

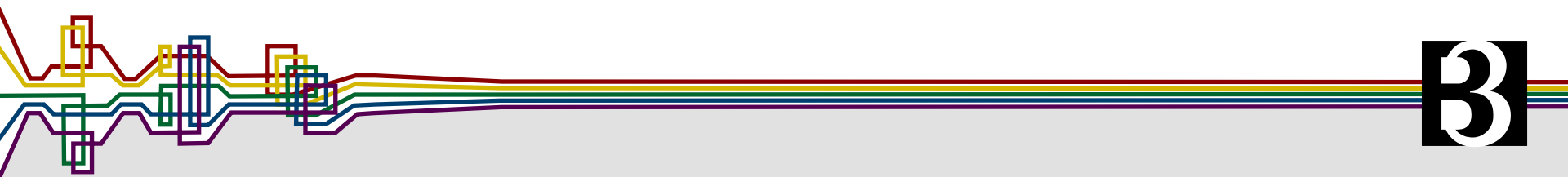
February 24, 2015

Energy Design Conference and Expo | Duluth, MN

GETTING TO NET ZERO: SETTING AND ACHIEVING ENERGY GOALS WITH AN INTEGRATIVE PROCESS

Rick Carter, LHB Inc.

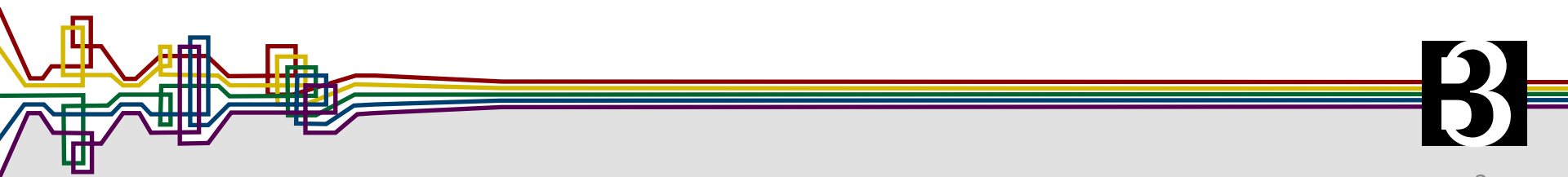
Becky Alexander, LHB Inc.



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SESSION LEARNING OBJECTIVES



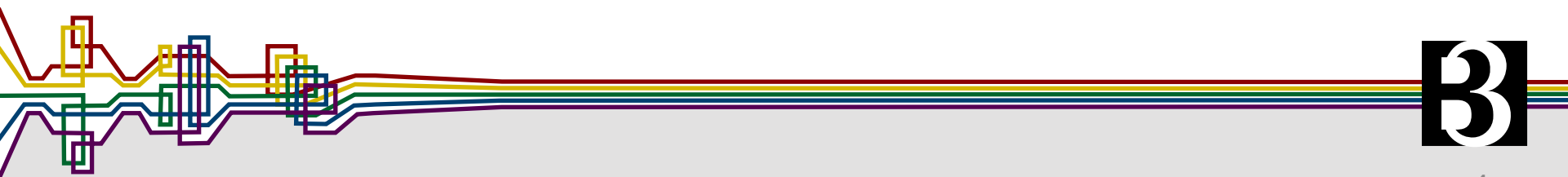
- Describe the objectives of Minnesota's Sustainable Buildings 2030 (SB 2030) to reduce building energy consumption and carbon emissions.
- Summarize the concept of energy use intensity (EUI) and describe how it enables the establishment of normalized energy baselines and targets for a project.
- Identify specific characteristics of an integrative process and its implications for building energy performance.
- Use the SB 2030 Energy Standard Tool to set an energy target for a project.
- Describe the benefits of utilizing early energy modeling and energy design assistance programs as tools to achieve energy targets.
- Explain the concept of commissioning and its value to improving building energy performance.
- Leverage actual performance tracking to achieve energy targets on your next building project.



SESSION OUTLINE



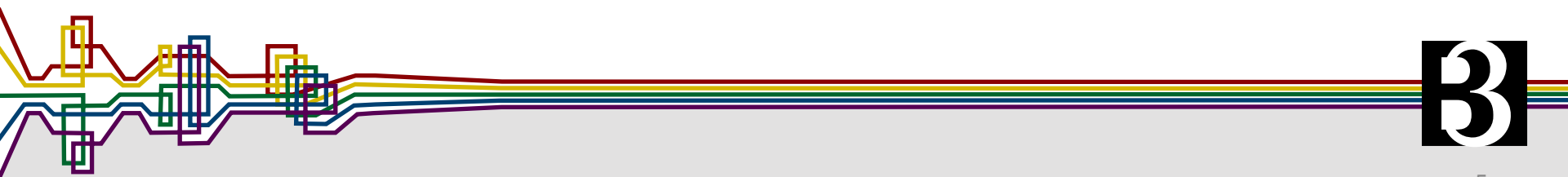
- SB 2030 Overview
- Tools to help achieve SB 2030
 - Integrative Process
 - Using an Integrative Process to meet SB 2030
 - Determine the average energy use for comparable buildings
 - Calculate the SB 2030 Energy Standard
 - Optimize energy use
 - Implement energy reduction strategies
 - Perform energy modeling
 - Evaluate the use of low carbon energy sources
 - Perform commissioning
 - Track actual performance using B3 Benchmarking
 - Ensure energy-efficient operations
- Case Studies



SUSTAINABLE BUILDINGS 2030 (SB 2030)



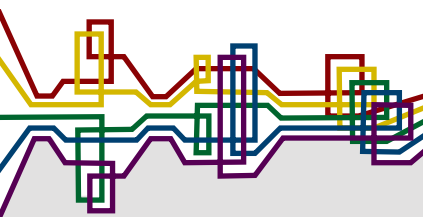
- SB 2030 Origins
 - B3 Guidelines
 - Next Generation Energy Act
 - Minnesota Climate Change Advisory Group
 - SB 2030 project team
 - SB 2030 program elements
- SB 2030 Overview
 - Required projects
 - SB 2030 Energy Standard
 - Energy Use Intensity
 - Process
 - Cost-effectiveness evaluation



B3 HISTORY IN MINNESOTA



- Hennepin County Sustainable Building Guidelines developed in 1995.
- The B3 Sustainable Building Guidelines were established in 2004 for all new state-bonded projects and were updated in 2008 to include all substantial renovations.
 - 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
- The original energy requirement in the B3 Guidelines was replaced by the Energy Standard from the SB 2030 program in 2009.



NEXT GENERATION ENERGY ACT (2007)

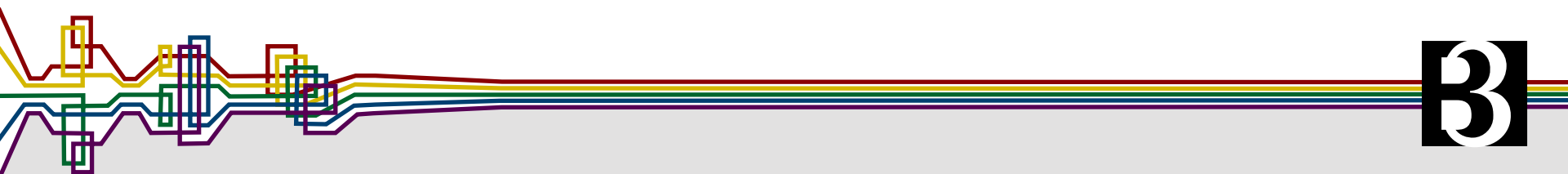


GREENHOUSE GAS REDUCTION

- **Reduce greenhouse gas emissions (from 2005 levels):**
 - **15% by 2015**
 - **30% by 2025**
 - **80% by 2050**

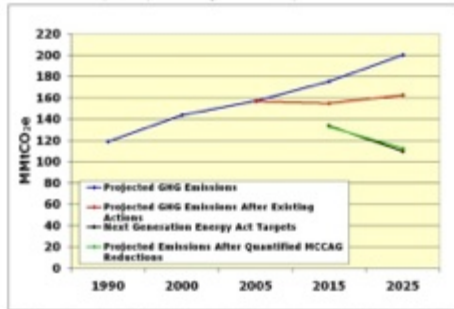
ENERGY CONSERVATION

- **Statewide energy conservation goal of 1.5% of annual retail electric and gas sales**
- Expand and improve the state's conservation improvement program
- Provide research and development and technical assistance to utility companies through the Department of Commerce
- Increase energy efficiency in state buildings



MINNESOTA CLIMATE CHANGE ADVISORY GROUP

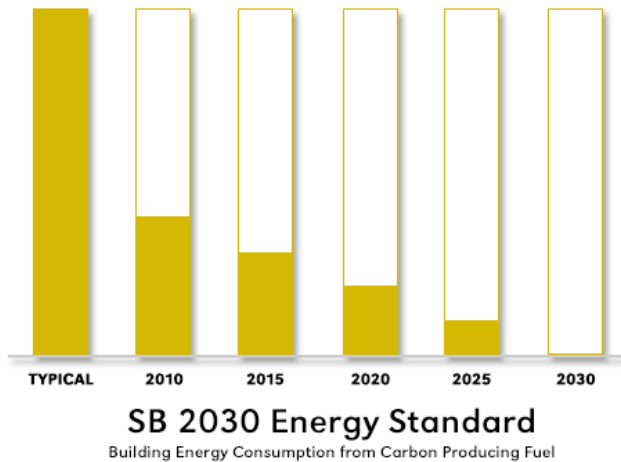
Figure EX-4. Annual GHG emissions: reference case projections and MCCAG recommendations (consumption-based, gross emissions)



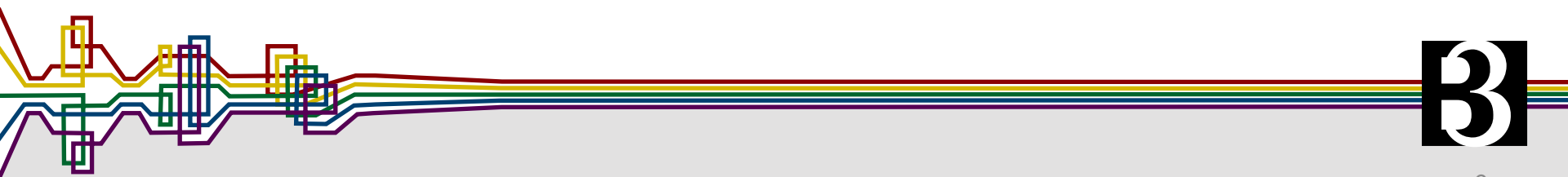
MMtCO₂e = million metric tons of carbon dioxide equivalent; GHG = greenhouse gas; MCCAG = Minnesota Climate Change Advisory Group

- The Minnesota Climate Change Advisory Group (MCCAG) was formed as a result of the NGEA
- MCCAG developed a comprehensive set of state-level policy recommendations to reduce Minnesota's greenhouse gas emissions
- One policy recommendation was to **"adopt green building guidelines ... for all commercial and residential buildings consistent with *Architecture 2030* targets."**
- This led to the development of the Minnesota Sustainable Building 2030 (SB 2030) initiative, which was passed by the Minnesota legislature in 2008.

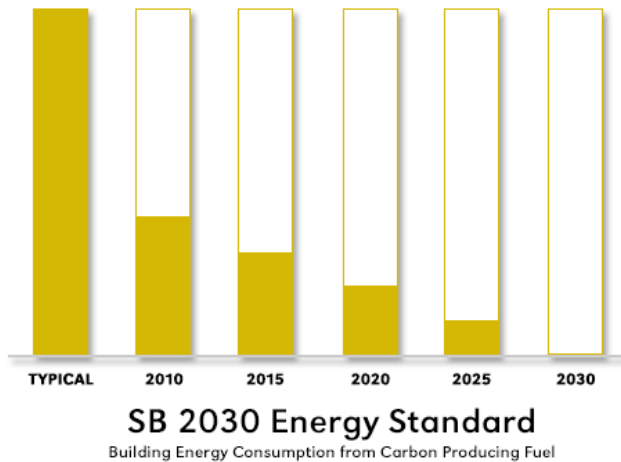
SUSTAINABLE BUILDING 2030



- The purpose of SB 2030 is “to establish **cost-effective** energy-efficiency performance standards for new and substantially reconstructed commercial, industrial and institutional buildings that can significantly **reduce carbon dioxide emissions by lowering energy use ...**”
- These standards have become the energy use requirements for state-bonded projects through the B3 Guidelines (Minnesota Sustainable Building Guidelines).



