Performance Metrics™

Rick Carter, AIA, LEED ®AP

Building Energy Codes Program, 2008

St. Paul, MN

July 24, 2008
2:45 – 3:45

Oneka Elementary School

Performance Metrics ™

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Health House

Learning Objectives

1. A person attending this session will be able to identify what performance metrics are appropriate for a specific building or site.

2. Students will understand how this would be different energy, water, storm water, human performance and other metrics to be determined.

3. The student will learn how to request these performance metrics.

Gaar Lofts

Learning Objectives

4. The student will be able to identify or locate the best benchmark.

5. Upon receiving the metrics, the student will understand how to compare the data with the appropriate benchmarks in order to assess performance and determine the success of the project when compared to projected data.

6. Based on the comparison of the data to the benchmark and develop an explanatory case study for use in making recommendations going forward.

Bungalow Court

Agenda

Healthy Building Design

Sustainable Design

Performance Metrics™

Websites

Costs

Phillips Eco Enterprise Center

Buildings Impact the Environment

United States Accounts for:

5% of World population

25% of World resource consumption

40% of World waste creation

Architects, Engineers and Building Owners have an opportunity to impact resource consumption and waste creation.

SMDC Lobby

Environmental Impact of Buildings

Quality Bicycle Products

65% total US electricity consumption

>36% total US primary energy use

30% total US greenhouse gas emissions

136 million tons of construction and demolition waste in the US
(approx. 2.8 lbs./person/day)

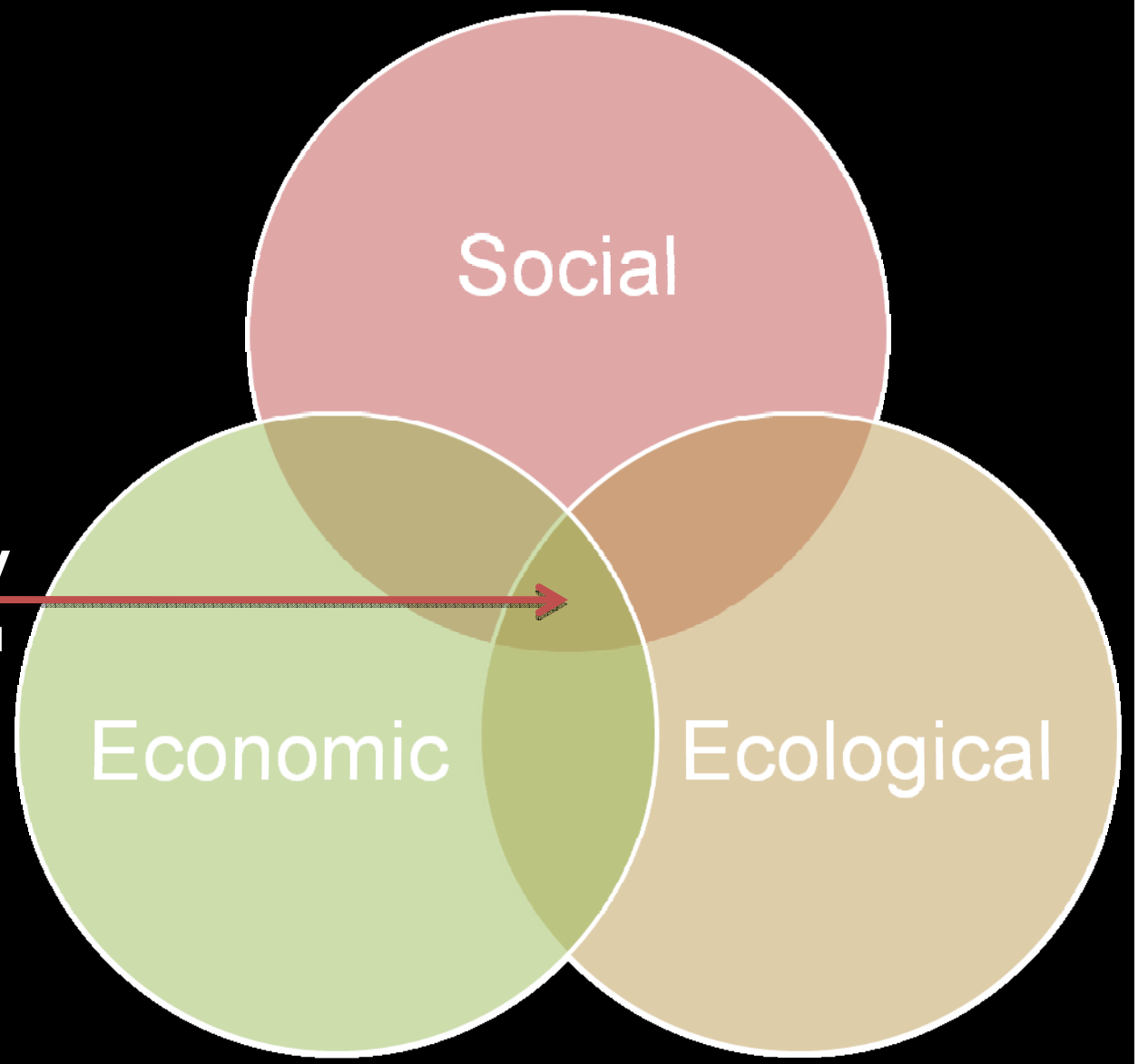
12% of potable water in the US

40% of raw material use globally
(3 billion tons annually)

Definitions

Sustainability:

"Meeting the needs of the present without compromising the ability of future generations to meet their own needs."



Sustainability

A balance of social, economic, and ecological needs

Healthy Building Design

ALA Health House 1994

1992-1997

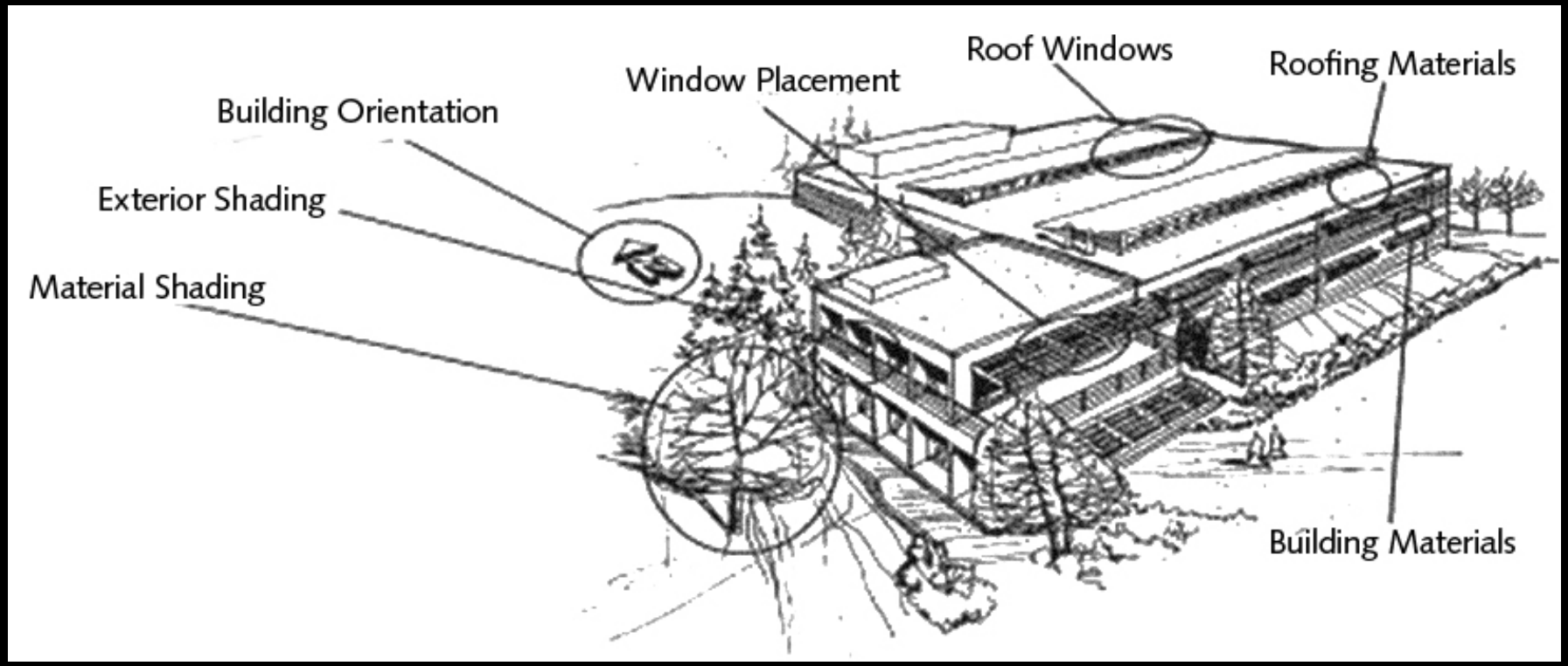
What Exactly is Healthy Building Design

Site and storm water management

Energy efficiency and daylighting

Improved air quality and productivity

Resource efficiency – water efficiency, durability, and waste reduction



Site and Stormwater Management

Strategies:

- Smart site location
- Reduce paving
- Maximize infiltration
- Use native plantings
- Use of green roof
- Alternative transportation

Site and Stormwater Management

Benefits:

- Less artificial watering
- Reduced fertilization
- Fewer pesticides
- Reduced operating costs
- Improved water quality
- Improved aesthetics

Phillips Eco Enterprise Center

Energy Efficiency and Daylighting

Phillips Eco Enterprise Center

Strategies:

- Building orientation
- Manage daylighting
- Energy analysis
- Efficient equipment and appliances
- Efficient ventilation
- Lighting controls

Energy Efficiency and Daylighting

Benefits:

- Lower costs
- Rebates from utilities
- Less reliance on fossil fuels
- Improve indoor environmental quality
- Lower environmental impact

Eagle Point

Occupant Health

Phillips Eco Enterprise Center

Strategies:

