Sustainability in Operations & Maintenance

APPA Institute
San Antonio, TX
6/25/24

Edward von Bleichert
University of Colorado **Boulder**

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.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

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

AIA Approved Continuing Education

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 for reporting and outreach.

AIA Approved Continuing Education

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, electrification, tree & turf care, and more
4. Share practical stories from around the country.

AIA Continuing Education Provider

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 sustainable practices across facilities operations & maintenance
4. Learn different approaches to successfully integrating sustainability into operations and services

AIA Approved Continuing Education

Personal Introduction

- Sustainability Program Manager since 1/1/17
- Division of Infrastructure & Sustainability
- Formerly the Assistant Director for Environmental Operations
- Former programs
  - In-house waste collection & processing
    - Recycling, composting, solid waste
    - On campus recycling facility
    - Service contracts
  - Integrated Pest Management (IPM)
  - Wildlife management
- Current Focus
  - High Performance Construction
  - Electrification
  - Operational support
  - Reporting

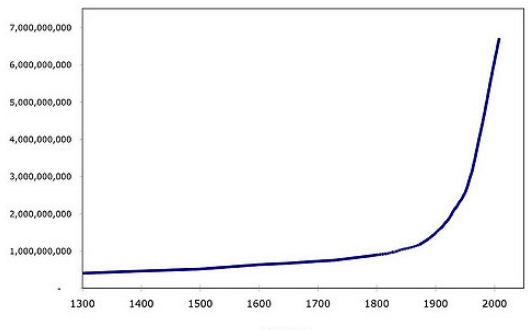
Course Goals

- 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~~ 11 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

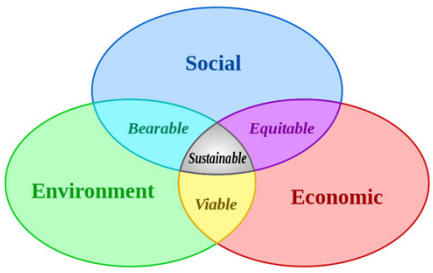
The "7th generation" principle taught by Native Americans says that in **every decision**, be it personal, governmental or corporate, we must **consider how it will affect our descendants** seven generations into the future.

Generally speaking:

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

- **long-term view**
- **forward thinking**
- **comprehensive planning**

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



Thoughts?

SUSTAINABILITY

Is / Should be About

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

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' **
    - Goes beyond compliance

    ***** externalities = uncompensated environmental effects of production and consumption***

    Examples?

Continuous Improvement as a Driver of Sustainability

- Notion can be daunting but offers flexibility
  - Will it ever end?!
  - Can't achieve everything at once
  - Will always be a next phase or second chance of sorts
  - Under promise and over deliver
- Routine updates, maintenance as important as continuous improvement…*Drift!*

Drivers of Continuous Improvement

- Change, in general
- Time
- Staffing turnover
- 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'

Win – Win – Win

- Financial
- Environmental
- Social
  - Housekeepers
  - Laundry staff

Sustainability Initiatives

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

Integrated Landscape Management

Elm Bark Beetle example

- 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 synthetic 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

Potential pitfalls

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

Potential / evolving solution

- Move to trunk injections?
- Currenlty use broadcast oils as needed (diminished pressure)

Wildlife Management

Research ponds example

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

Solution / Results

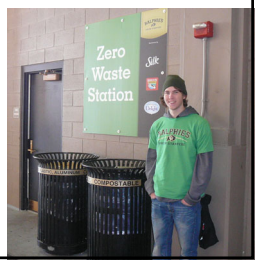
- 'Beaver Deceivers' installed
- Water level stabilized
- Mature trees wrapped and protected
- Relocation unnecessary
- Resource limits regulate population

Sustainable?

Zero Waste Athletic Events

Folsom Stadium example (Pre 2008)

- Recycling only outside gates and tailgate lots for decades; no composting
- 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%

RALPHIE'S GREEN STAMPEDE

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

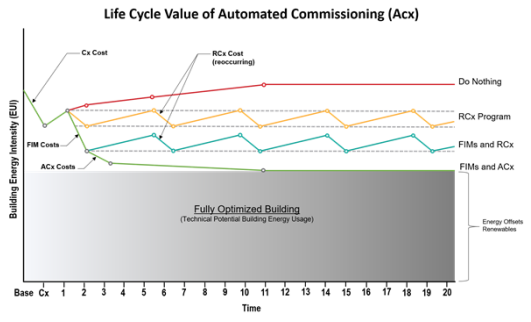
Landfill Diversion Rate

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

Sustainable?