SUSTAINABLE BUILDING 2030



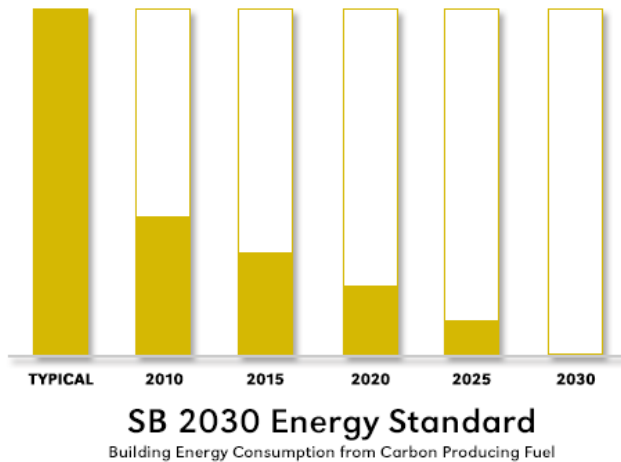
CLIENTS

- Department of Commerce
- Real Estate and Construction Services

CONSULTANTS

- Center for Sustainable Building Research
- The Weidt Group
- LHB, Inc.
- Center for Energy and the Environment
- Herzog Wheeler and Associates

SUSTAINABLE BUILDING 2030

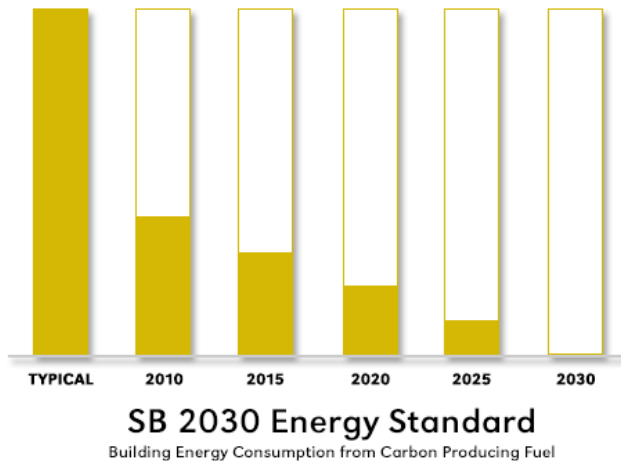


PROGRAM ELEMENTS

- Develop a program for setting SB 2030 Energy Standard targets and meeting them in design
- Assist in development of utility incentive programs incorporating the SB 2030 program
- Develop case study database and track building performance
- Deliver training program for design professionals
- Develop an energy efficient operations program



SUSTAINABLE BUILDING 2030

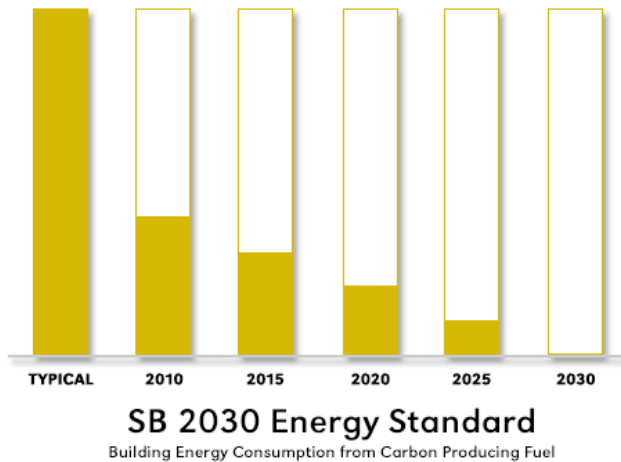


REQUIRED PROJECTS

SB 2030 is a required program for all state-bonded buildings that receive General Obligation (GO) bonds (regardless of the amount):

- All new buildings
- All substantially renovated buildings that include:
 - At least 10,000 sf
 - Replacement of HVAC system in all or part of the building
- That started Schematic Design after August 1, 2009

SUSTAINABLE BUILDING 2030



REQUIREMENT

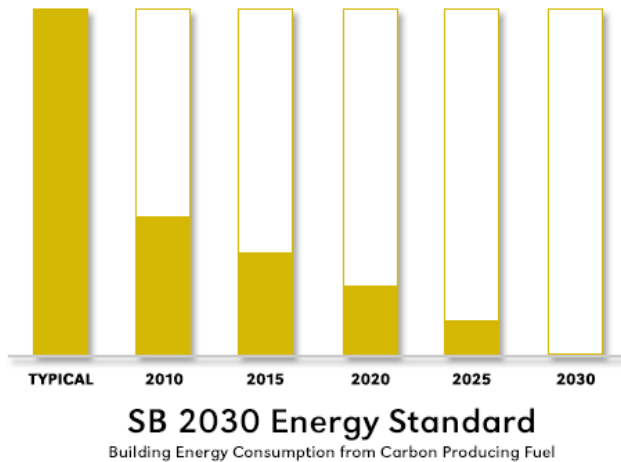
Meet energy performance targets (Energy Standards) that reduce* the use of carbon producing fuel for building operations by:

- 60% (for buildings designed) in 2010
- 70% in 2015
- 80% in 2020
- 90% in 2025
- 100% in 2030

These targets are halved for renovations of existing buildings.

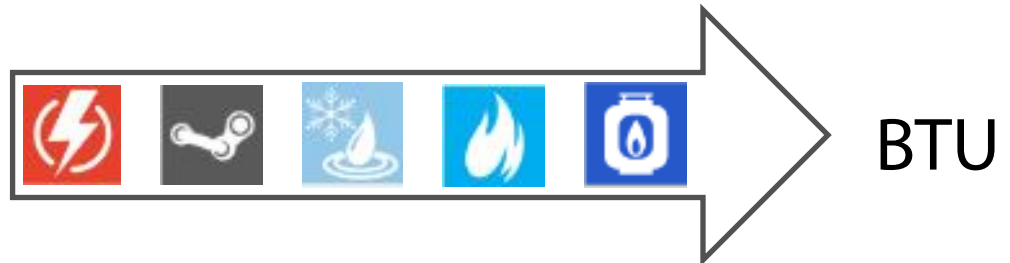
*from a baseline of representative buildings in existence in 2003.

SUSTAINABLE BUILDING 2030

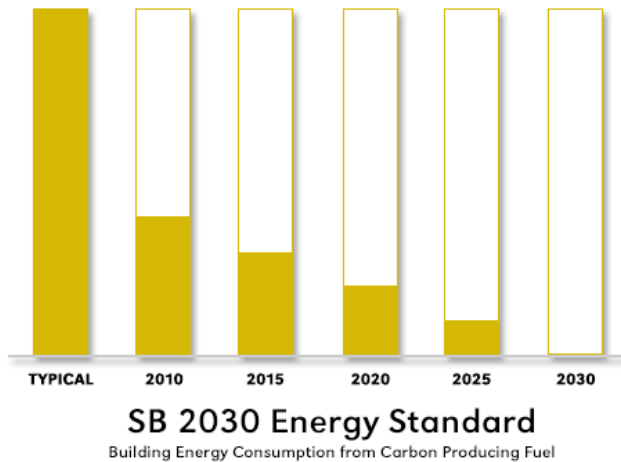


ENERGY METRIC

- A common metric is needed to compare different fuel types.
- Units such as barrels, cubic feet, tons, therms, and kilowatt-hours can all be converted into the equivalent number of British thermal units (Btu).
- A Btu is the amount of energy needed to raise the temperature of 1 pound of water by 1 °F
 - 1 kBtu = 1,000 Btu
 - 1 MMBtu = 1,000,000 Btu



SUSTAINABLE BUILDING 2030



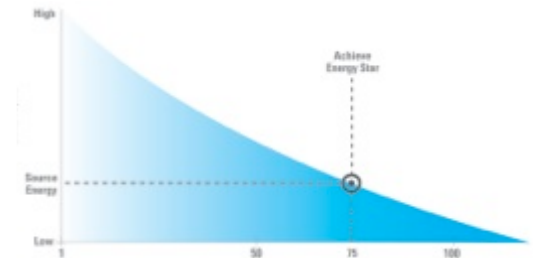
ENERGY METRIC

- By normalizing energy use by building area, multiple buildings can be compared to each other.
- Energy use intensity (EUI):
 - Building energy use ÷ area (gross square feet)
 - kBtu/sf-year

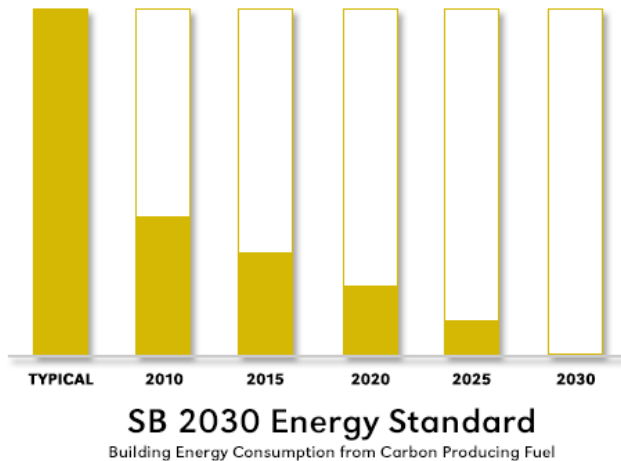
MPG



EUI



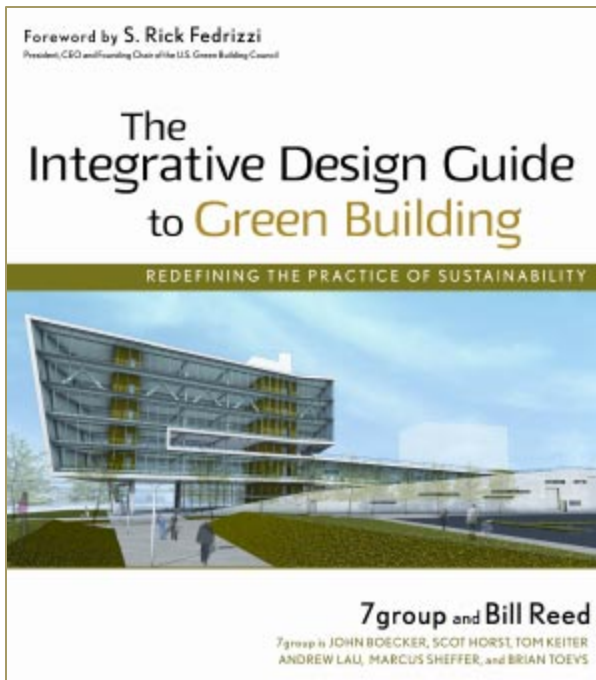
SUSTAINABLE BUILDING 2030



COST EFFECTIVENESS EVALUATION

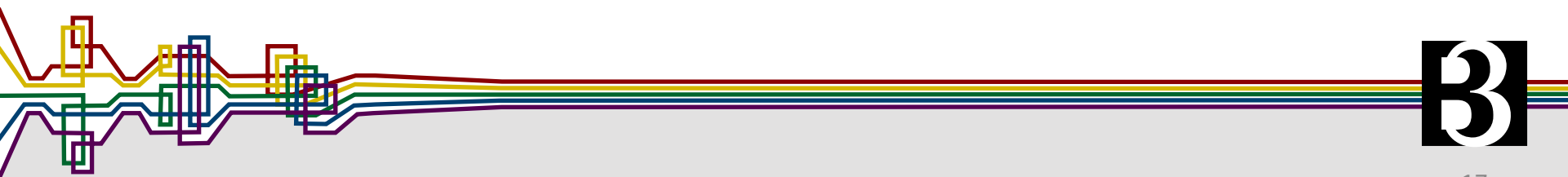
- The majority (94%) of buildings have been able to cost-effectively meet the SB 2030 Energy Standard.
- If a building cannot meet the SB 2030 Energy Standard cost-effectively, the project team can apply for an Adjusted Energy Standard.
- Cost-effectiveness is defined here in accordance with the definition used in utility energy conservation (CIP) programs as a simple payback period of 15 years or less.
- The Adjusted Energy Standard is established with consideration of all reasonable energy conservation strategies with less than a 15 year simple payback

INTEGRATIVE PROCESS



- Definition
- Key characteristics
- Key steps
- Integrative process in green rating systems
 - ANSI
 - B3 Guidelines
 - LEED
 - Green Communities
 - Green Globes
- Benefits

EVERYBODY ENGAGING EVERYTHING EARLY



INTEGRATIVE PROCESS DEFINITION

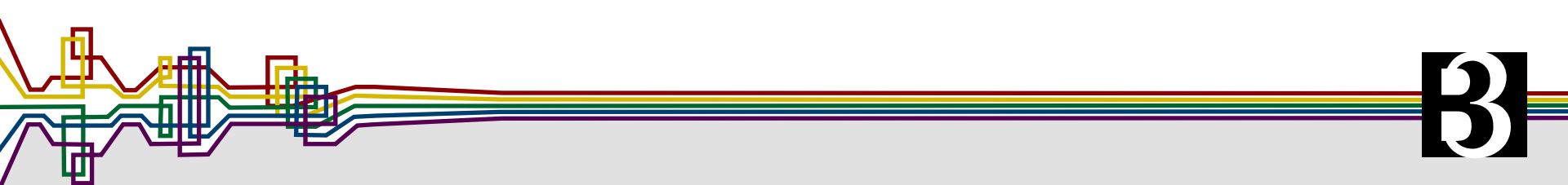
WHY:

The goal of using an integrative process is “to design and construct projects that are cost-effective over both the short and the long terms” and that achieve “high levels of building performance, human performance, and environmental benefits” (ANSI/MTS Integrative Process (IP) 2.0 Standard)

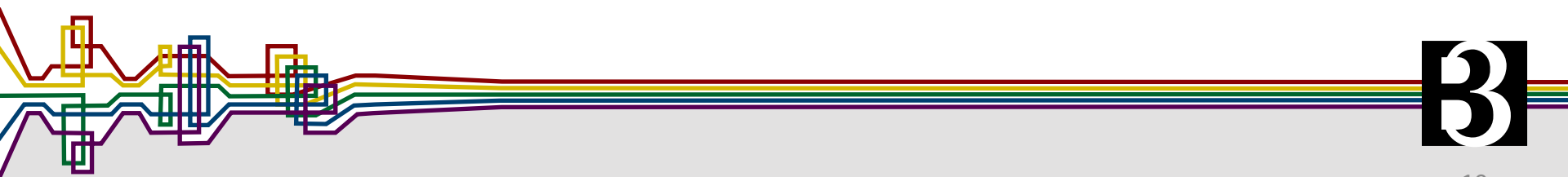
HOW:

This is achieved through a holistic approach that brings together all project team members during the initial phases of design, engaging them in a continual discovery process that optimizes the interrelationships among systems.