- Eliminate, separate, filter
- Increase ventilation
- Increase direct control
- Prevent moisture/mold
- Increase daylighting
- Use low offgassing materials

Occupant Health

St. Joan of Arc

Benefits:

- Lower liability
- Lower health costs
- Long lasting materials
- Less harm to environment
- Improved recruiting and retention
- Increased productivity

Resource Efficiency

Strategies:

- Build less – don’t build
- Build with less
- Increase durability
- Incorporate salvaged material
- Reduce waste
- Reduce water consumption

Millennium Star Energy Home

Resource Efficiency

St. Joan of Arc

Benefits:

- Less initial cost
- Longer life
- Lower maintenance costs
- Lower disposal costs
- Less landfill use
- Lower water use

Sustainable Design

1997-2007

LEED ®

LEED covers many different types of buildings and construction. These are covered under the following LEED products:

- LEED-NC: LEED for new construction and major renovations/ additions
- LEED-EB: LEED for existing buildings
- LEED-CI: LEED for commercial interiors
- LEED-CS: LEED for core and shell
- LEED-H: LEED for homes
- LEED-ND: LEED for neighborhood developments

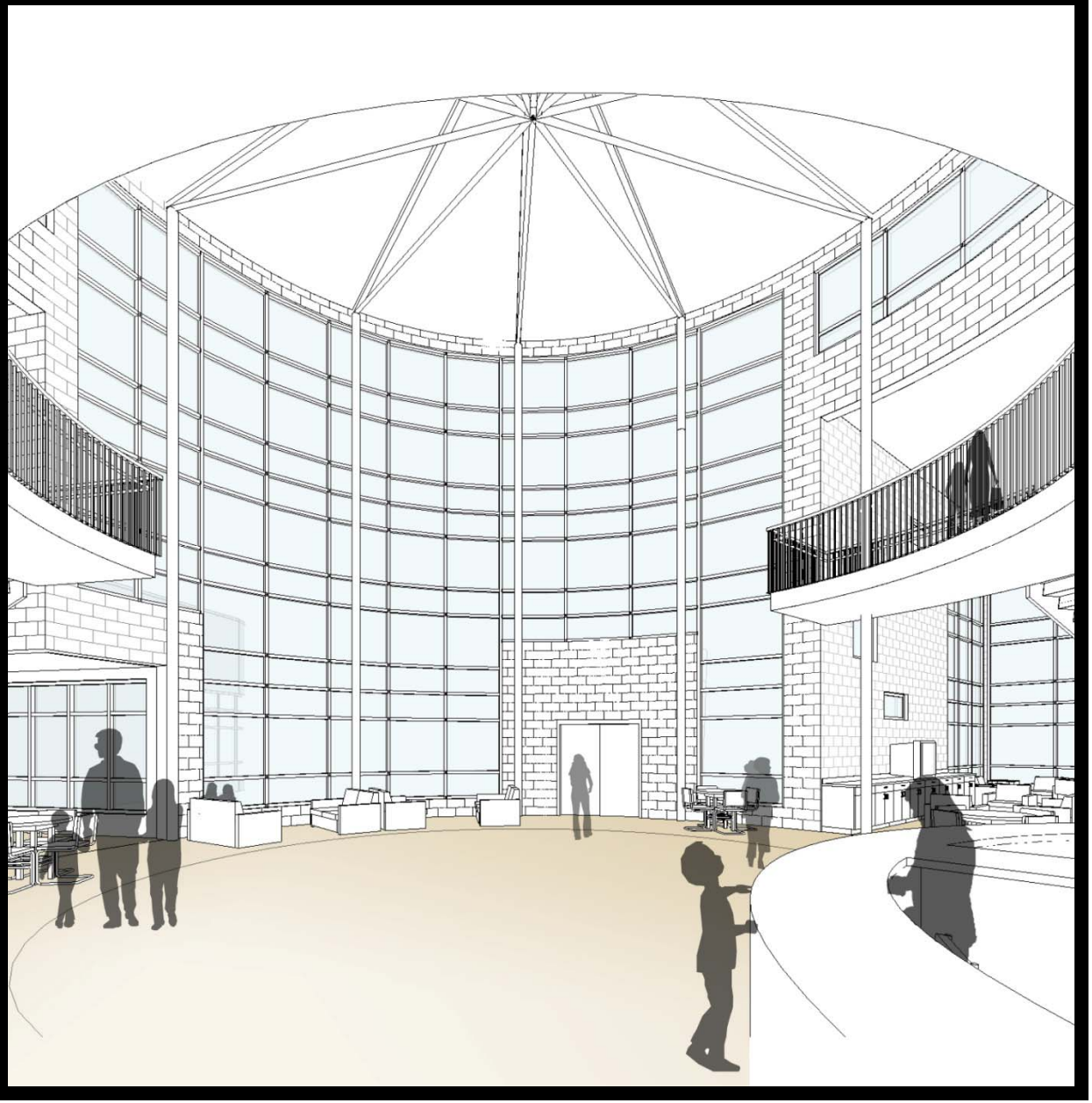
Whole Foods Co-op

Minnesota Sustainable Building Guidelines

The Minnesota Sustainable Building Guidelines are mandatory for all new buildings receiving funding from bond proceeds after January 1, 2004.

The guidelines must:

- Exceed existing Energy Code by at least 30%
- Focus on achieving lowest possible lifetime costs for new buildings
- Encourage continual energy conservation improvements on new buildings
- Include air quality and lighting standards that create and maintain a healthy environment
- Facilitate productivity improvements



Admin MINNESOTA

Green Communities™

Green Communities is the first national green building program focused entirely on affordable housing.

It incorporates:

Traditional green innovations
Sustainable materials
Reduce environmental impact
Energy efficiency

Supplemental innovations

Safeguarding health of residents

Design
Materials

Site Placement with easy access to:

Public transportation
Schools
Services

Ripley Gardens

Energy Star

Two Harbors High School

The ENERGY STAR program has dramatically increased the use of energy efficient products and practices and is well positioned to promote more widespread efficiency improvements.

Successful with many opportunities utilizing existing technology and practices to save money by improving the efficiency of:

Homes
Buildings
Industries

ENERGY STAR PARTNER

Minnesota Greenstar

Benz Court

Developed by a partnership of the nonprofit Green Institute, BATC, and NARI-MN with funding support from the Minnesota Pollution Control Agency

A voluntary certification system based on independent 3rd party verification

Designed for Minnesota's builders/ remodelers with attention to the state's unique climate concerns and environmental issues

mngreenstar

2030 Challenge

The fossil fuel reduction standard for all new buildings shall be:

50% today

60% in 2010

70% in 2015

80% in 2020

90% in 2025

Carbon-neutral in 2030 (using no fossil fuel GHG emitting energy to operate). These targets may be accomplished by purchasing (20% max.) renewable energy and/ or certified renewable energy credits.

Environmental Living and Learning Center with HGA Architects

Performance Metrics ™

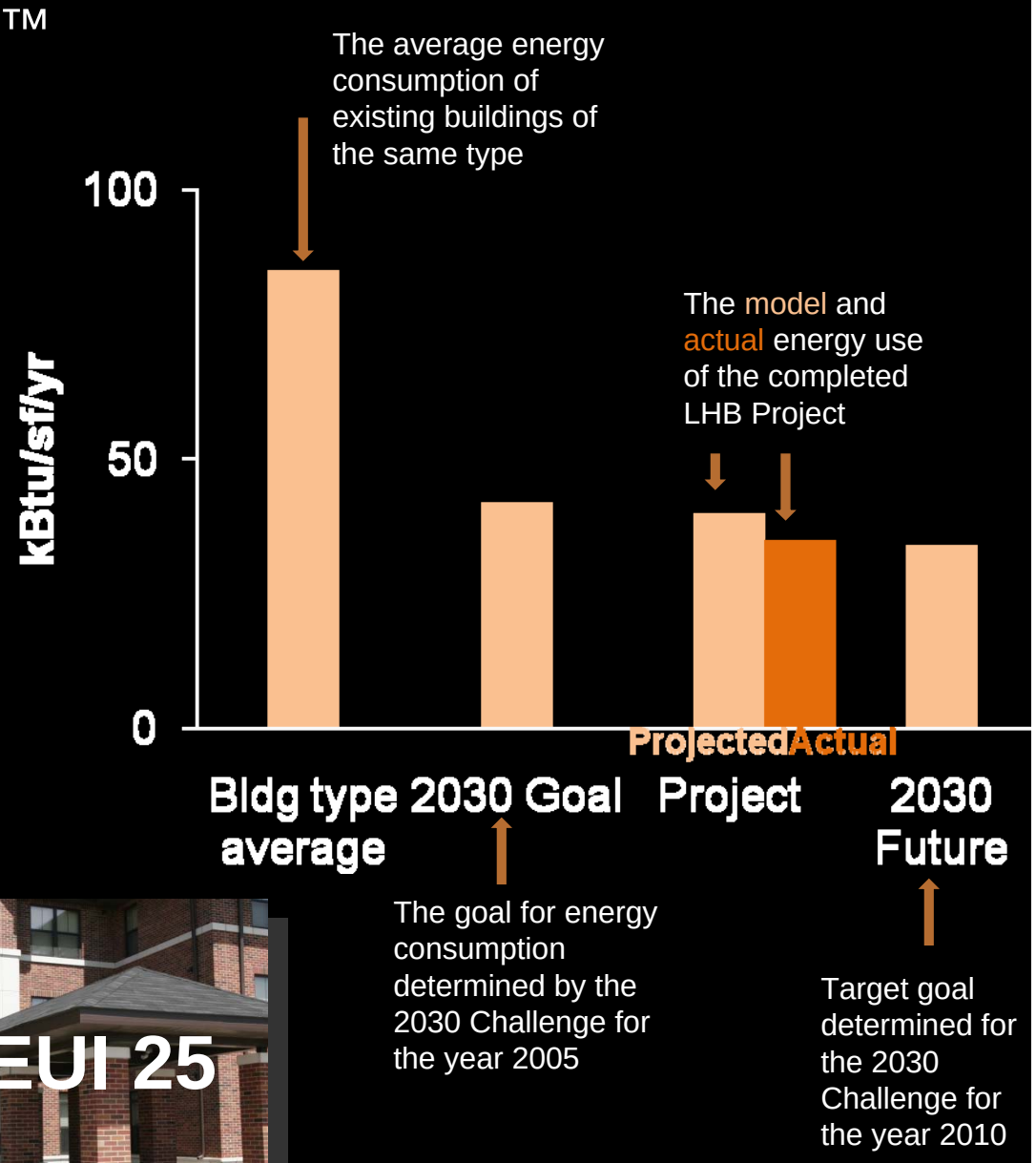
Al Loehr's Veteran's and Community Studio Apartments

2007 – present

Performance Metrics ™

LHB Performance Metric ™ : Energy Use Intensity (EUI)

LHB's energy use intensity (EUI) metric is measured in kilo (1,000) British thermal units per square foot per year (kbtu/sf/year). The lower a building's EUI, the better. Bar graphs compare projected and actual EUI of LHB designed buildings to that of an average building of the same type in the region (a target established by The 2030 Challenge).