- Disposable approach
  - High resource use
  - Recycling process not benign
  - Sourcing
- Large carbon footprint
  - Team & spectator travel
  - Sourcing
- Tailgate lots relatively unchanged
- Many other aspects of game day operations untouched
- High (student) labor needs

Energy Management Saw-tooth



UCB Campus Energy Consumption
(Energy Master Plan 2021)

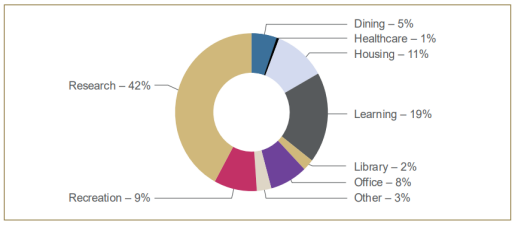


Figure 6: Energy Use by Building Type

www.colorado.edu/masterplan/EMP

Wide-range of lab efficiency & sustainability efforts

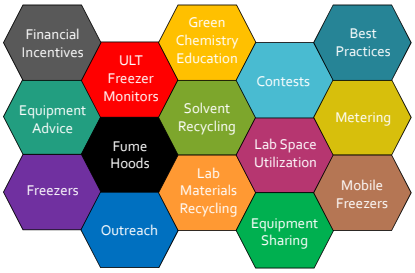
Energy & water savings

Solid waste diversion

Hazardous waste reduction

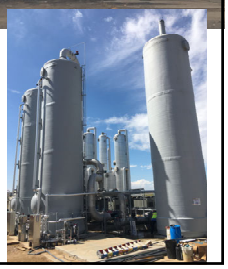
Efficient use of space & equipment

Scientist engagement



Energy Production
Heartland BioGas Facility



Montana State University M&O

Residence Hall Upgrades

- Replacing ~900 platform beds with 'loft-able' beds
- Voluminous waste destined for landfill
- Work began on graduation day
- Student supported effort



Solution / Results


Reduced disposal costs

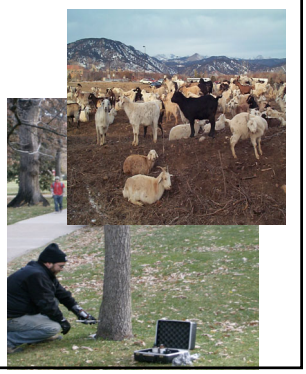
- 100% of metal lofts recycled (15,000 lbs.)
- 78% of wood from beds repurposed.
- ~700 mattresses recycled

Collaborative effort

- Meaningful student involvement
- Potential to help underserved community – temporary housing for homeless
- Leveraged event to collect other items (food, electronics, spare change)

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
  - Walk behind equipment

Backpack batteries for electric blowers, string trimmers, and hedge trimmers.

- 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…

- Waste Management
  - Co-collections in custodial, grounds, food service
- 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
  - Carbon footprint / embodied carbon
- Green Office:
  - Energy & water conservation
  - Reusables use – mugs, plates, utensils
  - Paper use

Other Opportunities

- Use of less toxic chemicals
  - Cleaning supplies
  - Adhesives
  - Finishes
  - Carpet, composite materials, furniture
- Pesticide use reduction
  - Request IPM for your shop space
  - IPM design standards
- Travel
  - Bus, shuttle, rideshare, train
  - Carbon offsets
- Vehicle / Fleet
  - Use of E-bikes
  - EVs, PHEVs, Hybrids
  - Bio-diesel, CNG

Micro Mobility

E-bikes

- Boulder B-Cycle (Trek™)
- Fleet electrification began Fall 2021
- 385,000 CU affiliate rides in 2022
  - 87% increase over 2021
- Displacing SOV trips?

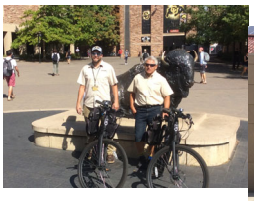
E-Scooters

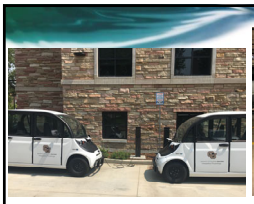
- Lime ™
- Pilot began w/ 300 scooters and restricted zones (campus)
- Pilot successful & expanding
  - Approaching 900 citywide
- Displacing SOV trips?

