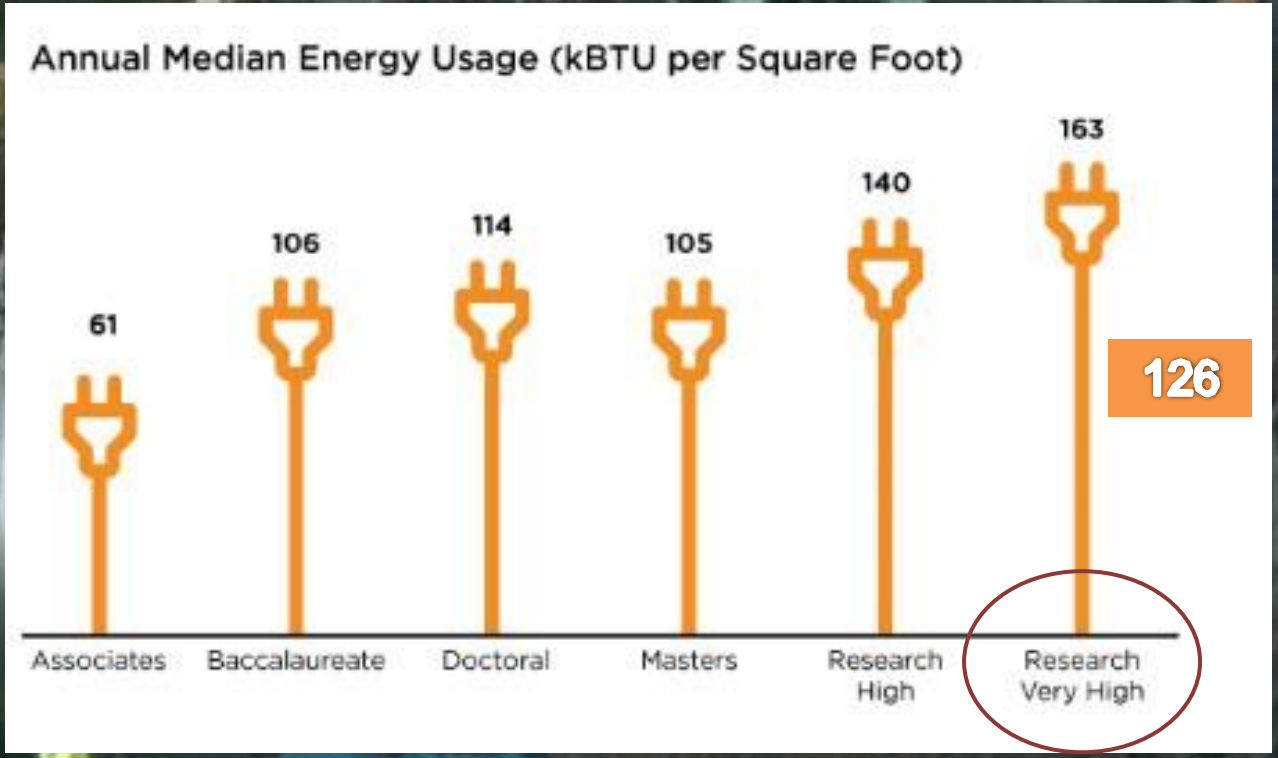
"The Key Facilities Metrics Survey allows us to not only see how we're performing year-to-year but also see how we're doing amongst our peer institutions. That helps us identify where we could see more savings through efficiency measures."

Katie Greer, former assistant director, facilities services, Black Hills State University