Quality Bicycle Products

LEED® – NC Gold Certified

+ $750,000

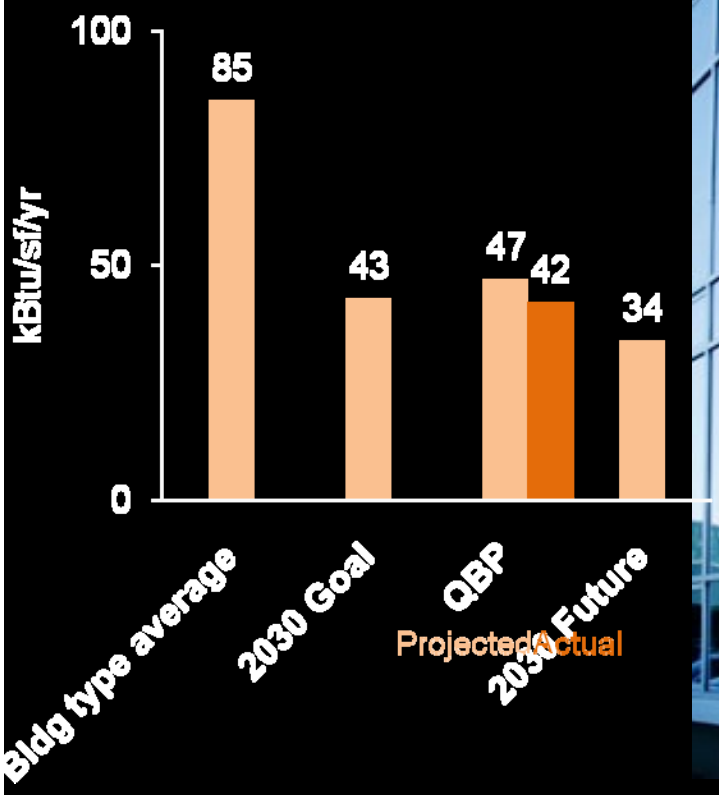
In additional building costs to achieve energy efficiencies

- $75,000

In reduced annual costs from achieved energy efficiencies

10 Year payback

10% Return on investment

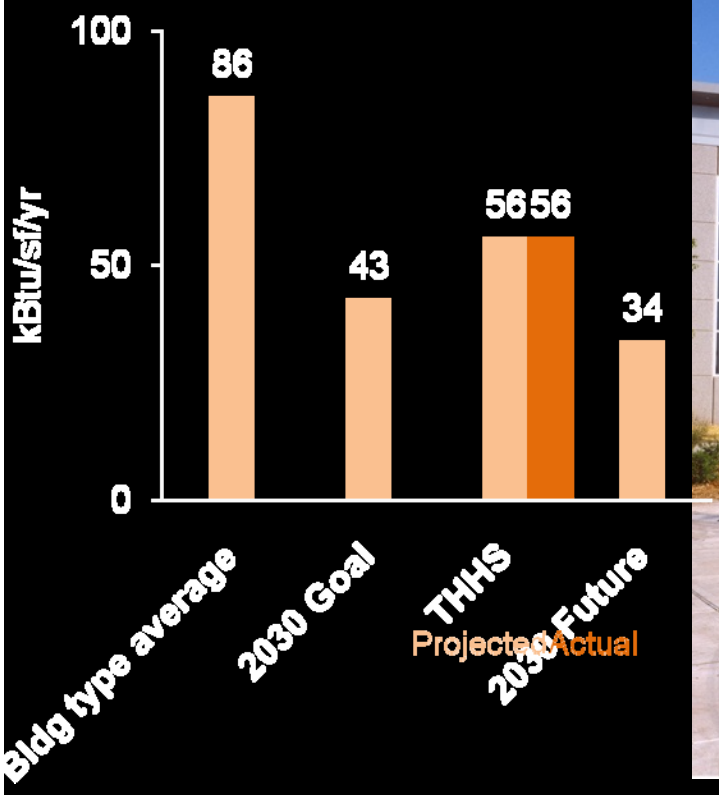


Two Harbors High School

Construction Cost Comparison $/sf

MN Median 2005	Two Harbors HS
Total Construction $161/ sf	$127/ sf

R.S. Means Median 2005	Two Harbors HS
Mechanical = 24.6	17.8
Electrical = 14.27	13.8



Al Loehr Veterans and Community Apartments

Geothermal Heating and Cooling

+ $400,000

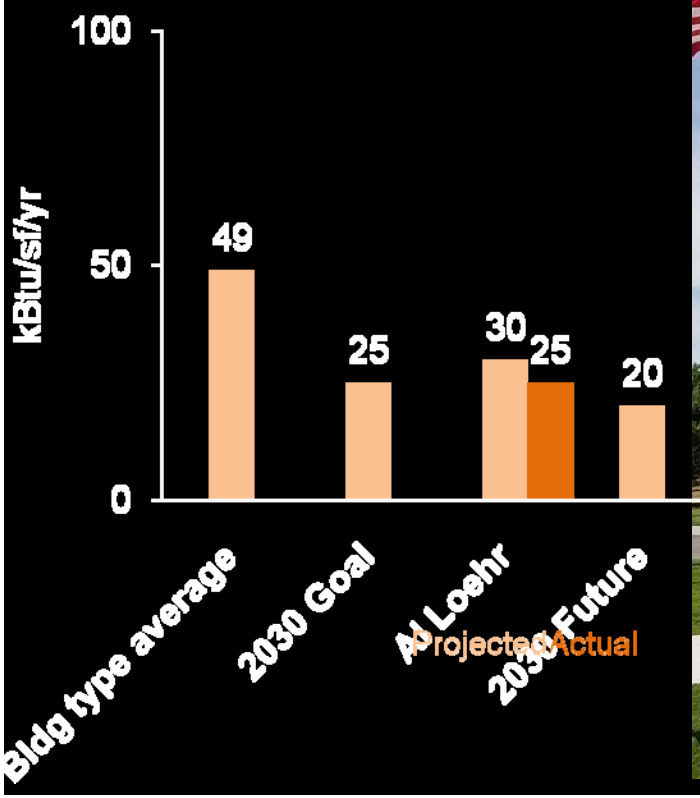
In additional building costs to achieve energy efficiencies