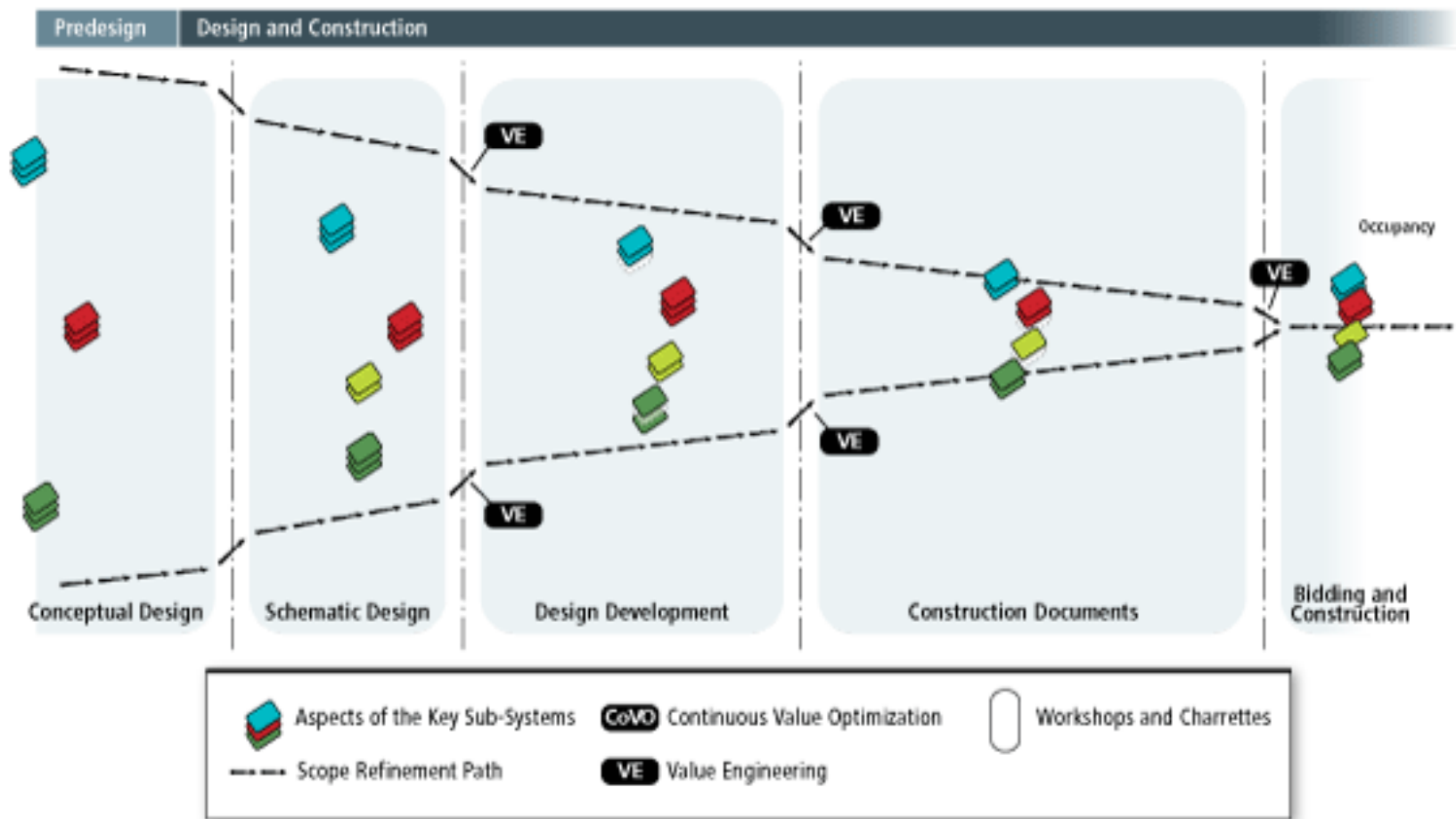
- Building systems as a unified organism (not separate pieces)
- Building team as a unified organism (not solving problems in isolation)



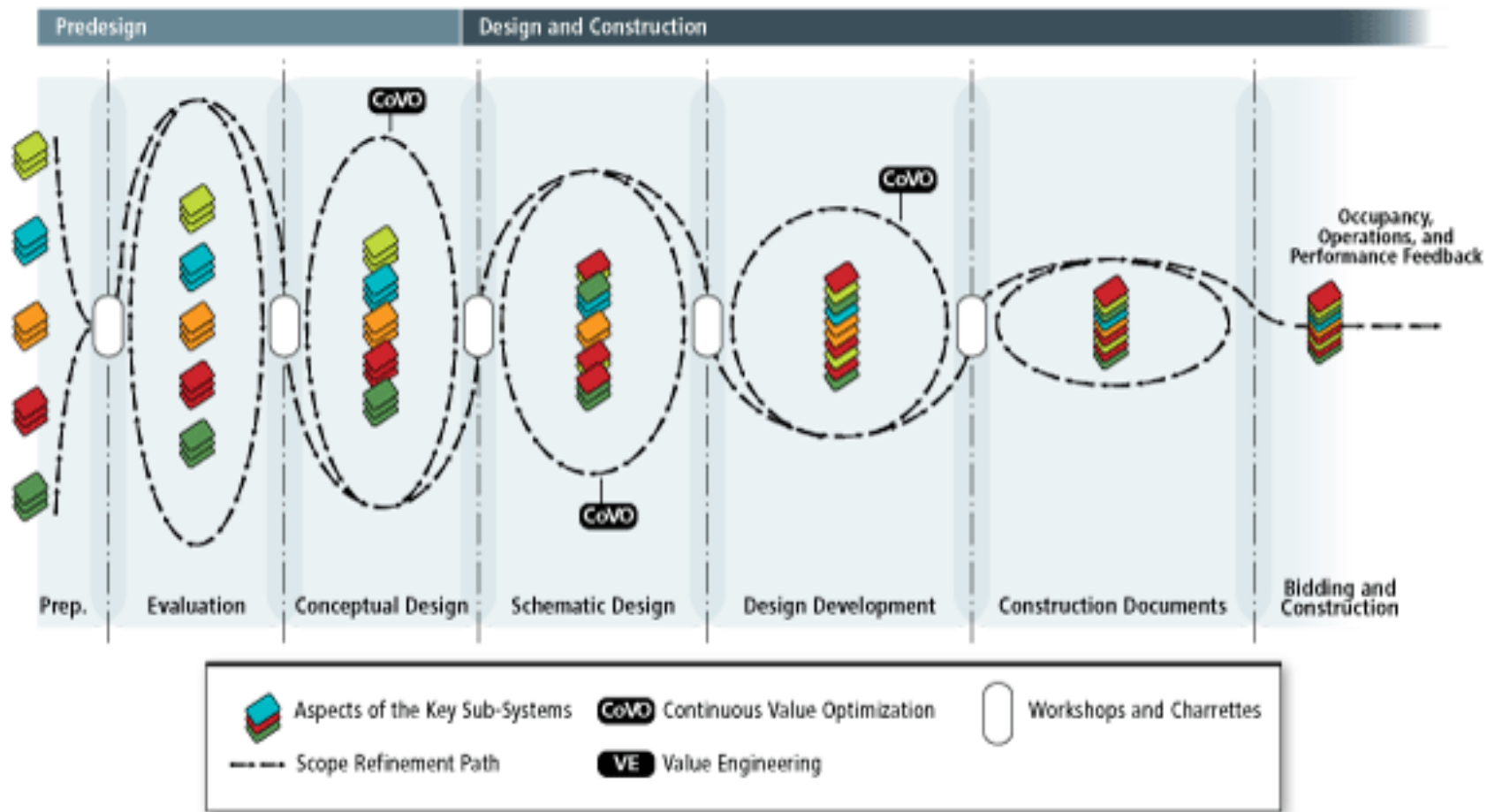
TRADITIONAL PROCESS



TRADITIONAL PROCESS

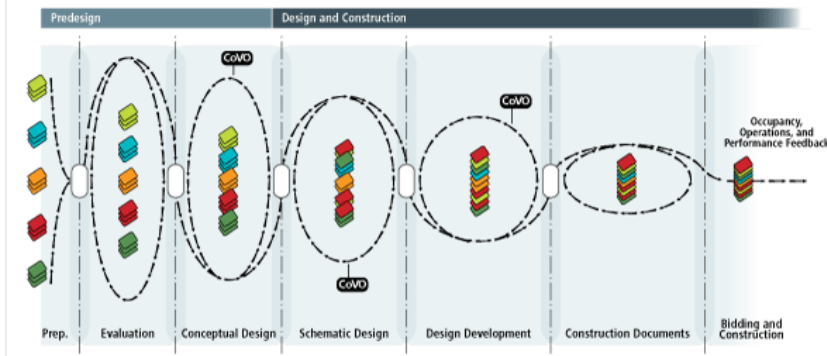


INTEGRATIVE PROCESS



INTEGRATIVE PROCESS VS. TRADITIONAL PROCESS

INTEGRATIVE



Integrated design process, with multiple disciplines working collaboratively

Early collaboration that leverages expertise of each team member

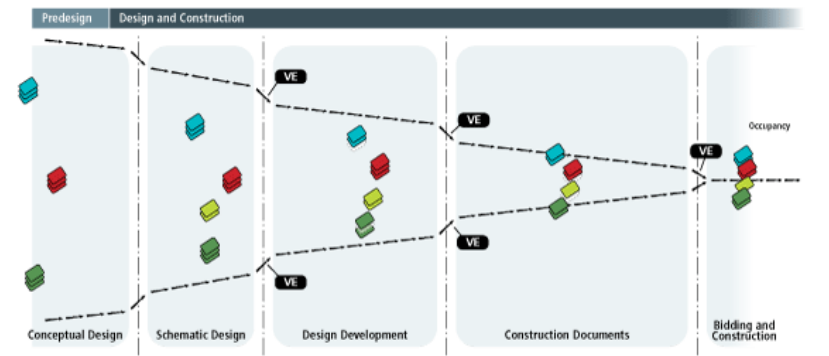
Open communication between all team members throughout design process

Significant time and fees allotted to discovery phase or predesign

Continual collaborative discovery process that optimizes interrelationships among systems

Continuous value optimization

TRADITIONAL



Linear design process, with 'hand-offs' from discipline to discipline and from phase to phase

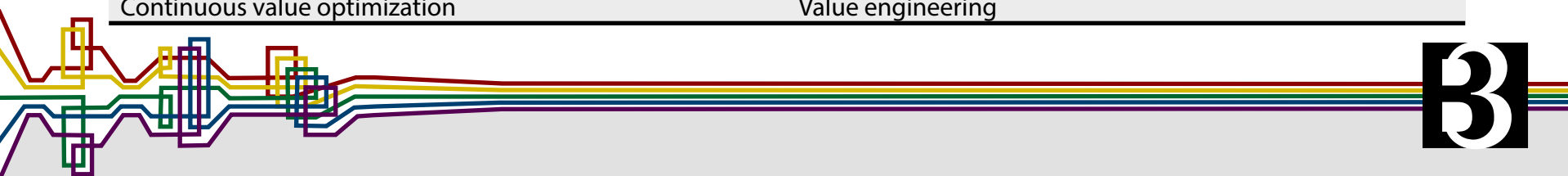
Collaborators are involved as little and as late as possible