APPA LEADERSHIP IN EDUCATIONAL FACILITIES

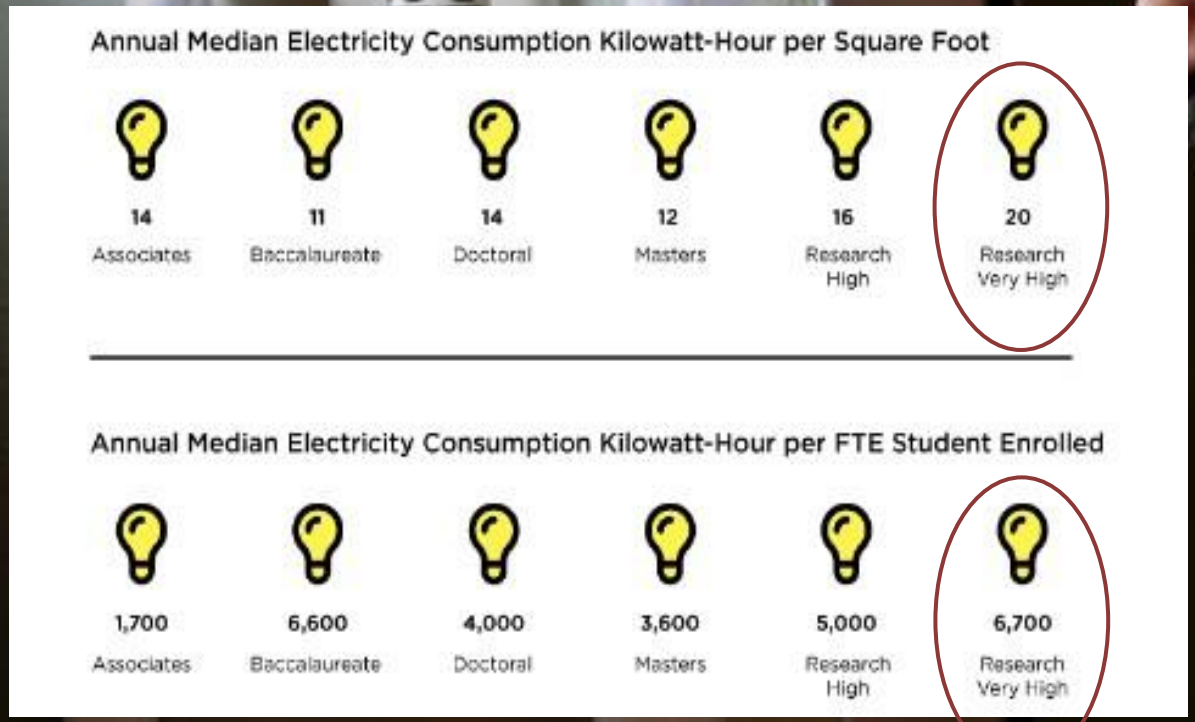
NACUBO

Energy: BTU



Be Boulder.
In SUSTAINABILITY

Electricity

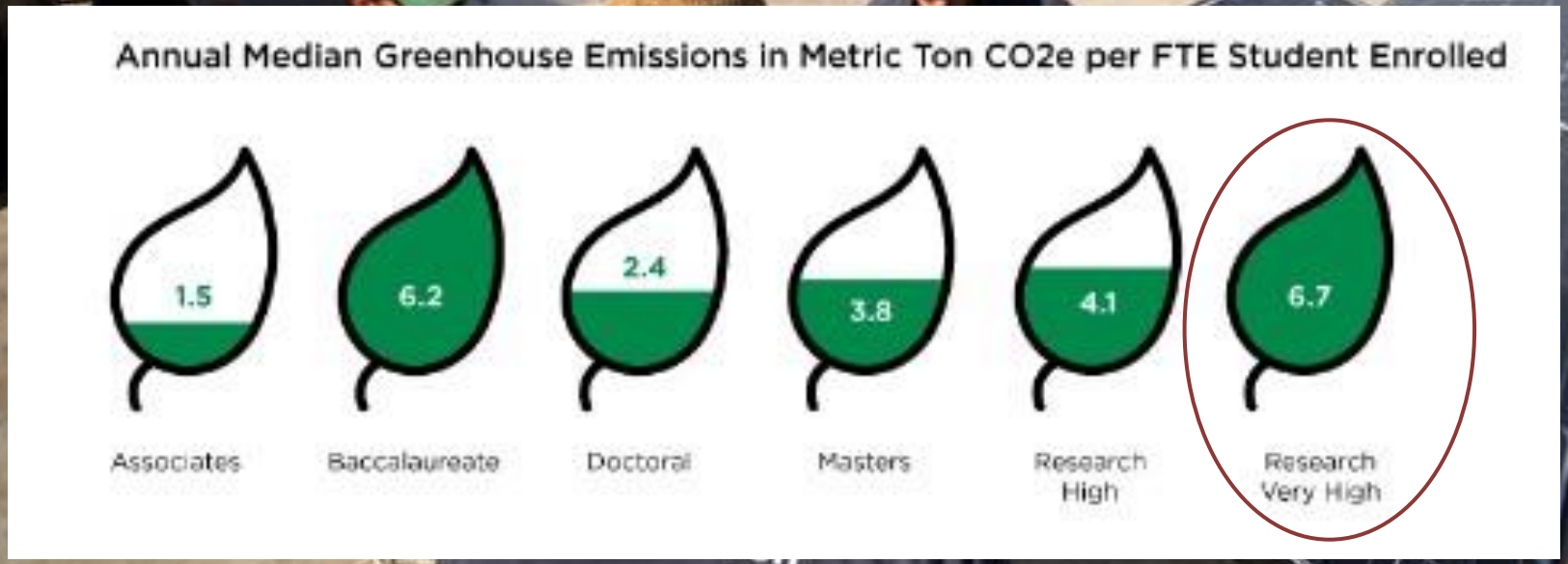


13.8

5,063

Be Boulder.
In SUSTAINABILITY

Carbon Footprint

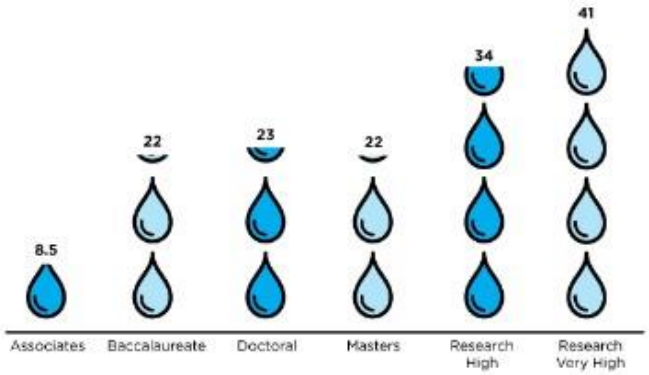


4.64

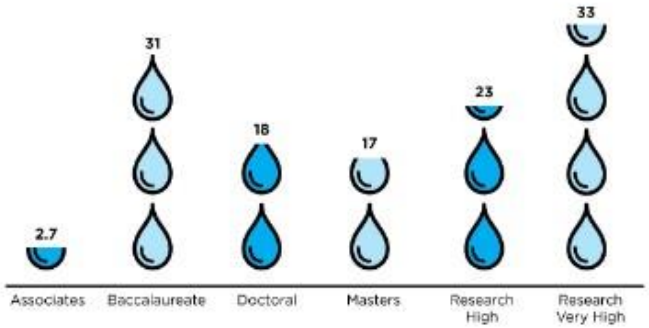
Be Boulder.
In SUSTAINABILITY

Water