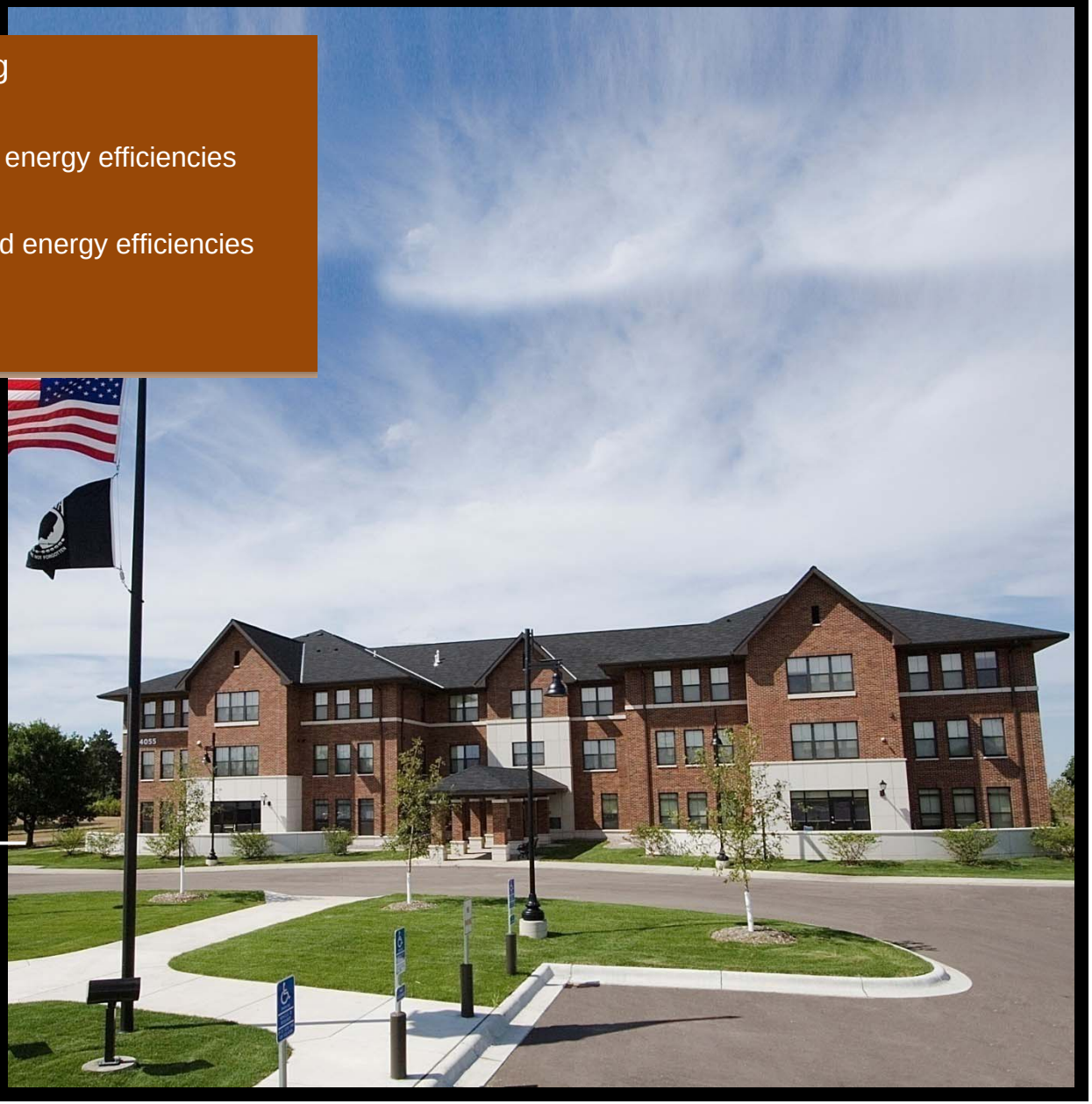
- $50,000

In reduced annual costs from achieved energy efficiencies

8 Year payback

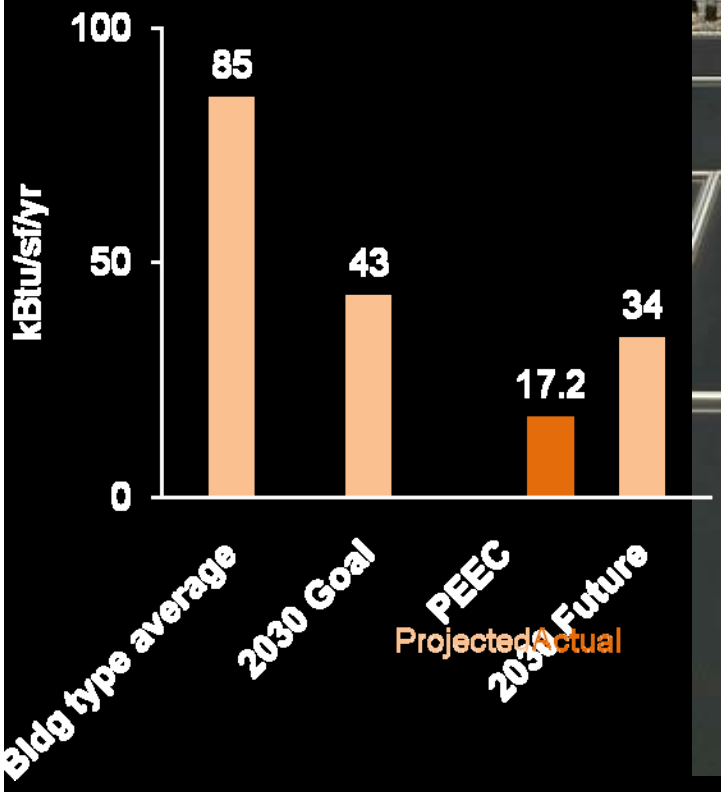
12.5% Return on investment





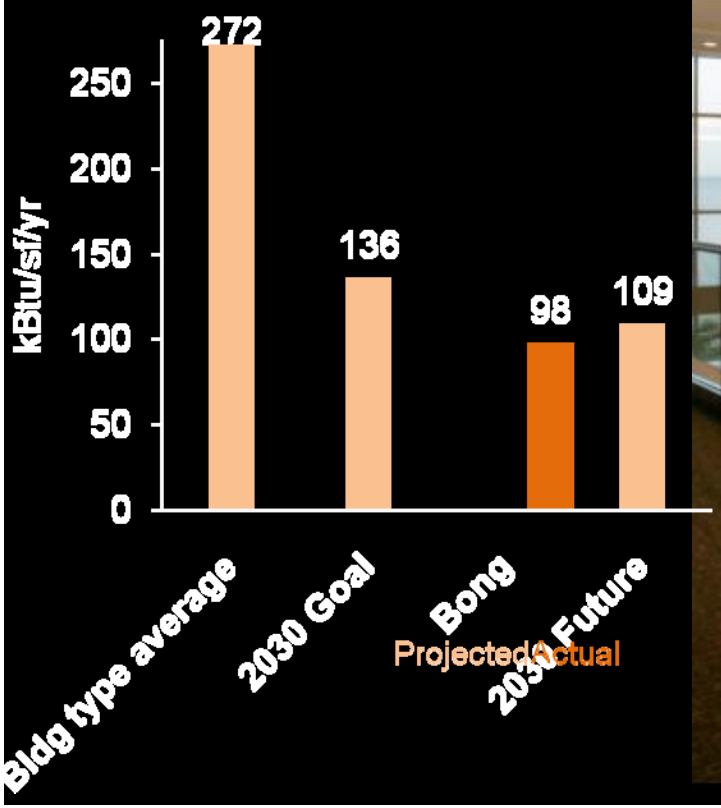
Phillips Eco Enterprise Center

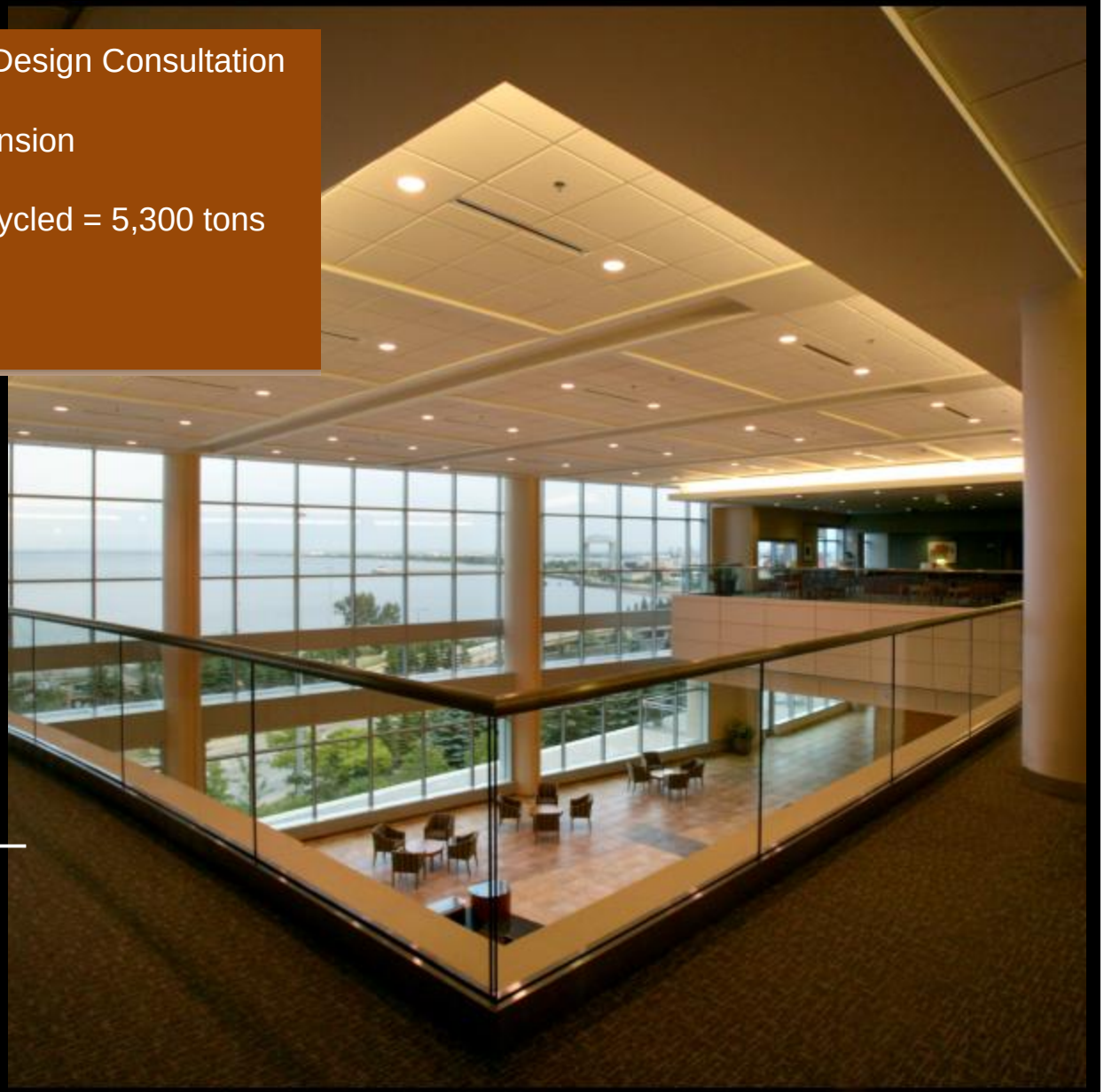
Completed in 1999
$147/ sq ft
Energy Star rating of 95
LEED® Pilot Project



SMDC Cancer Center

LHB Provided Healthy Building Design Consultation to HKS Architects
$50M, 236,000 sf Hospital Expansion
LEED® Gold Certified
63% of Construction Waste Recycled = 5,300 tons





How Did We Get to Our Metric?