Limited communication other than that defined by contractual agreements

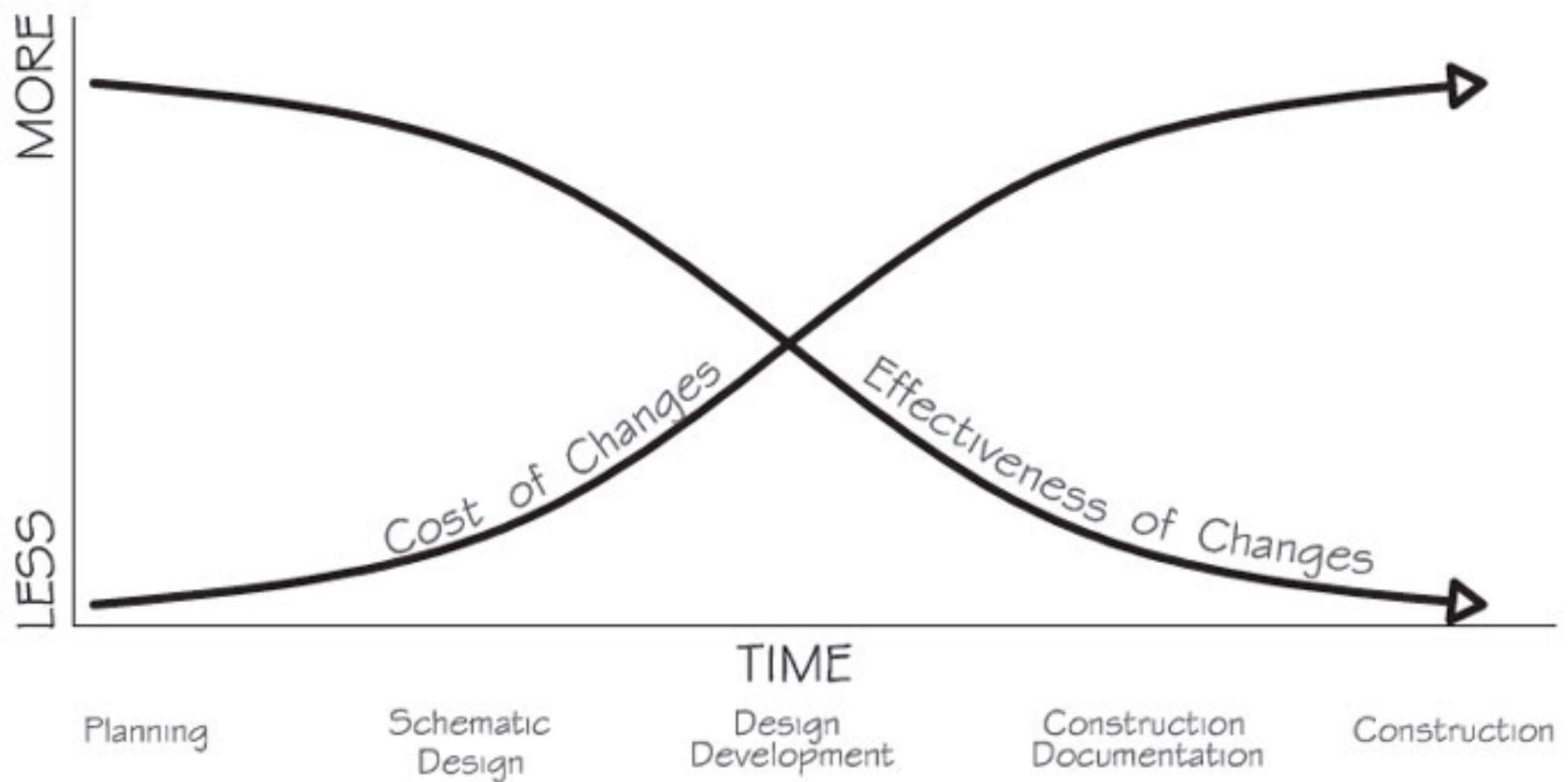
Majority of time and fees allotted to Construction Documents and Construction Administration phases, may not include a discovery phase

Costly conflict resolution during later phases of design and construction

Value engineering

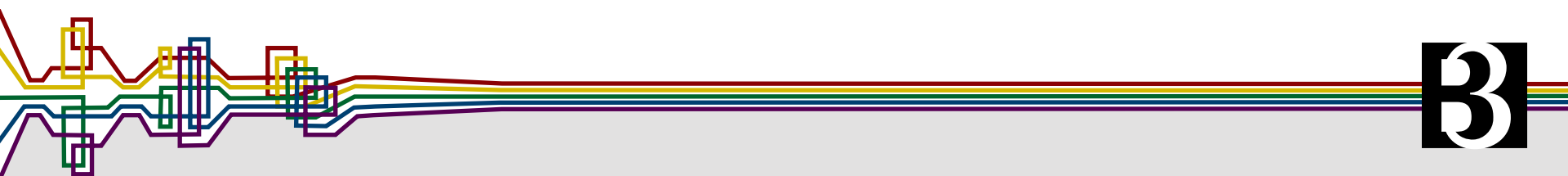


INTEGRATIVE PROCESS

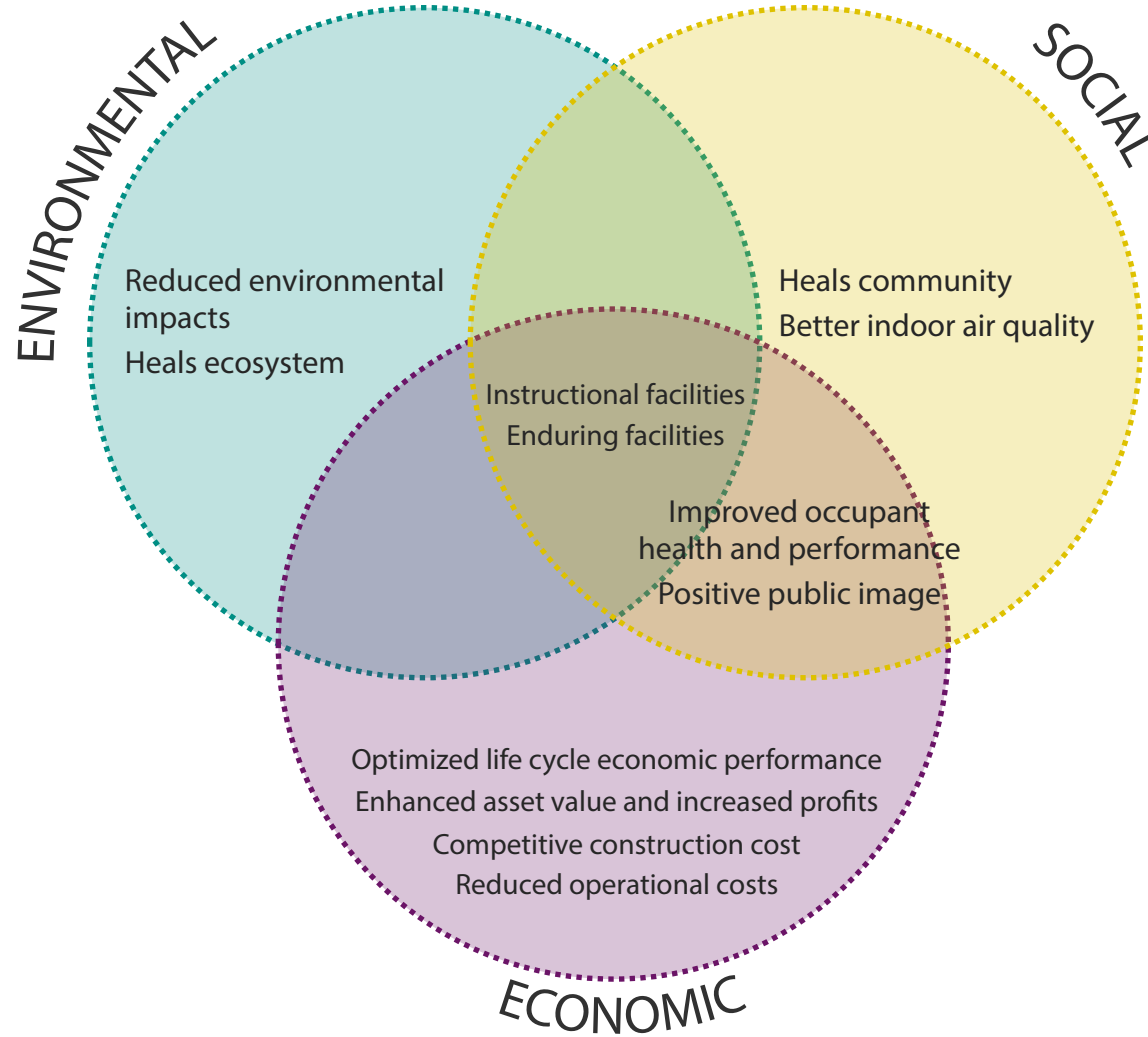


INTEGRATIVE PROCESS IN GREEN RATING SYSTEMS

Program	Title/Credit	Requirements
ANSI	Integrative Process v2.0	(1) Workshops at key phases, (2) Performance benchmarks, metrics, and targets, (3) cost-bundling template, (4) Road Map, (5) Owner's project requirements, (6) Basis of design, (7) Life cycle cost analysis, (8) Commissioning Plan, (9) M&V Plan, (10) Standard operating procedures, (11) Recommissioning Manual
B3 Guidelines	P.3 Integrated Design Process (Required)	(1) Kick-off meeting, (2) Design Intent Document, (3) Basis of Design Document, (4) Assess safety risk for Indoor Air Quality issues, (5) Construction Air Quality Management Plan and Warranty Period, (6) Air Quality Management Plan, (7) Construction Waste Management Plan, (8) Track user complaint/work request logs
LEED	Integrative Process v4 (1 point)	(1) Owner's project requirements, (2) Basis of design, (3) "Simple box" energy modeling analysis during schematic design, (4) Preliminary water budget analysis during schematic design
Green Communities	1.1a Integrative Design (Required)	(1) Integrative design meeting(s), (2) Green Development Plan that outlines integrative design approach; Recommendations: (1) Design charrette, (2) Project goals, (3) Document compliance process for future use, (4) Building envelope and mechanical installation details and installation guides, (5) Performance-based incentives for construction team, (6) Self-verification requirements for construction team
Green Globes	3.1.1 Integrated Design Process (9 points)	(1) Kick-off meeting, (2) Qualitative and quantitative design goals, (3) Progress meetings



INTEGRATIVE PROCESS – BENEFITS



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

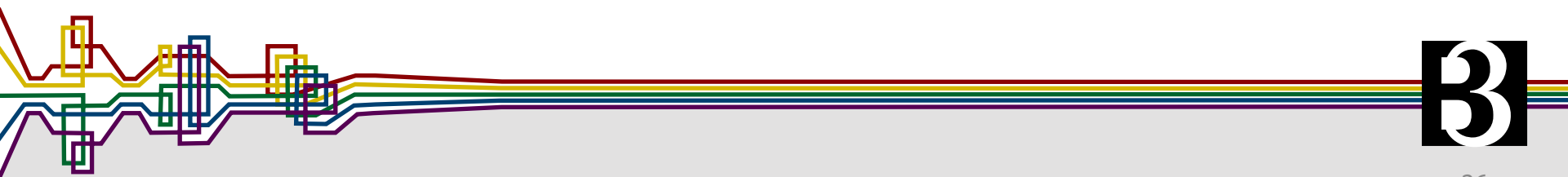


Several of the characteristics of an integrative process are integral to the design of the SB 2030 program, such as:

- Setting measureable targets
- Re-evaluating targets at key phases
- Performing early energy modeling

Additionally, using an integrative process makes it easier to meet SB 2030 Energy Standards.

- Engage in iterative process of research and analysis, group workshops, design, and evaluation of design relative to project goals.
- Leverage the relationships between systems to improve whole building efficiency.



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DESIGN

1. Determine the average energy use for comparable buildings
2. Calculate the SB 2030 Energy Standard
3. Optimize energy use
 - Implement energy reduction strategies
 - Evaluate strategy bundles through energy modeling
4. Evaluate the use of low carbon energy sources

Use findings to inform
future projects

OPERATIONS

1. Perform commissioning
2. Track actual performance using B3 Benchmarking
3. Ensure energy-efficient operations



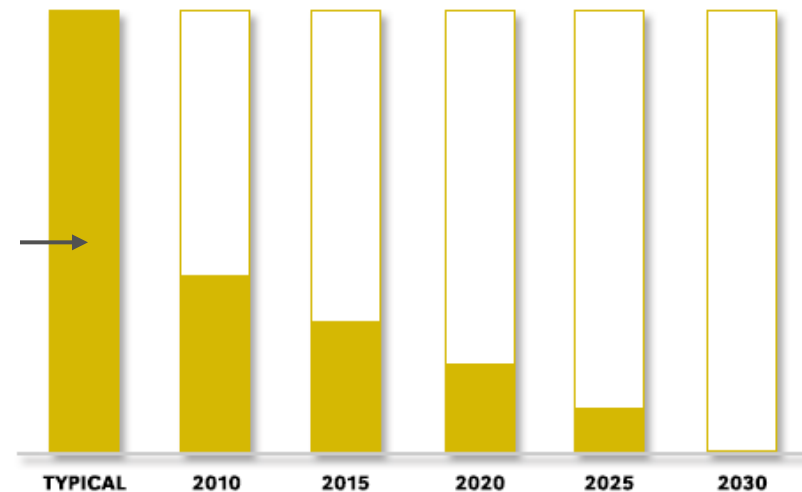
USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE

SB 2030 ENERGY STANDARD
OPTIMIZE ENERGY USE
OPTIMIZE ENERGY SOURCES
PERFORM COMMISSIONING
TRACK PERFORMANCE
ENSURE ENERGY-EFFICIENT
OPERATIONS

- Determining the average building energy use intensity (EUI) provides a standardized value of comparison for measurement and analysis. The “average building” may be based on other buildings within the region or on national averages.
- For SB 2030, the average building EUI sets the starting point for energy and CO₂ reduction against which each subsequent Energy Standard is calculated.