Annual Median Water Use in Gallons per Square Foot Maintained



Daily Median Water Use in Gallons per FTE Student Enrolled

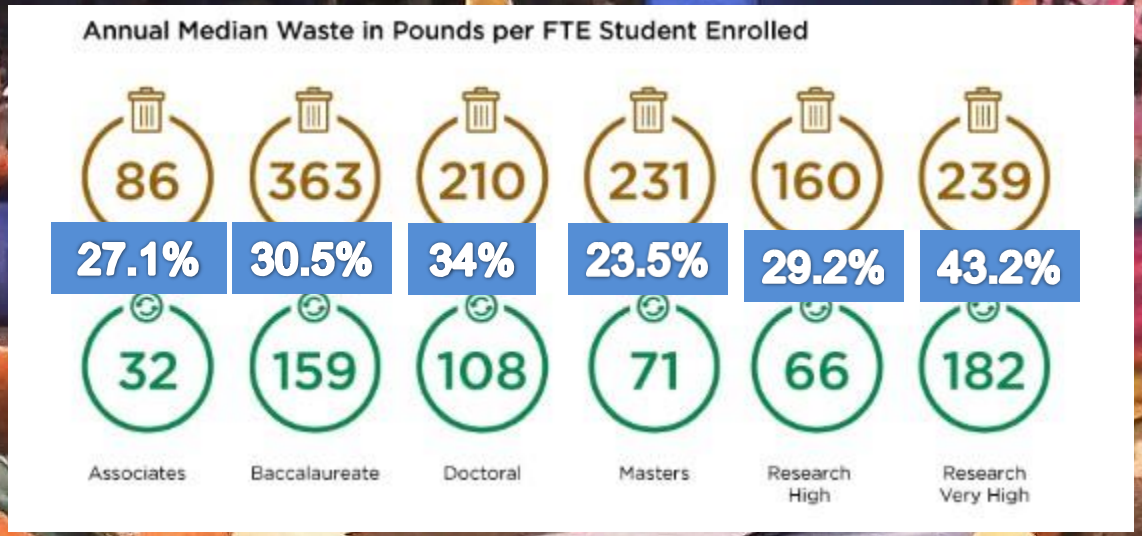


Water percentage of survey responses: 93%

28

Be Boulder.
In SUSTAINABILITY

Waste



212

42.7%

158

Be Boulder.
In SUSTAINABILITY

Continuous Improvement of Metrics

- Accuracy
  - Actuals vs. projections?
    - Metered?
    - Certified scales?
  - Inclusive?