EUI, our Energy Standard

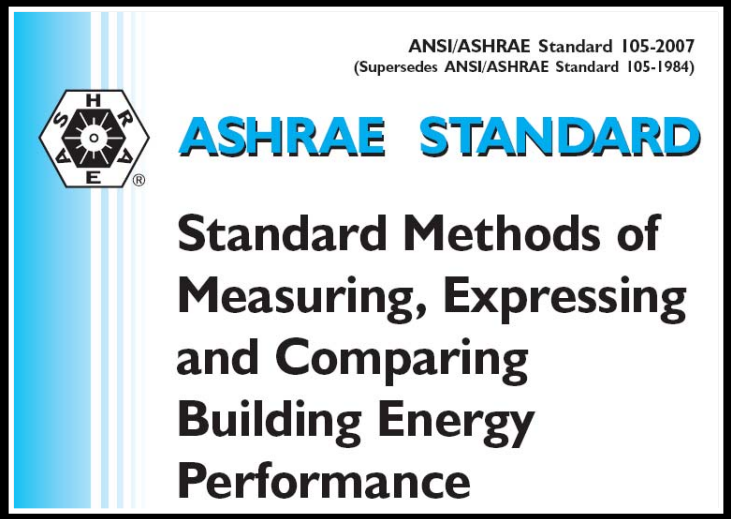
EUI stands for Energy Use(age) Intensity

For buildings, the units are KBtuh/sf/yr

Data has been collected by the Census Bureau since 1979, most recently in 2003

ASHRAE has a standard for this

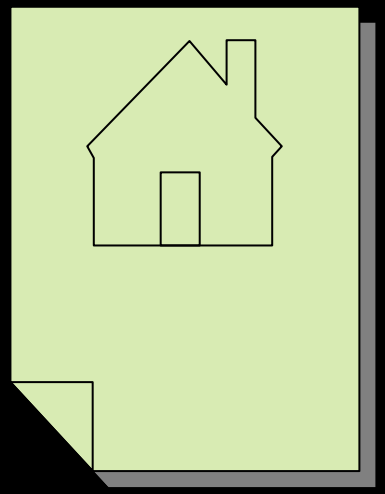
Energy Star uses this



Units measure units

We convert these different “units” into one common measurement spread over the area and one year

Power over time is energy



Water, water everywhere?

A metric we can get to

30 gallons per day per person

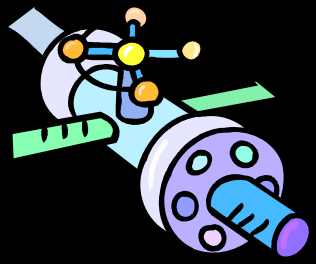
VS

We measure but don't know

The West Coast has consumption expectations.

The South West needs consumption reduction.

We need our own to understand total costs.

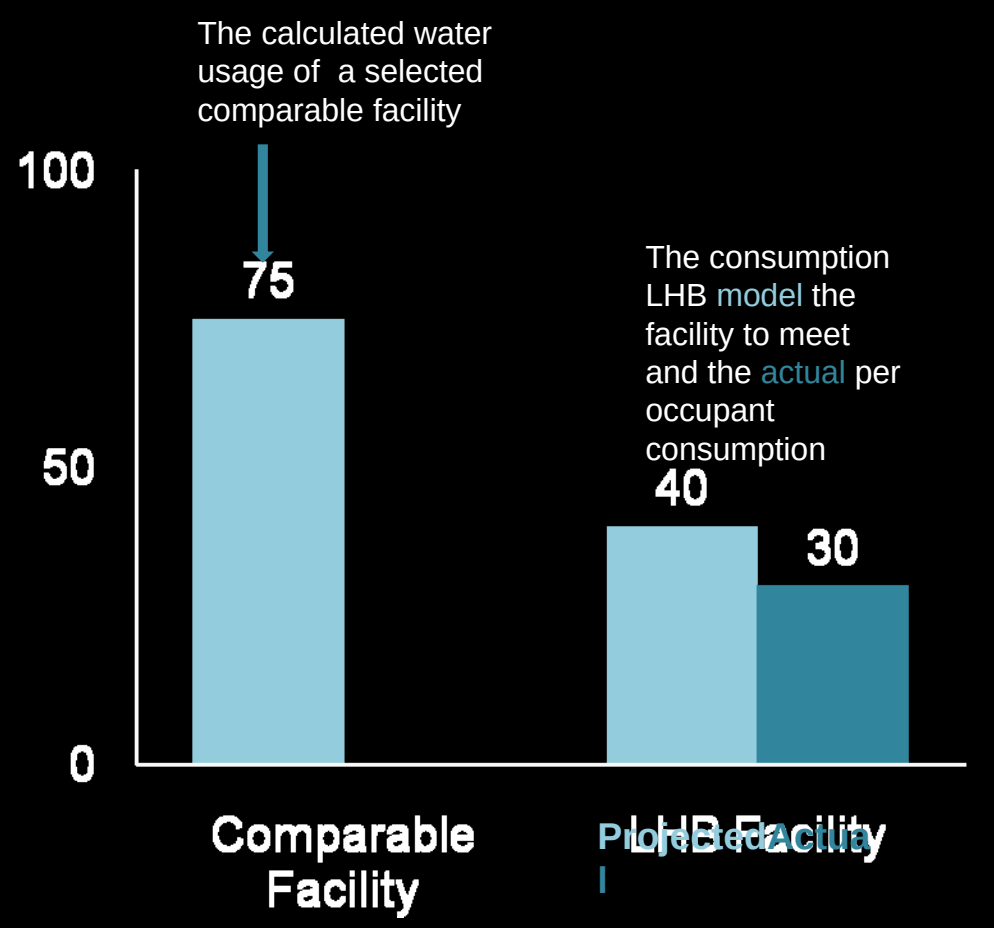


Performance Metrics ™

LHB Performance Metric ™ : Water

Numbers are acquired in a measurement based off of gallons per occupant per day. The calculation is then measured against varying comparable facilities. In some cases the original existing facility and in other facilities of the same type.

The resulting metric is OWC = Occupant Water Consumption



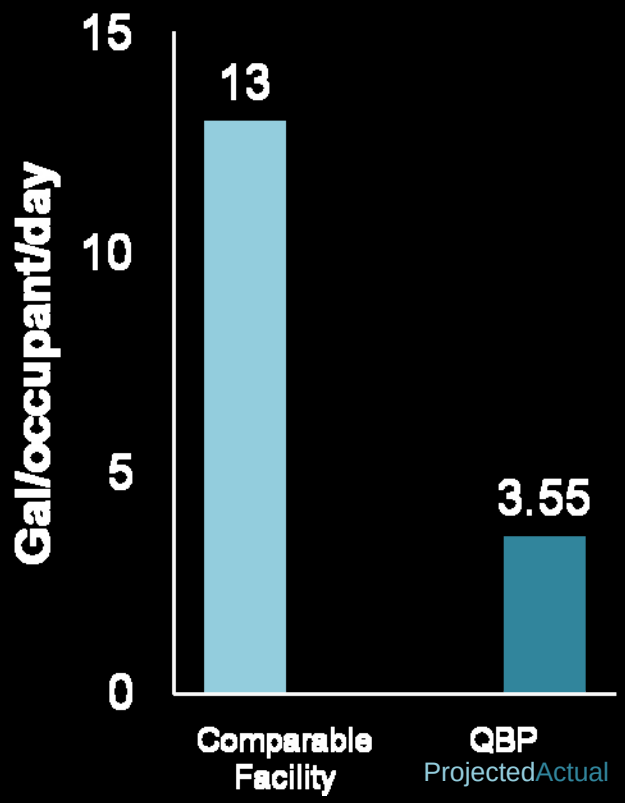
Quality Bicycle Products

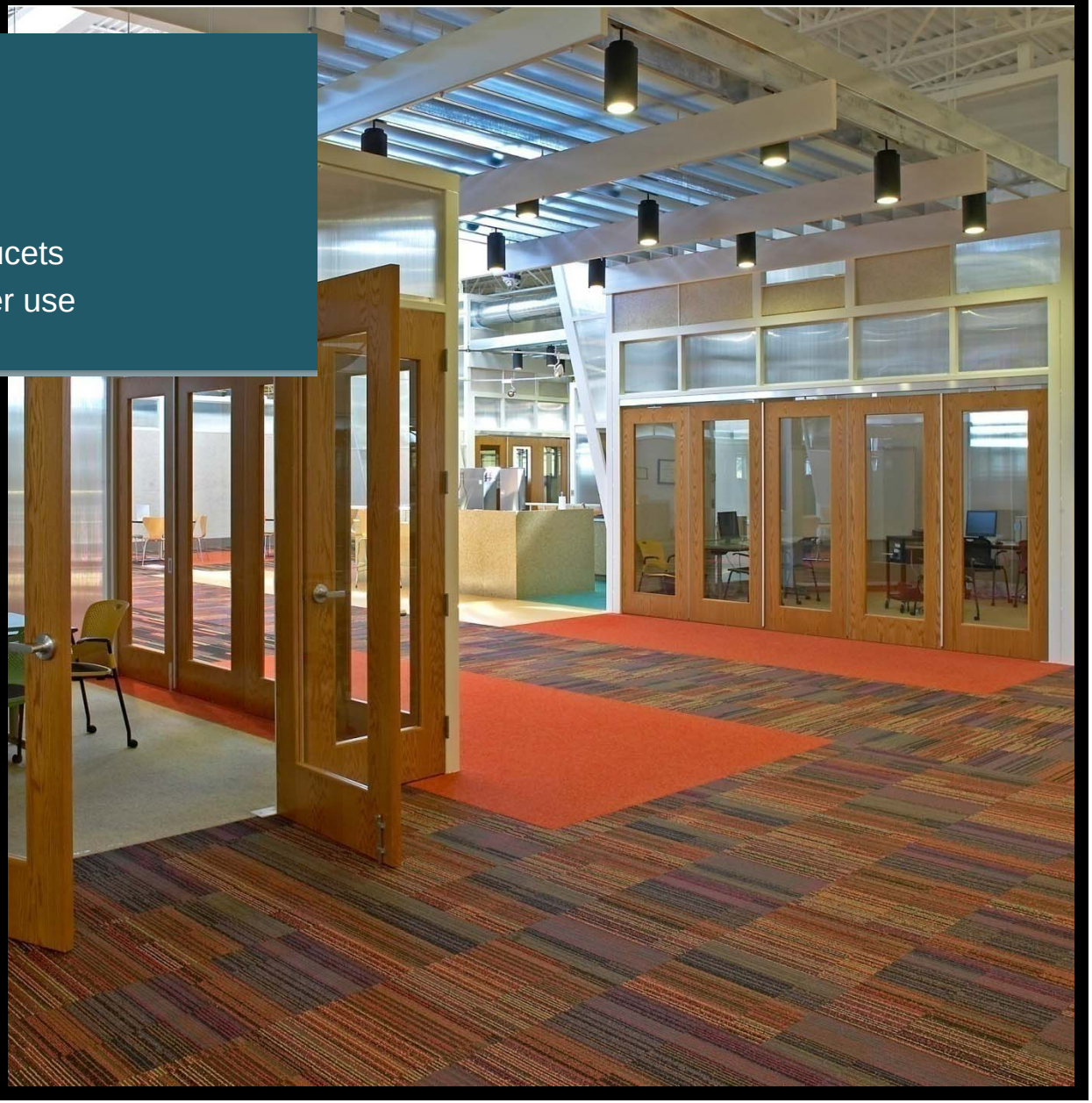
Features:

- Dual-flush toilets
- Low-flow showerheads
- Waterless urinals
- Sensor-operated water faucets

225,940 gallon reduction in water use

$868/yr in Savings



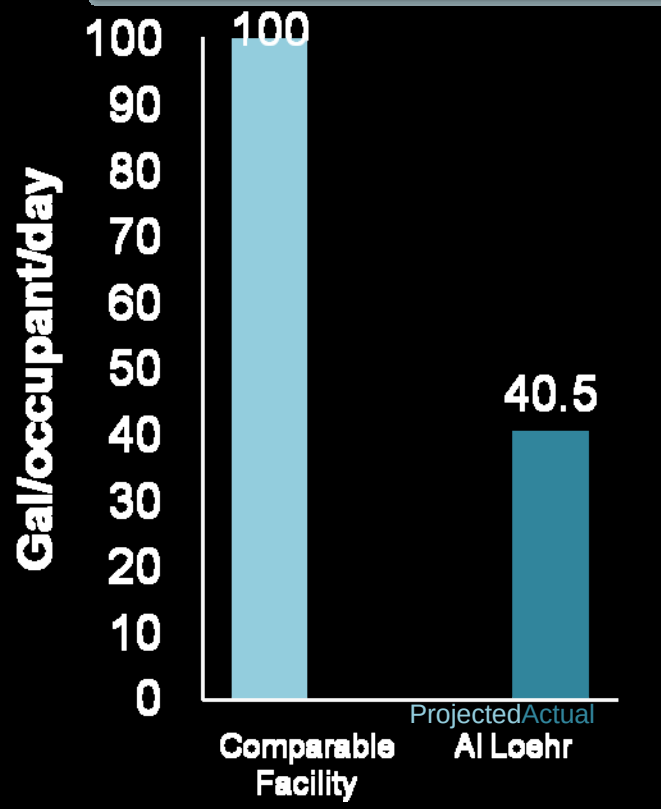


Al Loehr Veterans and Community Apartments

Average usage of water per 2 months: 145781.25 gallons

60 Occupants

40.5 gal/occupant/day



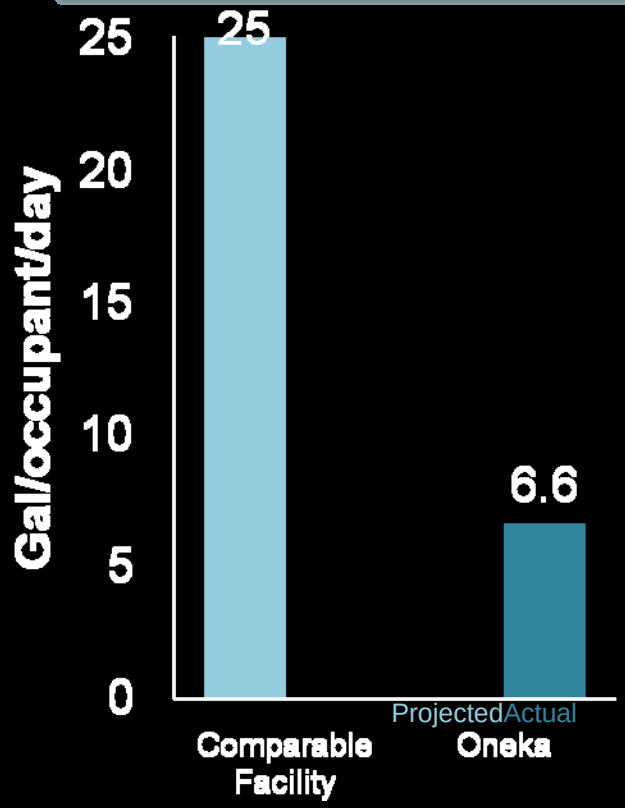
Oneka Elementary School

Results estimated off of one month of data collection and meter reading

1,800,000 gallons/ year

750 Occupants

2400/ gallons/ occupant/ year



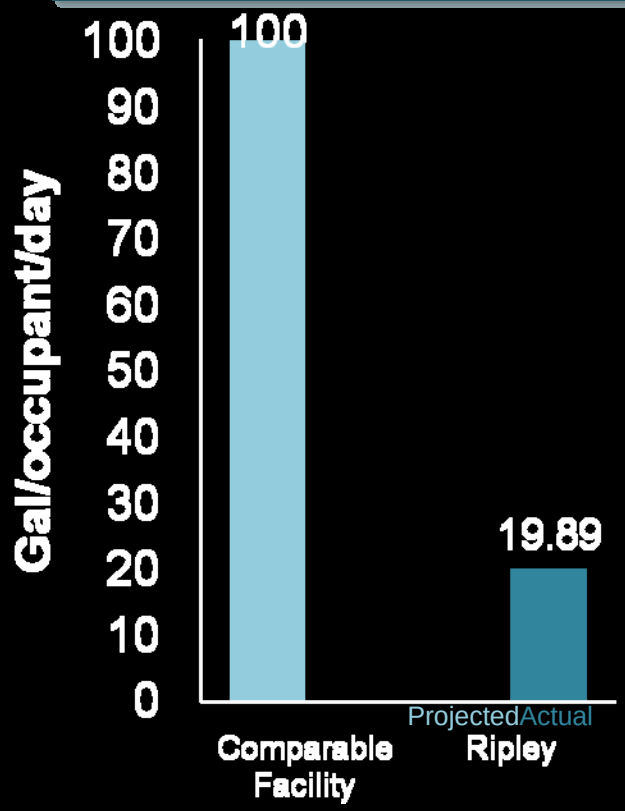
Ripley Gardens

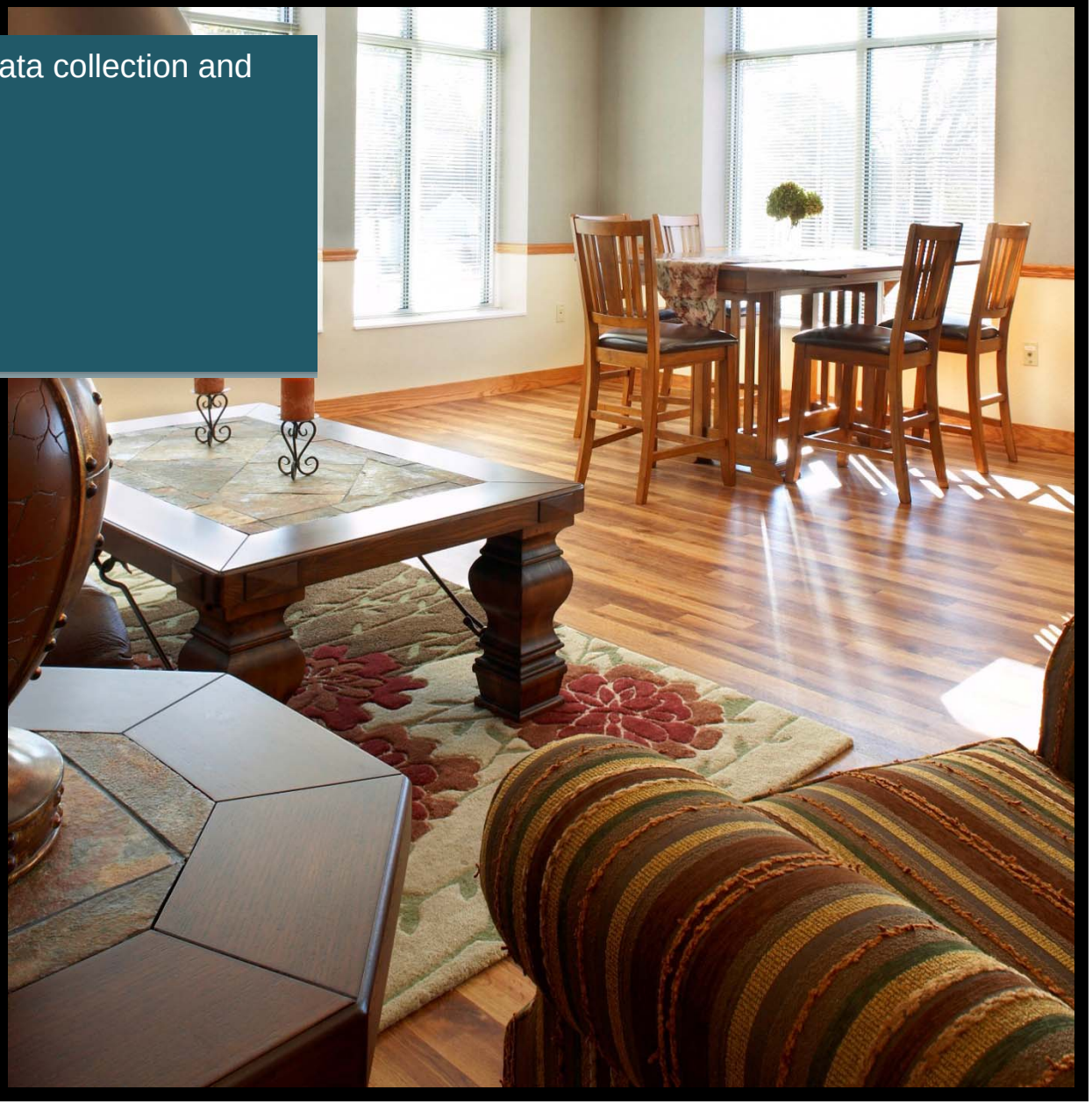
Results based on two years of data collection and meter reading