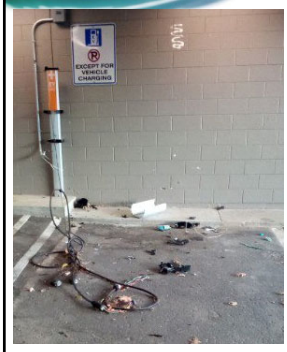
Win-Win-Win

Financial, environmental, and social benefits!

Elevator and Fire Suppression Technicians







Campus Dining Services

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) women & minority owned businesses
- Green manufacturing practices
  - Local protection of resources
  - Chemical use
  - Renewable energy use
- Packaging – redux, take-backs
- Country of origin – many health & environmental implications
- High performance certifications – i.e., EPA Energy Star ®, LEED

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

stars
a program of aashe

LEED

INTRO TO STARS

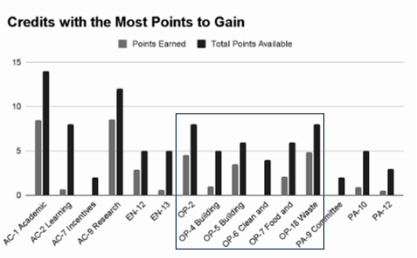
Sustainability Tracking, Assessment, and Rating System **(STARS)** is a transparent, self-reporting framework for colleges and universities to quantify their comprehensive sustainability performance.

1,076 institutions have registered to use the STARS Reporting Tool, of which 680 have earned a STARS rating.

Within the STARS report, the campus discloses information within the following categories: **Academics, Engagement, Operations, Planning & Administration,** and **Innovation** (optional)

University of Colorado **Boulder**

CAN WE IMPROVE?