AVERAGE
BUILDING USE



SB 2030 Energy Standard
Building Energy Consumption from Carbon Producing Fuel

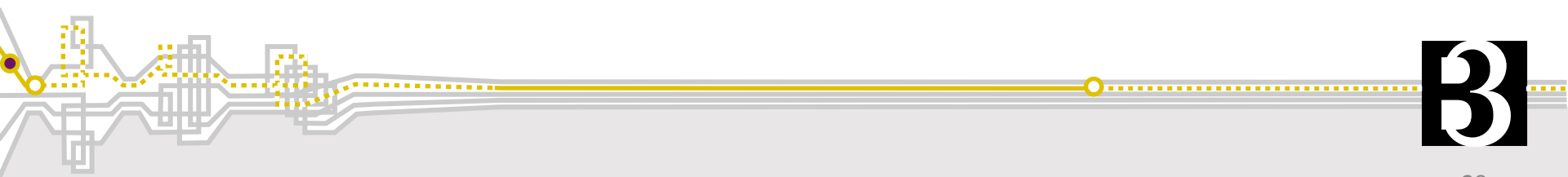
USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE

SB 2030 ENERGY STANDARD
OPTIMIZE ENERGY USE
OPTIMIZE ENERGY SOURCES
PERFORM COMMISSIONING
TRACK PERFORMANCE
ENSURE ENERGY-EFFICIENT
OPERATIONS

The calculation of the average building EUI for SB 2030 prioritized the following characteristics:

- Easy to use and understand
- Accurate for Minnesota's climate
- Consistent methodology
- Comprehensive – applicable to all building types
- Specific to each building's program and use



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE

SB 2030 ENERGY STANDARD
OPTIMIZE ENERGY USE
OPTIMIZE ENERGY SOURCES
PERFORM COMMISSIONING
TRACK PERFORMANCE
ENSURE ENERGY-EFFICIENT
OPERATIONS

BUILDING-SPECIFIC AVERAGE EUI

The SB 2030 team created a web-based calculation tool that allows project designers to either use “default” building characteristics or define “customized” characteristics based on their unique building program elements.

Editable building characteristics include:

- Building location
- Building gross floor area
- Building type(s)
- Number of floors
- Space type, floor area %, and hours of use
- Fuel source types for building

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE

SB 2030 ENERGY STANDARD

OPTIMIZE ENERGY USE

OPTIMIZE ENERGY SOURCES

PERFORM COMMISSIONING

TRACK PERFORMANCE

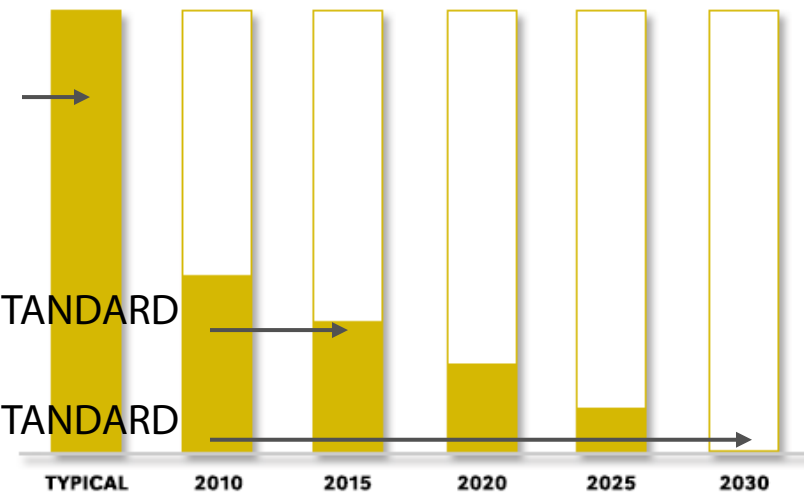
ENSURE ENERGY-EFFICIENT
OPERATIONS

- The SB 2030 Energy Standard is the energy target that must be achieved.
- Through 2029, the SB 2030 Energy Standard is a percentage reduction from the average building use, dropping by 10% every 5 years. For projects that start Schematic Design after January 1, 2015, the SB 2030 Energy Standard is a 70% reduction.
- In 2030, this switches from a relative target to an absolute target of 0 kBtu/sf from carbon producing fuel.

AVERAGE
BUILDING USE

2015 ENERGY STANDARD
(70% reduction)

2030 ENERGY STANDARD
(0 kBtu/sf)



SB 2030 Energy Standard
Building Energy Consumption from Carbon Producing Fuel

Step 1: Introduction

Welcome to the latest version of the SB 2030 Energy Standards Tool developed to create a custom project specific Energy Use Intensity (EUI) Standard for commercial and institutional buildings in the State of Minnesota.

What it does

The tool will identify the absolute energy performance consumption goal that new and renovated building projects are required to achieve using the B3 Energy Guidelines. The SB 2030 EUI Standard is expressed in units of kBtu/ft²/year of site energy consumption.

How it works

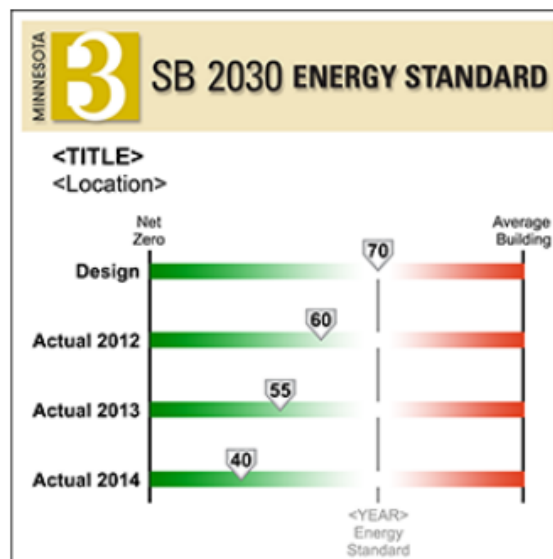
Project design professionals select and enter specific building characteristics based on their projects custom building program, operational characteristics, non-regulated energy code requirements, and building location. A web service then conducts an energy simulation based on the user's entry and calculates the required SB 2030 Standard EUI the owner and design team is required to achieve for their project.

How to use the results

The SB 2030 EUI Standard displayed on the Results page is entered by the user into the B3 Energy Guidelines tool to compare the proposed design energy consumption EUI.

To learn more about the Tools features and process, review the Information Document by clicking the information link at the bottom of the screen.

To use the import tool click on the following link: [Import Tool](#)



Step 2: Project Characteristics

Project Name *

Project Organization *

Project City *

Building Area Types ☐ 1 ☒ 2 ☐ 3

	1	2
Building Area Type	<input type="text" value="Office"/>	<input type="text" value="Retail"/>
Gross Floor Area *	<input type="text" value="100,000"/>	<input type="text" value="30,000"/>
Number of Floors *	<input type="text" value="1"/>	<input type="text" value="1"/>
Construction	<input type="text" value="New"/>	<input type="text" value="New"/>
Heating	<input checked="" type="radio"/> non-District <input type="radio"/> District	<input checked="" type="radio"/> non-District <input type="radio"/> District
Cooling	<input checked="" type="radio"/> non-District <input type="radio"/> District	<input checked="" type="radio"/> non-District <input type="radio"/> District
	<input type="button" value="Edit Characteristics"/>	<input type="button" value="Edit Characteristics"/>
	<input type="button" value="Edit Space Types"/>	<input type="button" value="Edit Space Types"/>

Step 2: Project Characteristics

Project Name: Sample Building



Space Types

Building area type: 1 - Office

Allocated: 100,000
Total building: 100,000

Allocation is OK

Space Type ▲	Floor Area ft ² ▼	Floor Area %		Person ft ²	Plug W/ft ²	Vent Rate CFM/ft ²	Light Hours %	Plug Hours %	Process Hours %	People Hours %
Open Office	35,000	35.0	Edit	200	1.2	0.08	66.1	49.4	49.4	25.0
Enclosed Office	25,000	25.0	Edit	150	1.2	0.09	50.7	49.4	49.4	24.3
Circulation	18,000	18.0	Edit	400	0.1	0.06	53.1	53.1	53.1	18.2
Mechanical Electrical Room	6,000	6.0	Edit	400	0.2	0.12	41.0	46.6	46.6	11.7
Storage	5,000	5.0	Edit	400	0.1	0.12	48.3	48.3	48.3	18.2
Medium Conference Room	4,000	4.0	Edit	20	1.0	0.31	45.6	41.3	41.3	19.5
Data Center	2,000	2.0	Edit	200	12.0	0.17	50.7	100.0	100.0	24.3
Lobby	2,000	2.0	Edit	100	0.3	0.11	62.0	62.0	53.1	18.2

Ok

Cancel

Project Name: Sample Building

Space Type: Open Office

Characteristics

Schedules

Non-regulated Code Space Type Characteristics

Loads

Plug Loads w / ft²

Process Loads BTU / hr / ft²

Sensible heat load to space %

Latent heat load to space %

Fuel Source
☒ Natural Gas
☐ Electricity
☐ Hot Water
☐ Other (non-utility) fuel

People

Max Density ft² / person

Sensible Heat Gain BTU / hr / person

Latent Heat Gain BTU / hr / person

Conditioning Type

Heating and Cooling

Ventilation Requirements

☒ People Requirement CFM / person
Addl Space Vent. Requirement
(ASHRAE 62 requirement) CFM / ft²

☐ Min. Air Changes
Unoccupied (0%) / hr
Occupied (>0%) / hr

Thermostat Settings

Occupied - deg F
Unoccupied - deg F

Humidity Control

☐ Maximum %
☐ Minimum %

OK

Cancel

Project Name: Sample Building

Space Type: Open Office

Characteristics

Schedules

Season:

Regular (Default)

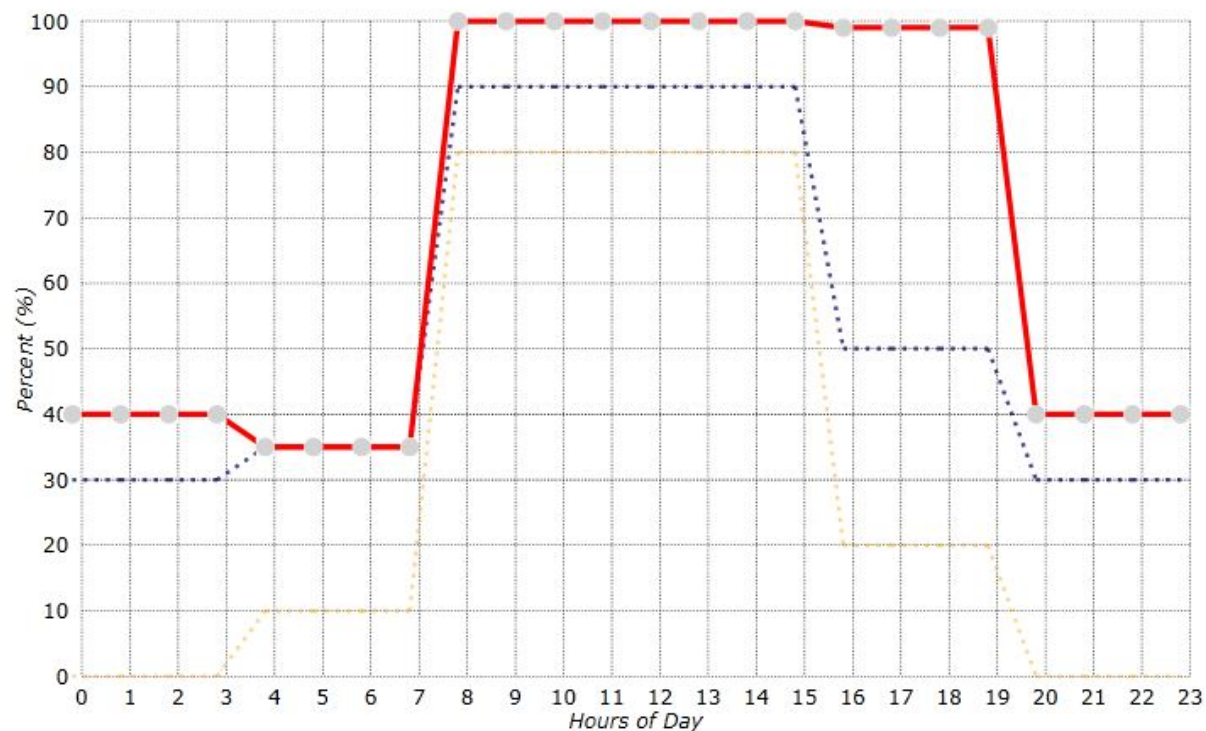
New

Edit

Delete

Weekday

Weekend/Holiday



Select All

Unselect All

Occupancy

Lighting

Plug Load

Process Load

OK

Cancel

Step 2: Project Characteristics

Project Name  Sample Building

Project Organization  Sample Organization

Project City  Minneapolis

Building Area Types ☐ 1 ☒ 2 ☐ 3

Building Area Type

Office

Gross Floor Area 

100,000

Number of Floors 

1

Construction

New

Heating

☒ non-District ☐ District

Cooling

☒ non-District ☐ District

Edit Characteristics

Edit Space Types

2

Retail

30,000

1

New

☒ non-District ☐ District

Edit Characteristics

Edit Space Types

Running Simulation..

Step 3: Results

Project Name: Sample Building

Organization: Sample Organization

Location: Minneapolis

Building Areas:	1	2
Type:	Office	Retail
Floor Area ft ² :	100,000	30,000
Floors:	1	1
Construction:	New	New
Heating:	Non-District	Non-District
Cooling:	Non-District	Non-District

Annual SB 2030 Energy Standard: **60** kBTU/ft²/yr

Annual SB 2030 CO₂: **22** lbs CO₂/ft²/yr

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE

SB 2030 ENERGY STANDARD

OPTIMIZE ENERGY USE

OPTIMIZE ENERGY SOURCES

PERFORM COMMISSIONING

TRACK PERFORMANCE

ENSURE ENERGY-EFFICIENT
OPERATIONS

SB 2030 PROCESS

Refine SB 2030 Energy Standard as building design develops.

PREDESIGN:

- Calculate SB 2030 Energy Standard using default inputs.

SCHEMATIC DESIGN:

- Recalculate SB 2030 Energy Standard using building-specific space use areas.
- Simulate design model energy consumption and compare to SB 2030 Energy Standard (must be within 15%).