2068.75 gal/ day

60 Units, 104 Occupants

19.89/ gallons/ occupant/ day





Performance Metrics ™

LHB Performance Metric ™ : Stormwater

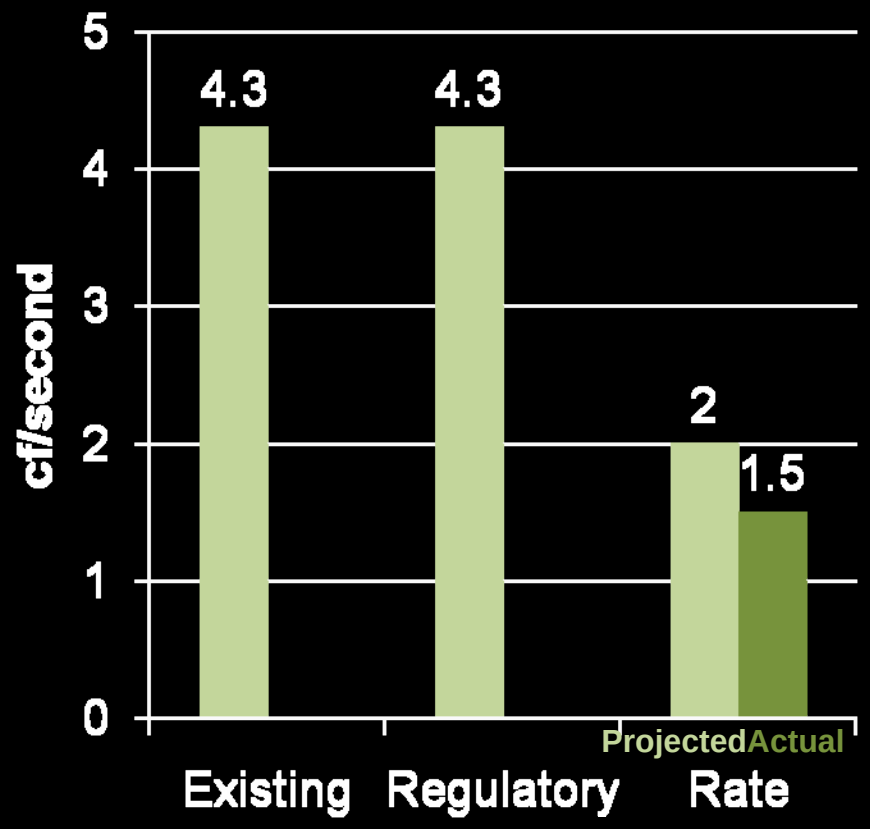
Numbers are calculated in three measurements including:

- Rate of cubic feet per second
- Volume
- Quality (total suspended solids)

Rate calculations are shown in the following slides comparing:

Existing
Regulatory
Desired
Actual

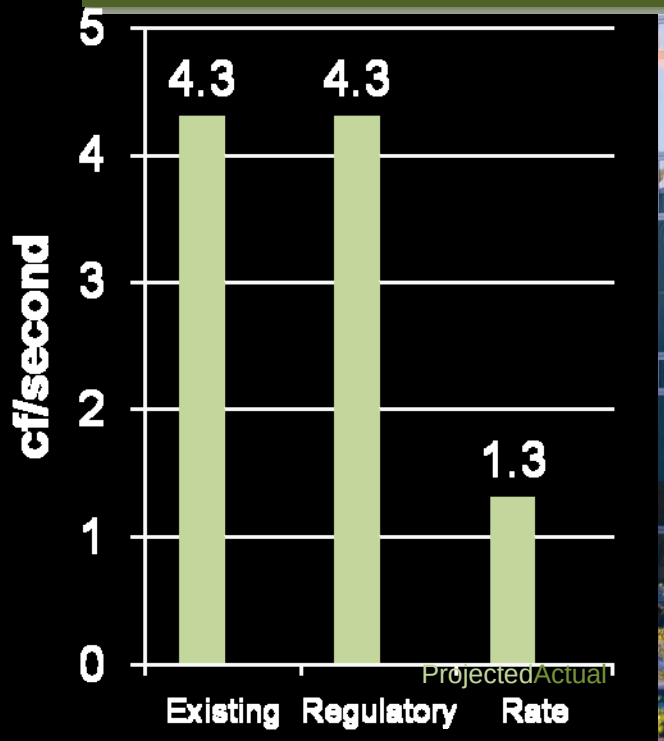
- Based on a 2-year storm event



Quality Bicycle Products

LEED® – NC Gold Certified

Stormwater run-off rate based on
2-year storm event



Ripley Gardens

Stormwater run-off rate based on
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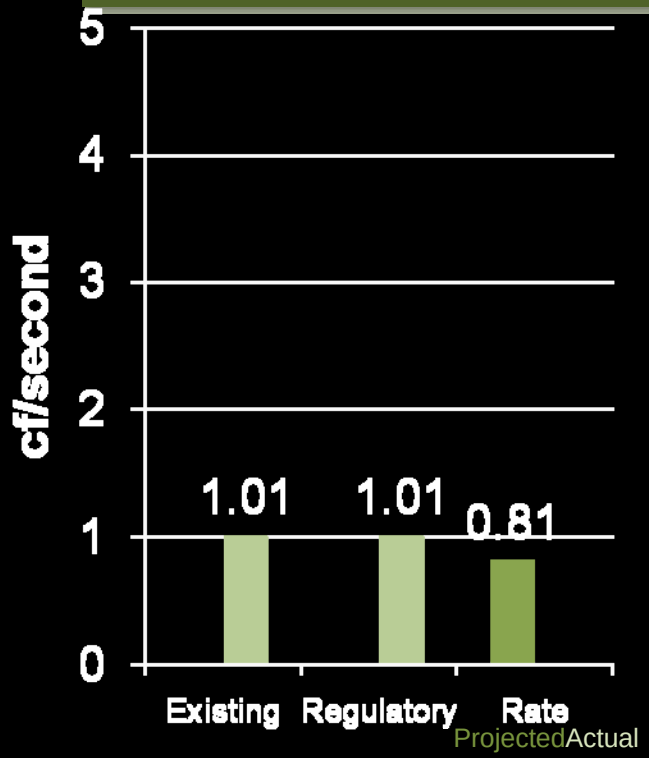
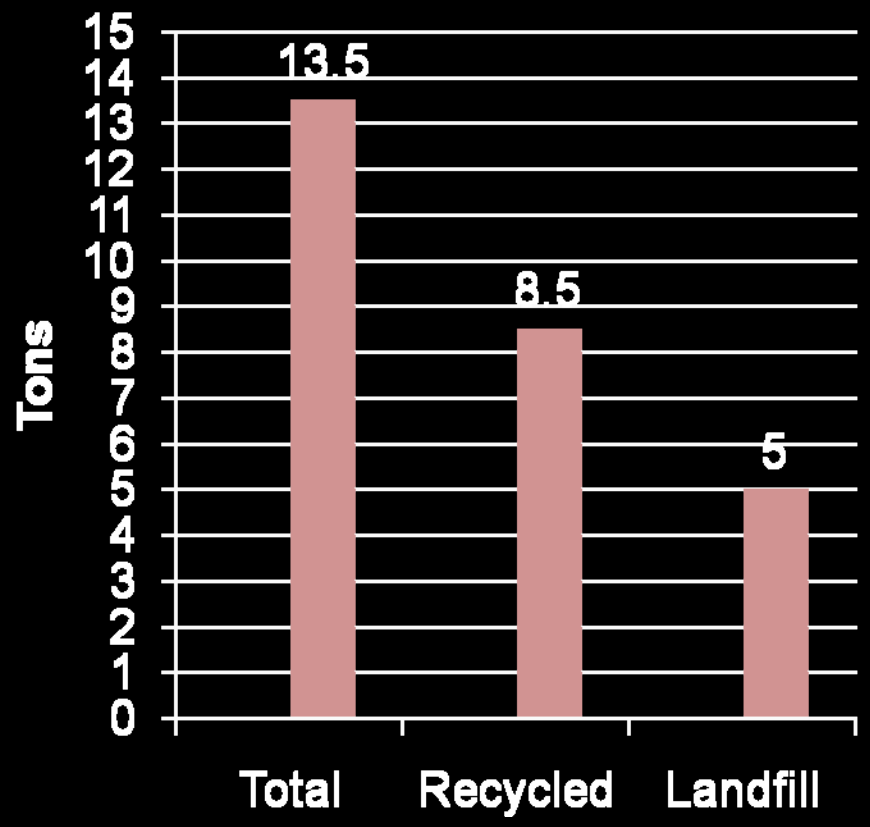


Performance Metrics ™

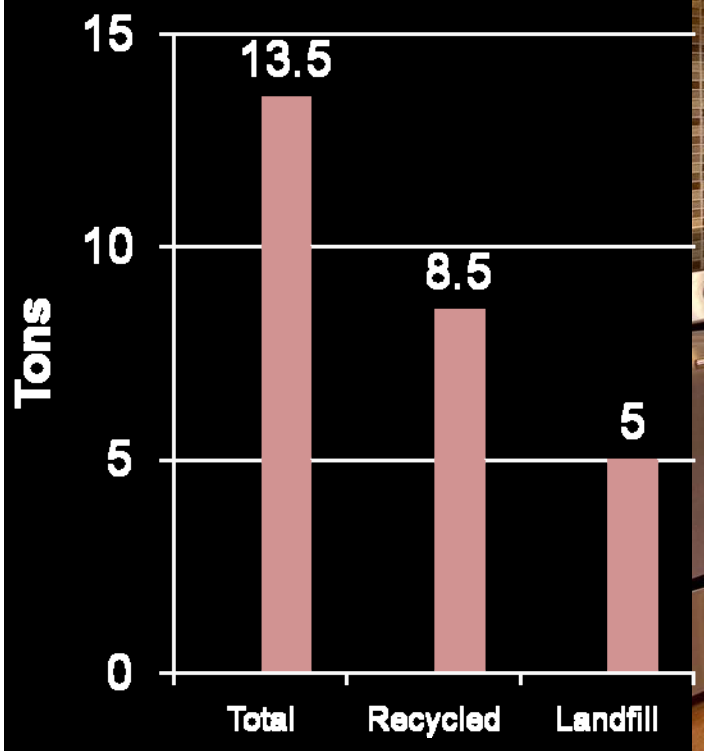
LHB Performance Metric ™ : Construction Waste