- Diversity
  - Weight vs. volume
  - Percent vs. actual
  - Timeframe
  - Baseline
  - Benchmarking

- Transparency

Landfill Diversion Rate Example

$$\frac{\text{Lbs. of Diverted Materials (Recycled, Composted, Re-used / Donated)}}{\text{Lbs. of Diversion + Lbs. of Landfill (Total Waste Generated)}} \times 100$$

Avoiding Inconsistencies in your Metrics

1. Diversion Rate: add to numerator but not denominator
    1. Construction waste, e.g.

2. Diversion Rate: exclude portions of data entirely
    1. Restrooms in Stadium
    2. Trash roll-offs in competition

3. Diversion Rate: Total waste vs. Per capita

4. Energy use: Total use vs. ‘Per square foot’ (EUI)

Honesty, Integrity, Accountability

- Honesty vs. Integrity
  - Only people to truly understand the details / history of your data is you, the generator.

Hold yourself to a higher standard

I.e., Pilot conversion to single stream recycling (UCB)

Other examples?

Marriott – Kudos for Transparency

**As part of our annual review process, we identified a single calculation error in the 2007 global water intensity baseline that resulted in an overstatement of progress toward our goal. Our 2014 global water intensity reduction has been restated to 9%.*

Error potentially made 8 years ago….was it worth correcting?

Just the Facts 2015
In SUSTAINABILITY

"**OUR GOAL** is nothing less than being **THE GLOBAL LEADER IN SUSTAINABILITY**—and that aspiration carries with it **GREAT RESPONSIBILITY** to advance on all fronts…"

—**Phil DiStefano**, CU-Boulder Chancellor (2014 CU-Boulder STARS report)

FIRST IN THE NATION

RECYCLING
- STUDENT-LED CAMPUS RECYCLING PROGRAM
- CAMPUS GREEN POWER PURCHASE

RENEWABLES
- BIODIESEL IN CAMPUS FLEET

ENGAGEMENT
- STUDENT-LED ENVIRONMENTAL CENTER
- STUDENT BUS PASS

ATHLETICS
- NCAA DIVISION 1 ZERO-WASTE ATHLETICS PROGRAM

RANKINGS
- STARS GOLD CAMPUS
- AAU CAMPUS TO EARN SIERRA CLUB #1

RESULTS
- CARBON NEUTRAL STUDENT GOVERNMENT & ATHLETICS

OVER 643 SUSTAINABILITY-RELATED COURSES are offered in 45 departments (about **24% OF ALL COURSES**)

IN 2013, CU-Boulder fully implemented **HEALTHY** and **PESTICIDE-FREE TURF** management

CU-BOULDER HAS 18 LEED BUILDINGS (6 Platinum), using **25–40% LESS ENERGY** than traditional structures

SINCE 2005, CU-Boulder reduced energy use by more than **22%** per square foot while the campus grew by **28%**

CAMPUS POTABLE WATER usage per square foot declined over **63%** **SINCE 2002**

27% of CU-Boulder Dining Services food and beverage purchases are locally produced

2020 GOALS
90% recycling rate
20% less carbon emissions

#1 RANKED
- ENVIRONMENTAL/ GEOSCIENCE RESEARCH PUBLICATIONS & CITATIONS
- ENVIRONMENTAL CENTER
- SPORTS SUSTAINABILITY

STUDENTS FIRST
86% say it's important for CU-Boulder to have a strong commitment to sustainability

89% try to make environmentally sustainable choices in the way they live

92% want to have a low carbon footprint

RECYCLING RATE IN CU-BOULDER FOOTBALL GAMES >90%

CU-BOULDER ATHLETICS is building the nation's first **"NET-ZERO ELECTRICITY"** football practice facility by increasing campus solar energy systems to over **2,000 KILOWATTS**—enough to power about **300 HOMES**

Be Boulder.
University of Colorado Boulder

Kelly Fox, CU-Boulder CFO, Presents this at NACUBO

July 2015

Survival Tips

- Own your plan
  - FM has many responsibilities and needs
  - Be upfront about your concerns, challenges, and limitations

- Strong Planning
  - Begin with the end in mind
  - Identify potential obstacles

- Forge internal partnerships
  - Utilities, custodial, grounds, trades, surplus property
  - Once partnered in operations, coordinate on outreach & promotions

- Don’t promote too early

Takeaways

- Make the business case
- Think outside the box
- Shoot for the moon but take small steps (Hotel Linens, i.e.)
  - Low-lying fruit
  - Small risk / Big impact
- Learn from failures
- Build off each success
- Collaborate
- Consistent & credible metrics and communication

THANK YOU!

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Be Boulder.

University of Colorado **Boulder**

This concludes The American Institute of Architects Continuing Education Systems Course

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