DESIGN DEVELOPMENT AND CONSTRUCTION DOCUMENTS:

- Recalculate SB 2030 Energy Standard using building-specific space use areas, fuel types, occupant loads, schedules, and settings.
- Simulate design model energy consumption and compare to SB 2030 Energy Standard (must be within 10% during Design Development and 5% during Construction Documents).

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE

SB 2030 ENERGY STANDARD

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TRACK PERFORMANCE

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OPERATIONS

ALTERNATIVE PATH METHOD

- The Alternative Path Method can be used if the building cannot meet the SB 2030 Energy Standard cost-effectively (i.e. within a 15 year simple payback)
- This path must be applied for at the end of Schematic Design
- The Alternative Path Method will produce a SB 2030 Adjusted Energy Standard based on cost effectiveness
 - All reasonable energy conservation strategies with less than 15 year simple payback will be consider in establishing the Adjusted Energy Standard
 - Strategies will be considered as individual strategies not as bundled strategies for paybacks

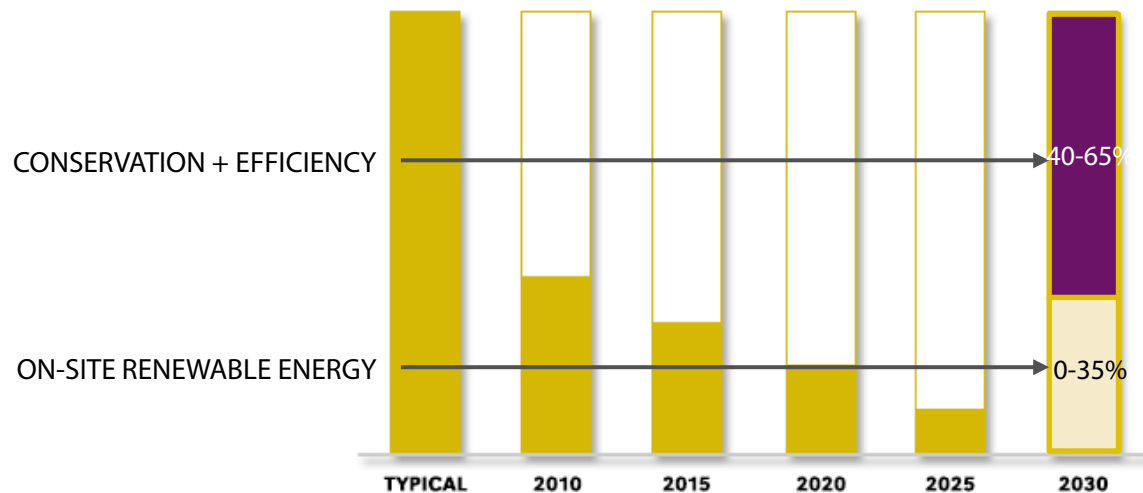
USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE
SB 2030 ENERGY STANDARD
OPTIMIZE ENERGY USE
OPTIMIZE ENERGY SOURCES
PERFORM COMMISSIONING
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OPERATIONS

ITERATIVE PROCESS

- Select energy reduction strategies
- Evaluate strategy bundles through energy modeling

RULES OF THUMB



SB 2030 Energy Standard
Building Energy Consumption from Carbon Producing Fuel

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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SB 2030 ENERGY STANDARD

OPTIMIZE ENERGY USE

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IMPACT OF DIFFERENT DECISIONS ON ENERGY USE

Building design fixes the load	Efficient systems meet the load	Energy sources to fuel systems	People run the systems
Building shape Building volume Glass location Glass area & type Insulation values Thermal mass Lighting concept Mechanical concept	Envelope Daylighting Lighting HVAC Controls District heating Domestic hot water	Wood Sun-active heat Sun-photovoltaics Wind generation Solar electricity Gas co-gen Micro turbines Fuel cells	Schedules Controls Maintenance Setpoints Windows Equipment Education Ongoing M&V
10% - 20%	15% - 40%	1% - 5%	10% - 20%
Minimize load as a first priority	Use simple, cost-effective systems	Use appropriate sources of energy	Operate the building well

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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SB 2030 ENERGY STANDARD

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OPERATIONS

EARLY ENERGY REDUCTION STRATEGIES

- Building shape & volume
- Building orientation
- Glass location & area
- Properties of components
 - Insulation (R-values)
 - Walls
 - Floor
 - Roof
 - Glazing
 - U-Factor
 - Visible Light Transmission
 - Solar Heat Gain Coefficient



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

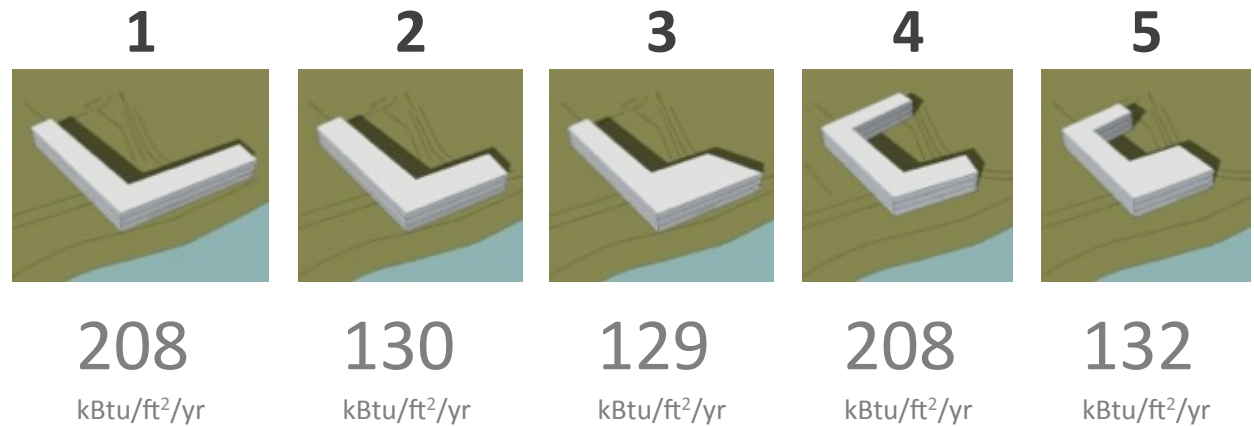
DETERMINE AVERAGE USE
SB 2030 ENERGY STANDARD

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OPERATIONS

EARLY ENERGY MODELING TOOLS (MODEL-BASED)

- IES-VE
- Autodesk:
 - Green Building Studio
- Sefaira



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE
SB 2030 ENERGY STANDARD

OPTIMIZE ENERGY USE

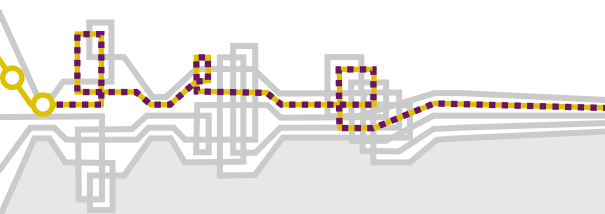
OPTIMIZE ENERGY SOURCES
PERFORM COMMISSIONING
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ENSURE ENERGY-EFFICIENT
OPERATIONS

FINAL ENERGY MODELING TOOLS

While early energy modeling is essential for meeting the aggressive SB 2030 Energy Standards, more accurate energy models are required during the Construction Documents phase to verify compliance with SB 2030.

Accepted energy models must use hourly data and be based on DOE 2.1 or later, such as:

- e-Quest
- TRACE 700
- Third party DOE 2.1 or 2.2-based simulations



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

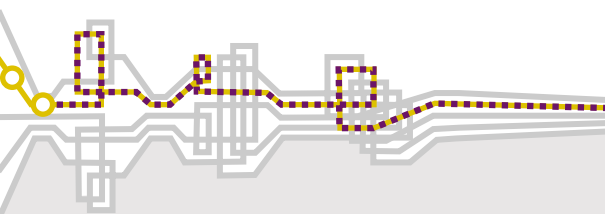
DETERMINE AVERAGE USE
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ENERGY DESIGN ASSISTANCE (EDA) – XCEL ENERGY

- Free energy consulting services and predictive energy modeling
- Includes goal-setting meetings, massing studies, daylighting analysis, HVAC analysis
- Construction rebates
- Design team reimbursement
- Measurement and verification: construction document review, onsite walk-through, data logging
- Additional analysis available for B3 projects (EDA Enhanced process), starting in Predesign or early Schematic Design phase



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE

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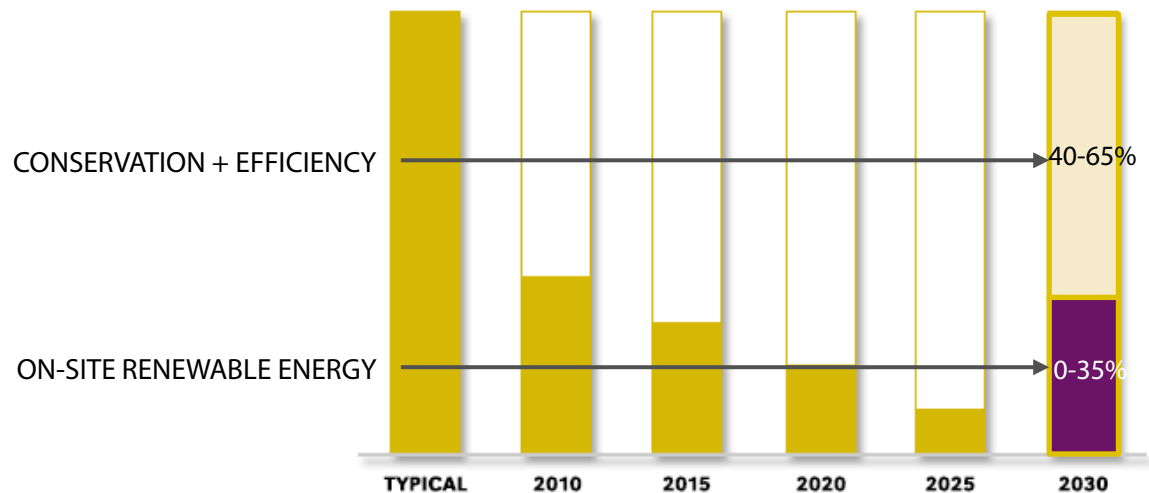
PERFORM COMMISSIONING

TRACK PERFORMANCE

ENSURE ENERGY-EFFICIENT
OPERATIONS

EVALUATE RENEWABLE ENERGY SOURCES

- Renewable energy resources in the United States
- On-site renewable energy



SB 2030 Energy Standard

Building Energy Consumption from Carbon Producing Fuel

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

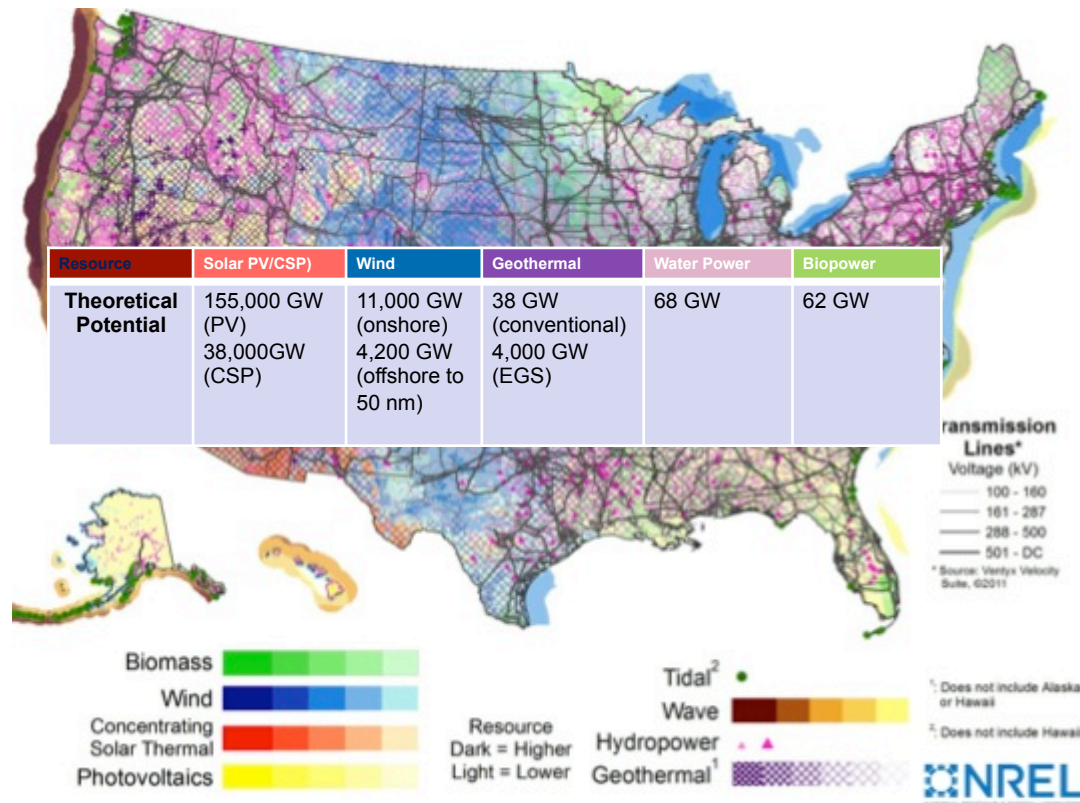
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RENEWABLE ENERGY IN THE UNITED STATES

The generation potential of renewable energy in the United States far exceeds the demand.