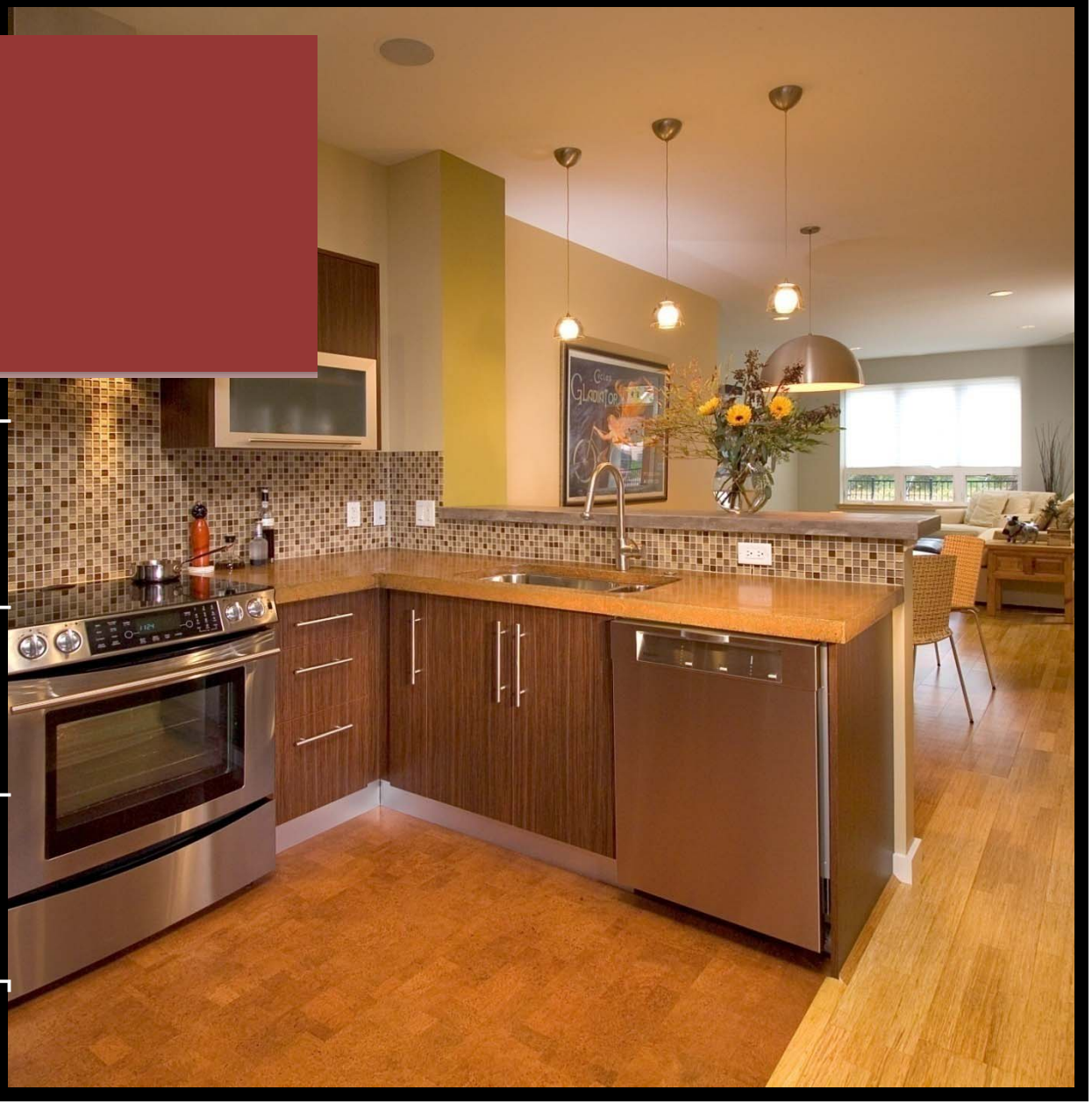
Numbers are calculated by amount sent to landfill and amount diverted.



E2 City Homes

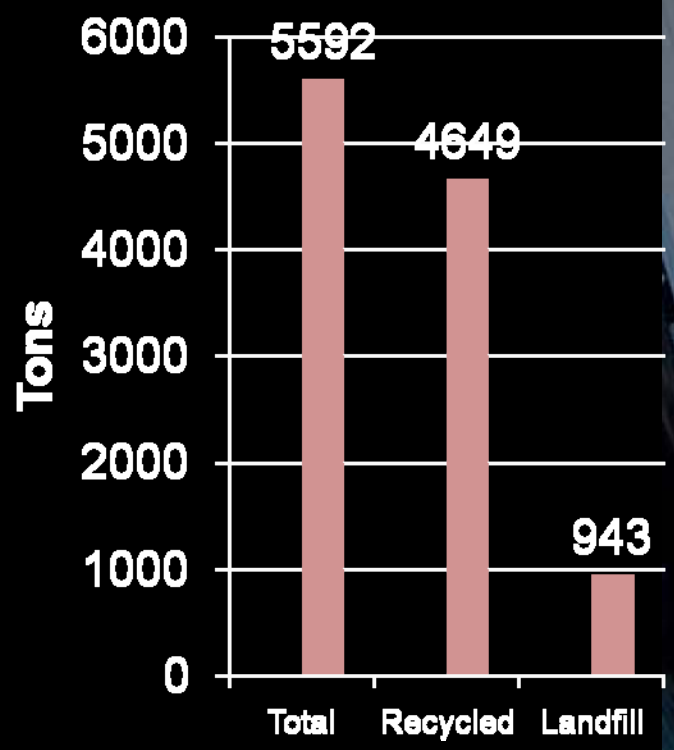
LEED ® - H Gold Certified





Quality Bicycle Products

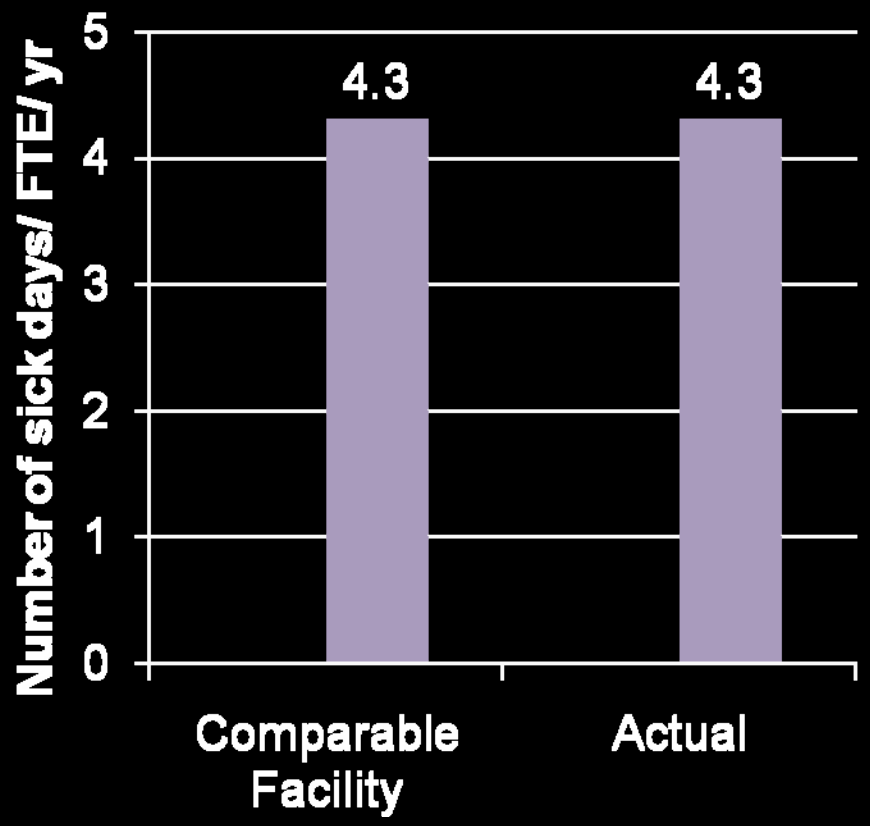
LEED® – NC Gold Certified



Performance Metrics ™

LHB Performance Metric ™ : Healthy Occupant

Numbers are calculated by number of sick days per full time employee/ student/ occupant. These numbers are then compared to industry averages of similar facility type.



Next Steps

- Transportation
  - Miles Commuted
  - Total LHB miles
- Carbon Impact
- Cost Impact

Oneka Elementary

Websites

LHB, Inc.
www. lhbcorp.com

Center for Sustainable Building Research, University of Minnesota
www. csbr.umn.edu

The Weidt Group
www.twgi.com

B3 Guidelines
www.scbr.umn.edu/B3

LEED
www.usgbc.org

Green Communities
www.greencommunities.com

2030 Architecture
www.architecture2030.org

Energy Star
www.energystar.gov

Lake Superior College

This concludes the American Institute of Architects Continuing Education Systems Program.

Costs

Eagle Point

LEED® Registration and Certification

B3 and LEED documentation

Energy Modeling

Commissioning

Additional Construction Costs

Life Cycle Costs