University of Colorado **Boulder**

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

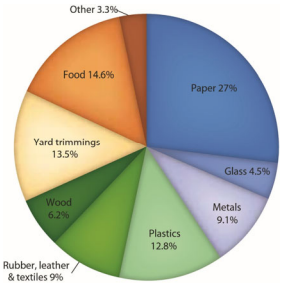
Materials & Resources

IEQ

Innovation / Regional Priority

Images from USGBC

Metrics 101

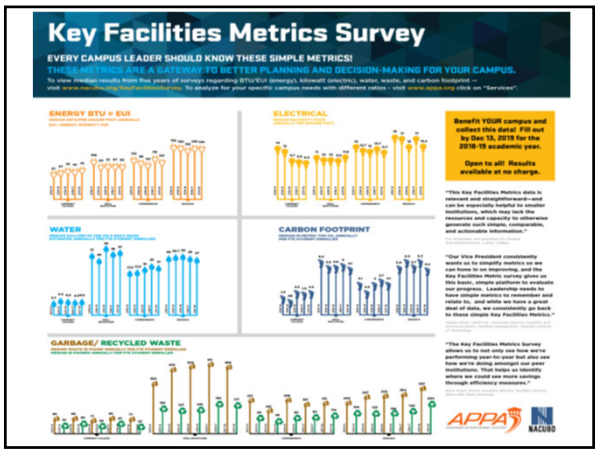


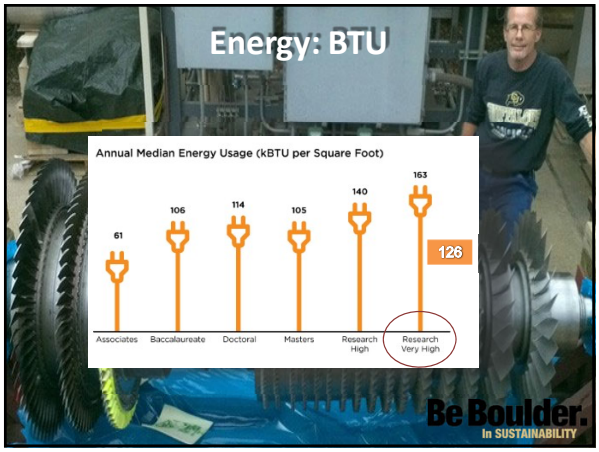
Foundational Metrics

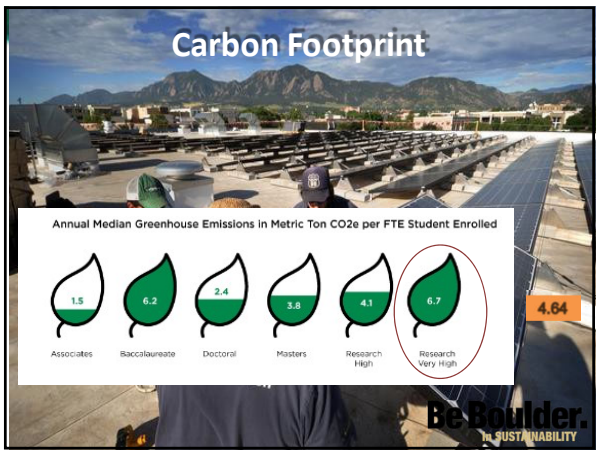
- Begin with the end in mind
  - Have a vision for your metrics
    - What do you hope to demonstrate? What story to be told?
  - Build room for expansion, evolution
- Establish minimum data collection needs in the core areas:
  - Environmental (Planet)
  - Social (People)
  - Fiscal (Profit)
- **Good 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
- Tailor outreach & education programs to focus on deficiencies
  - Acknowledge you are not perfect
- Benchmark against peer institutions
  - Use as basis for your plan


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.
ENERGY BTU = EUI
ELECTRICAL
WATER
CARBON FOOTPRINT
GARBAGE/ RECYCLED WASTE
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.
APPA
NACUBO


Energy: BTU
Annual Median Energy Usage (kBTU per Square Foot)
61
106
114
105
140
163
126
Associates
Baccalaureate
Doctoral
Masters
Research High
Research Very High
Be Boulder.
in SUSTAINABILITY


Carbon Footprint
Annual Median Greenhouse Emissions in Metric Ton CO2e per FTE Student Enrolled
1.5
6.2
2.4
3.8
4.1
6.7
4.64
Associates
Baccalaureate
Doctoral
Masters
Research High
Research Very High
Be Boulder.
in SUSTAINABILITY

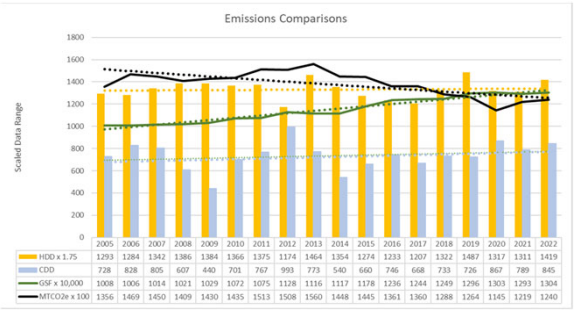
Continuous Improvement of Metrics

- Accuracy
  - Actuals vs. projections?
    - Metered?
    - Certified scales?
  - Inclusive?
- Diversity
  - Weight vs. volume
  - Percent vs. actual
  - Timeframe
  - Baseline
  - Benchmarking
- Transparency

Avoiding Inconsistencies in your Metrics

1. Diversion Rate error: add to numerator but not denominator
   1. Construction waste, e.g.
2. Diversion Rate: exclude portions of data / sectors of waste entirely
   1. Restrooms in Stadium, e.g.
   2. Certain trash containers (roll-offs) in competition, e.g.
3. Diversion Rate: Total waste vs. Per capita
4. Energy use: Total use vs. 'Per square foot' (EUI)
   1. Energy Use Intensity doesn't tell the whole story – CU Boulder EUI down but growth impacts overall carbon emissions

Consumption vs. EUI



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
HDD x 1.75	1293	1284	1342	1386	1384	1366	1375	1174	1464	1354	1274	1233	1207	1322	1487	1317	1311	1419
CDD	728	828	805	607	440	701	767	993	773	540	660	746	668	733	726	867	789	845
GSF x 10,000	1008	1006	1014	1021	1029	1072	1075	1128	1116	1117	1178	1236	1244	1249	1296	1303	1293	1304
MTCO2e x 100	1356	1469	1450	1409	1430	1435	1513	1508	1560	1448	1445	1361	1360	1288	1264	1145	1219	1240

Survival Tips

- Own your plan
  - FM has many responsibilities and needs
  - Be upfront about your concerns, challenges, and limitations
- Forge internal partnerships
  - Utilities, custodial, grounds, trades, surplus property
  - Coordinate on outreach & promotions
- Don't promote too early

Takeaways

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

THANK YOU!

Ed von Bleichert
Sustainability Program Manager
Division of Infrastructure & Sustainability
University of Colorado, **Boulder**
vonb@Colorado.edu
www.colorado.edu/fmGREEN

Be Boulder.
University of Colorado Boulder

This concludes
The American Institute of Architects
Continuing Education
Systems Course

AIA Approved Continuing Education