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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SB 2030 ENERGY STANDARD

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OPERATIONS

ON-SITE RENEWABLE ENERGY

- Determine whether the site is suited to low/no carbon energy sources such as solar, geothermal, or wind.
- Evaluate how renewable energy sources can be leveraged to optimize the relationships between systems.
- Investigate economic incentives that will help minimize the life cycle costs. <http://dsireusa.org/incentives/>



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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COMMISSIONING

Commissioning provides verification that the building's subsystems are correctly installed and operating to achieve the owner's project requirements.

- HVAC
- Plumbing
- Electrical
- Fire/life safety
- Building envelope
- Interior systems
- Sustainable systems
- Lighting
- Wastewater
- Controls
- Building security

The B3 guidelines require design and construction commissioning.

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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- **MISCOMMUNICATION:** Steam line was medium pressure but the installed valve was designed for low pressure steam
- **RESULT:** Over humidification, wasted steam, and water damage to the floor below



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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SB 2030 ENERGY STANDARD
OPTIMIZE ENERGY USE
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TRACK PERFORMANCE

ENSURE ENERGY-EFFICIENT
OPERATIONS

Tracking actual performance is essential to ensure that energy targets are being met and to identify opportunities for savings. SB 2030 projects are required to do this using B3 Benchmarking.

PERFORMANCE TRACKING TOOLS

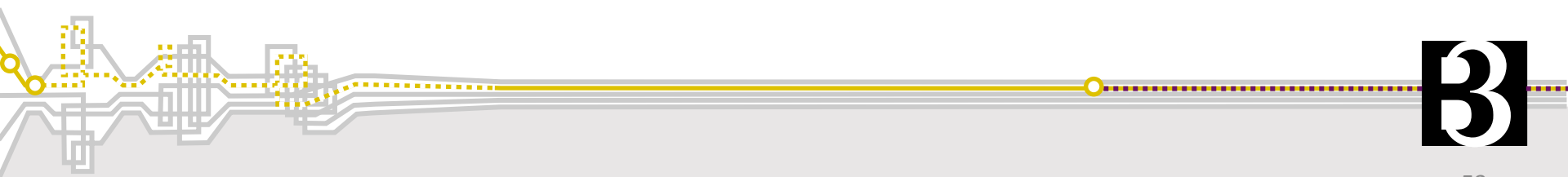
Tool	Scope	Cost	Data Source	Comparisons
B3 Benchmarking	Minnesota	Free for public buildings	Utility Bills (monthly)	Benchmark, similar buildings, previous use (baseline), Energy Star buildings, and targets
Energy Star Portfolio Manager	Nation	Free	Utility Bills (monthly)	Benchmark, similar buildings, previous use (baseline), Energy Star buildings, and targets
Energy Print	Nation	Varies	Utility Bills (monthly)	Benchmark, similar buildings, previous use (baseline), Energy Star buildings, and targets
Lucid	World	Varies	Smart Meters (real-time)	Other buildings (in defined community), previous use (baseline), and targets

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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USE OF B3 BENCHMARKING TOOL

1. Define building and meters
2. Set the design model consumption goal by month
3. Enter actual monthly consumption by metered fuel type
4. Compare design goal to actual consumption
5. Investigate building systems and operational assumptions if actual energy consumption is higher than the design goal



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

1. Define building and meters.

The screenshot displays the 3 BENCHMARKING software interface. The top navigation bar includes a search bar with 'silver creek' entered, a sidebar with 'Other, Minnesota Housing Part' and 'MHFA Silver Creek Corner', and a top right area with 'Logged in as Katie Schmitt', 'Energy Mode', 'Water Mode', and 'Meter Search' buttons. The main content area is titled 'Minnesota Housing Partnership MHFA Silver Creek Corner' with address '21xx Silver Creek Road Rochester, MN 55904' and 'Multi Family Housing 22,291 SF'. Below this are tabs for 'SUMMARY', 'BENCHMARK', 'PEER COMPARISON', 'ENERGY STAR', 'BASELINE', 'REPORTS', and 'IMPROVEMENTS'. The 'SUMMARY' tab is active, showing four key metrics: 'B3 Benchmark' (4 stars), 'B3 Peer Rating' (6%), 'ENERGY STAR Score' (Pending), and 'Baseline' (9.62%). It also displays 'Meter Data Current To 12/31/2013' and 'Contiguous Months 25'. A 'Buildings' section lists 'MHFA Silver Creek Corner' as 'Multi Family Housing' with '22,291 SF' and 'Occupied 10/24/2011'. A 'Meters (3 meters)' section contains a table with three entries: 'Elec Meter one', 'Propane one', and 'Steam Meter one'.

Meter Name	Status	Type	Utility Company	Meter #	Account #	First Rdg	Last Rdg
Elec Meter one	✓	Electric	Olmsted Waste to Energy	2125 - elec		11/1/2011	12/31/2013
Propane one	✓	Propane	(Unknown)		Silver Creek	10/24/2011	2/3/2014
Steam Meter one	✓	Steam/Hot Water	Olmsted Waste to Energy	2125 - steam		12/1/2011	12/31/2013

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

2. Set the design model consumption goal by month

The screenshot displays the B3 Benchmarking web application. The top navigation bar includes the '3 BENCHMARKING' logo, a search bar with 'silver creek' entered, and user information 'Logged in as Katie Schmitt'. Mode selectors for 'Energy Mode', 'Water Mode', and 'Meter Search' are present. The left sidebar shows a tree view with 'silver creek' and 'Other, Minnesota Housing Part'. The main content area is for 'Minnesota Housing Partnership MHFA Silver Creek Corner', located at '21xx Silver Creek Road, Rochester, MN 55904'. It features a tabbed interface with 'SUMMARY', 'BENCHMARK', 'PEER COMPARISON', 'ENERGY STAR', 'BASELINE', 'REPORTS', and 'IMPROVEMENTS'. The 'BENCHMARK' tab is active, showing a 'Targets' section with a table for setting goals. The table has columns for 'Name', 'Scope', and 'Fuel Sources/Units'. A row is pre-filled with 'Design Mode', 'Other, Minnesota Housing Partnership (MH)', and 'Electric (kWh), Steam'. Below the table are checkboxes for 'Show All Targets' and 'Add New Target'. To the right, the 'Improvement Programs' section is currently empty. At the bottom, there are two placeholder boxes for 'Archived Energy Audits' and 'B3 Benchmarking Quarterly Statement', both marked as 'Coming soon.'.

3 BENCHMARKING

Logged in as Katie Schmitt

Energy Mode Water Mode Meter Search

silver creek

Other, Minnesota Housing Part

MHFA Silver Creek Corner

Minnesota Housing Partnership
MHFA Silver Creek Corner
21xx Silver Creek Road
Rochester, MN 55904

SUMMARY BENCHMARK PEER COMPARISON ENERGY STAR BASELINE REPORTS IMPROVEMENTS

Targets
Create goals and monitor progress for a site or organization.

Name	Scope	Fuel Sources/Units
Design Mode	Other, Minnesota Housing Partnership (MH)	Electric (kWh), Steam

☐ Show All Targets

Improvement Programs
Participate in an energy improvement program for greater motivation and support in realizing your site energy performance goals. Coming soon.

Archived Energy Audits
Keep track of physical building assessments in one location. Coming soon.

B3 Benchmarking Quarterly Statement
Just like a bank statement, this report provides a quarterly snapshot of site energy performance. Coming soon.

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

2. Set the design model consumption goal by month

Target Editor

Step 1. Target General Info

Specify general info about the target you would like

Target Name

SB 2030 Target

Description

Design model monthly energy consumption

Target Type

☒ Relative Target

A relative target allows you to track your performance against a baseline.
Example - I want to improve my energy consumption

☒ Absolute Target

An absolute target lets you enter monthly energy consumption values.
Example - I want to compare the actual consumption to a target

Purpose of Target (Optional)

☐ Recommissioning Improvement

☐ Retrofit Improvement

☒ Expected New Building Performance

☐ High Level Organization Goal

☐ High Level Site Goal

Cancel

Target Editor

Step 2. Energy Source Type

Specify the fuel sources and unit types you wish to include

☒ Electric (kWh)

☐ Electric Renewable (kWh)

☐ Natural Gas (Therms)

☒ Steam/Hot Water (ThousandPounds)

☐ Chilled Water (TonHours)

☒ Propane (Gallons)

☐ Fuel Oil (Gallons)

☐ Wood (Tons)

Cancel

Target Editor

Step 3. Target Consumption

Enter the absolute target consumption you have calculated/simulated.

	Electric (kWh)	Steam/Hot Water (ThousandPounds)	Propane (Gallons)
January	23,279	98	48
February	20,097	87	43
March	18,905	72	47
April	15,621	38	46
May	15,825	21	48
June	17,459	12	46
July	19,292	11	48
August	18,374	12	48
September	15,549	20	46
October	15,200	31	48
November	16,619	56	46
December	22,309	92	48

Cancel

Prev

Next

Finish

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

3. Enter actual monthly consumption by metered fuel type.

Electric Meter Editor

Meter Name:

Meter Services:

Utility Company:

Emissions: CO2: 1722.67 lbs/MWh | CH4: 0.029 lbs/MWh | N2O: 0.029 lbs/MWh

Account #:

Meter #: Premise #:

Connection Date: Disconnection:

Meter is connected to: ☒ MHFA Silver Creek Corner

Comments:

Meter Readings (Bills)

Start Date	End Date	Consumption (kWh)	Peak KW Demand	Demand Charge	Total \$	\$ Per Unit	Consumption
11/1/2011	11/30/2011	20,160.00	0.00	\$0.00	\$1,982.85	\$0.098	
11/30/2011	12/31/2011	28,160.00	0.00	\$0.00	\$2,769.70	\$0.098	
12/31/2011	1/31/2012	24,000.00	0.00	\$0.00	\$2,360.10	\$0.098	
1/31/2012	2/28/2012	24,800.00	0.00	\$0.00	\$2,439.22	\$0.098	
2/28/2012	3/31/2012	24,160.00	0.00	\$0.00	\$2,376.27	\$0.098	
3/31/2012	4/30/2012	23,200.00	0.00	\$0.00	\$2,281.85	\$0.098	
4/30/2012	5/31/2012	22,240.00	0.00	\$0.00	\$2,187.42	\$0.098	
5/31/2012	6/30/2012	25,920.00	0.00	\$0.00	\$3,136.62	\$0.121	
6/30/2012	7/31/2012	26,880.00	0.00	\$0.00	\$3,252.80	\$0.121	
7/31/2012	8/31/2012	26,400.00	0.00	\$0.00	\$3,194.71	\$0.121	

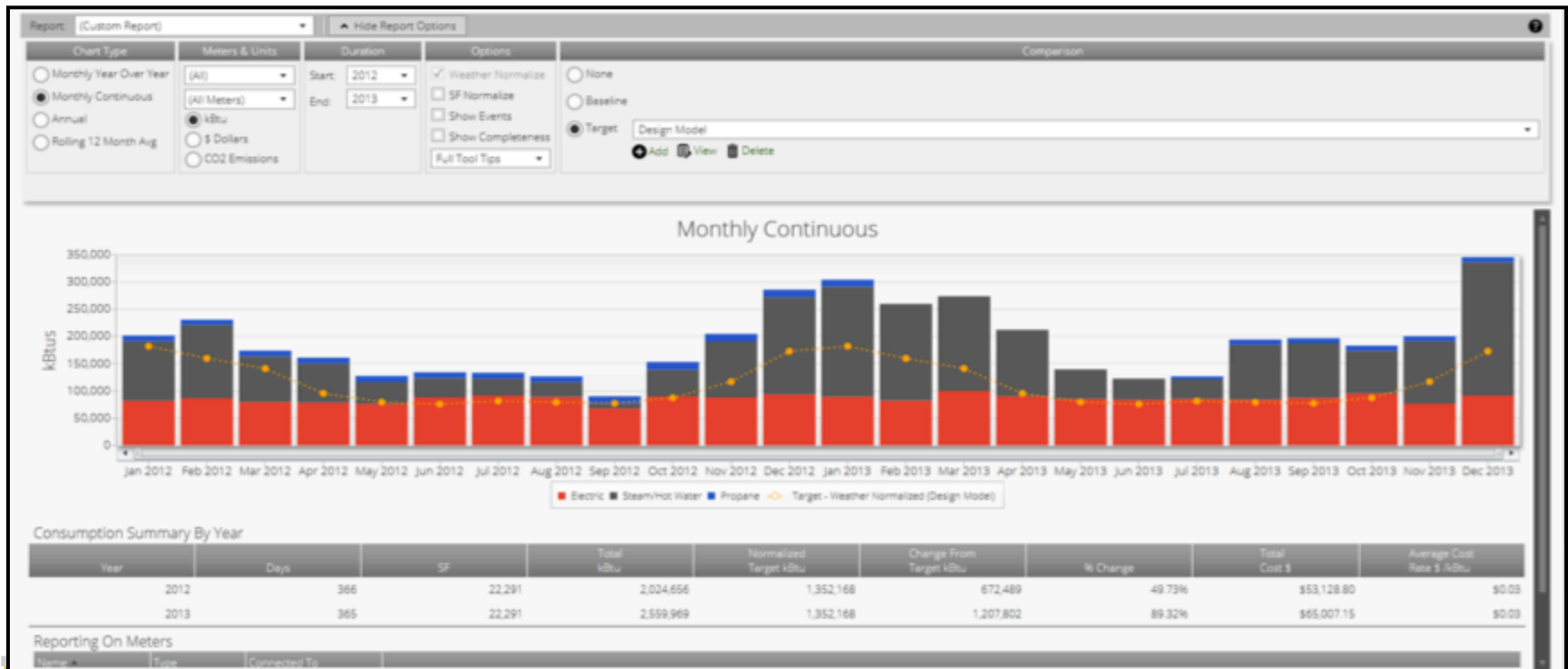
+ Add New Reading Re-sort Readings

Meter readings should be contiguous, with each start date matching the prior end date. You may enter new readings in any order.

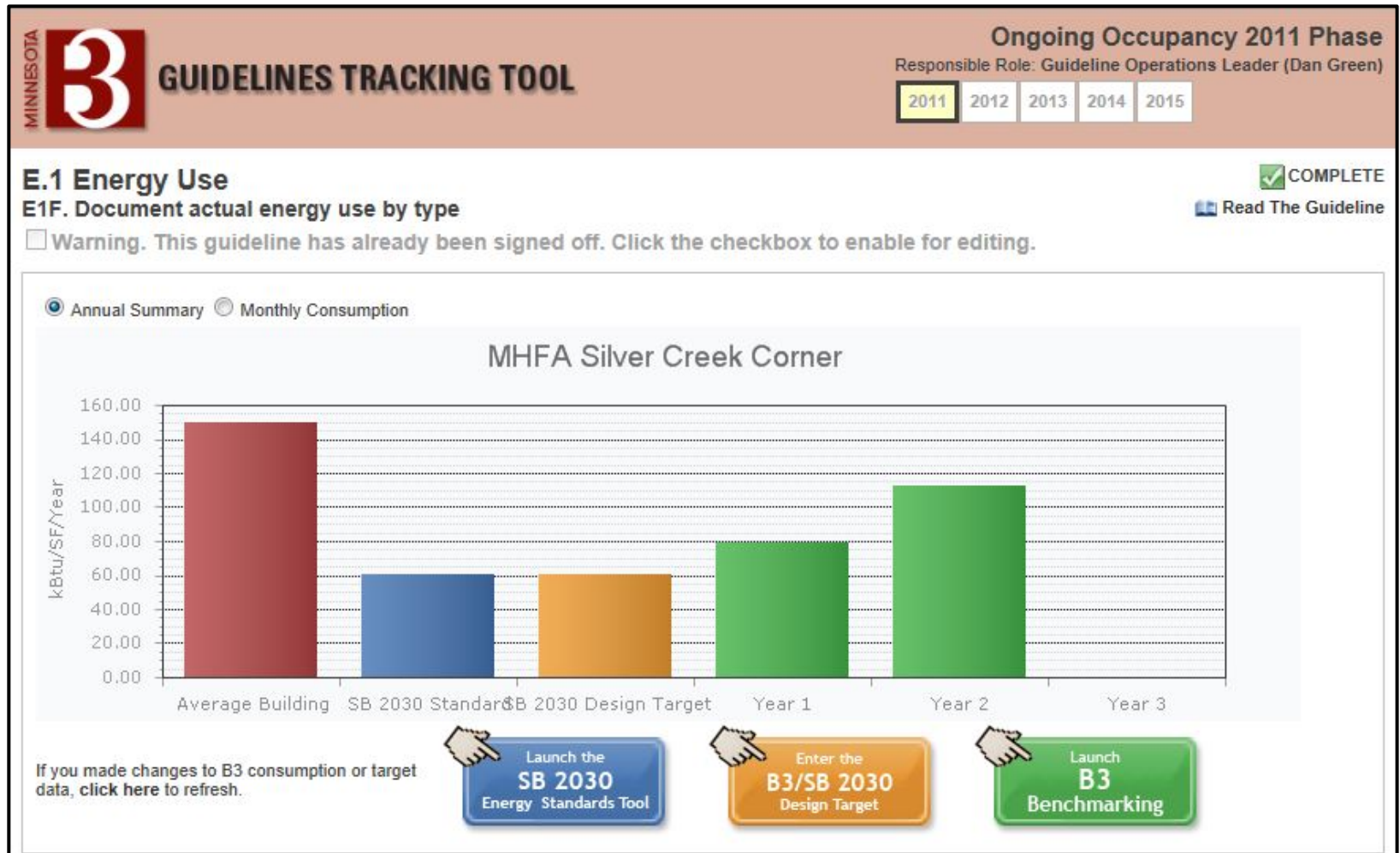
Save Cancel

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

4. Compare design goal to actual consumption.
5. Investigate building systems and operational assumptions if actual consumption is higher than design goal.



USING AN INTEGRATIVE PROCESS TO MEET SB 2030



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE
SB 2030 ENERGY STANDARD
OPTIMIZE ENERGY USE
OPTIMIZE ENERGY SOURCES
PERFORM COMMISSIONING
TRACK PERFORMANCE

**ENSURE ENERGY-EFFICIENT
OPERATIONS**

PROBLEM PREVENTION & PROBLEM-SOLVING

B3 projects are required to:

- Develop an Operations Management Plan that includes:
 - Systems turnover process (from Construction to Operations)
 - Operations and Maintenance Manuals
 - Problem Response Plan
 - Maintenance Plan
 - Measurement and Verification Plan
 - Systems Operations Manual
 - Funding and Staffing Plan
- Implement Operations and Maintenance Practices
- Annually review and update Operations Management Plan

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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OPERATIONS**

EXISTING BUILDING COMMISSIONING

A systematic process for identifying opportunities to optimize performance in existing buildings.

- **RETRO-COMMISSIONING:** commissioning an existing building to resolve problems and enhance building performance
- **RE-COMMISSIONING:** commissioning a building that has already been commissioned to ensure continued operational efficiency

RESEARCH & DOCUMENT

- Facility use and hours
- Systems
- Known deficiencies
- Historical utility usage and costs

INVESTIGATE

- Inspect systems and current operation
- Trend systems
- Measure key operational data points

ANALYZE

- Review trending data for anomalies
- Calculate potential savings
- Calculate potential costs

RECOMMEND

- Provide owner documented ECOs with estimated payback
- Provide owner list of any non-energy saving recommendations found during study

VERIFY

- Proposed addition to our scope 2014
- Verify which ECOs were implemented
- Review actual energy savings a year post implementation

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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**ENSURE ENERGY-EFFICIENT
OPERATIONS**

HOBO DATA LOGGER

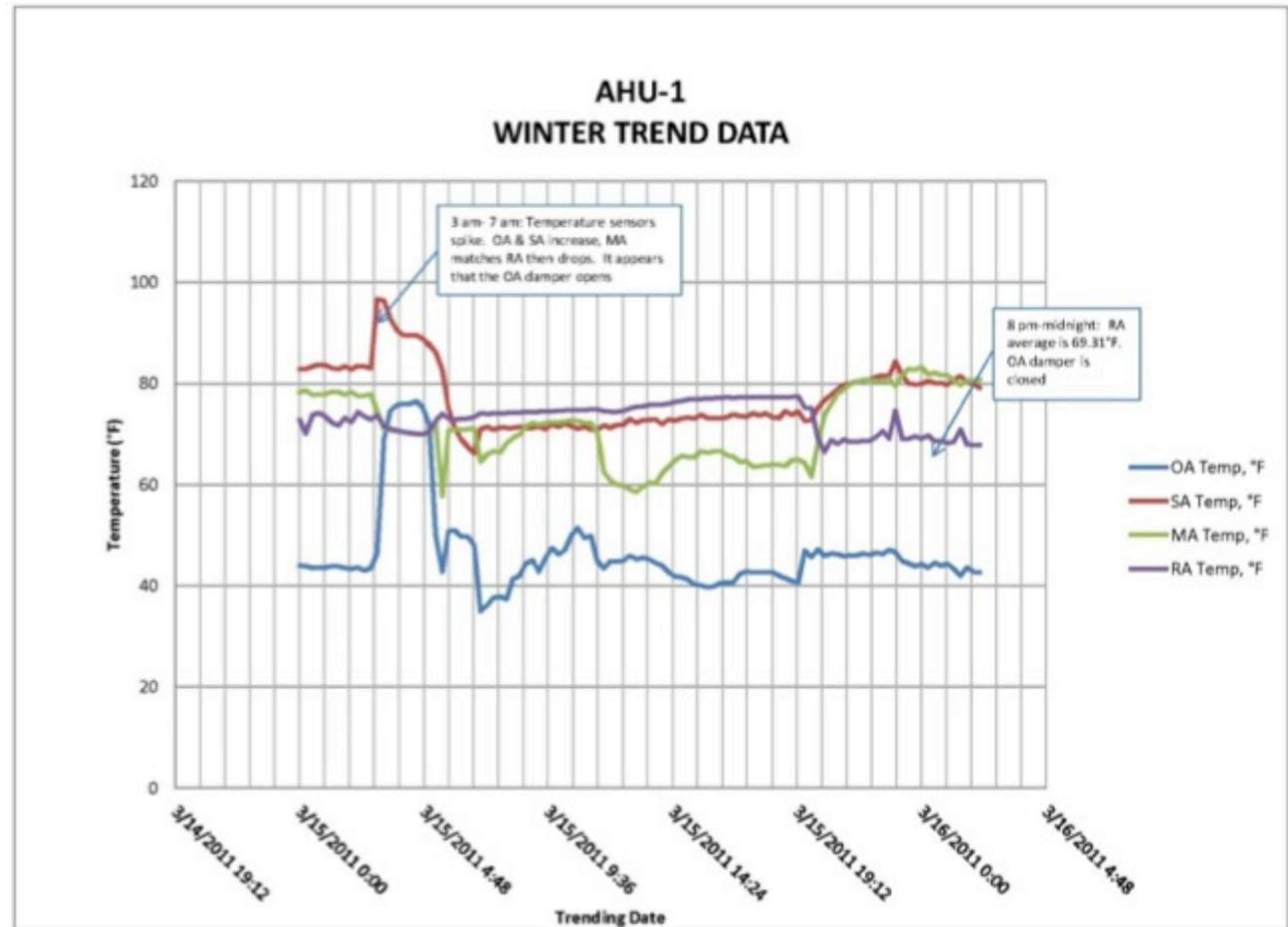
- Measures space temperature, humidity, and light intensity every 15 minutes for two weeks
- Place in spaces of concern & review data



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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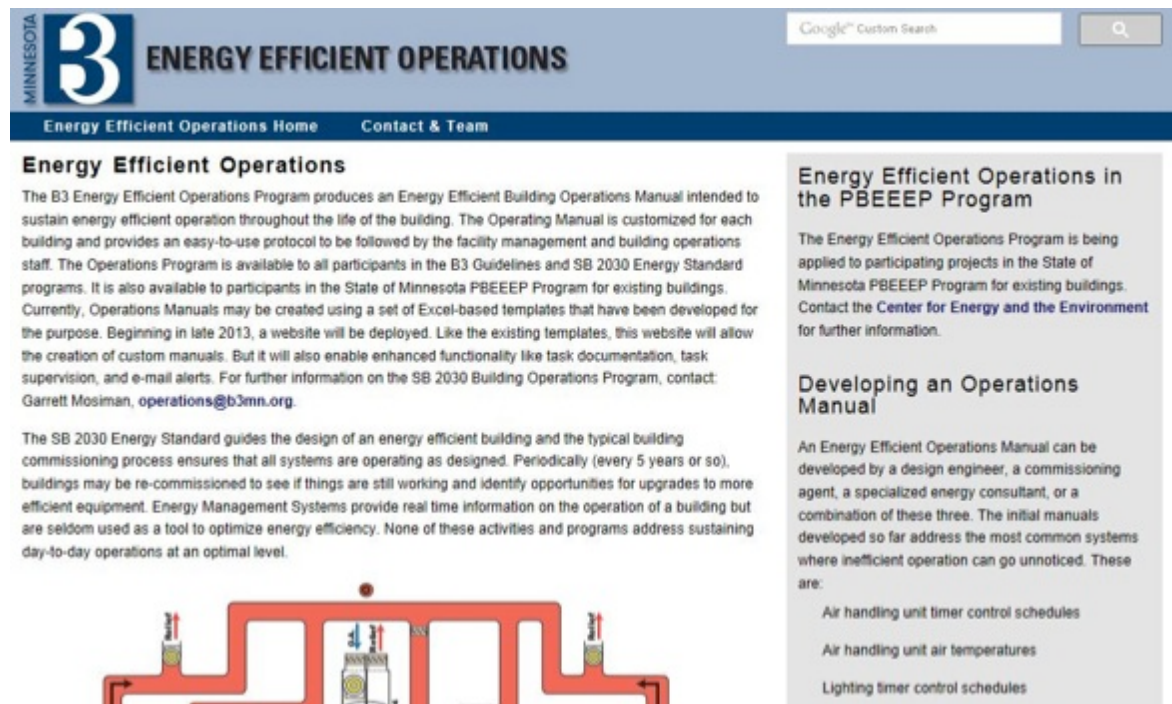
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**ENSURE ENERGY-EFFICIENT
OPERATIONS**

B3 ENERGY EFFICIENT OPERATIONS

Follow a Building Operations Manual to manage and reduce energy use



Energy Efficient Operations

The B3 Energy Efficient Operations Program produces an Energy Efficient Building Operations Manual intended to sustain energy efficient operation throughout the life of the building. The Operating Manual is customized for each building and provides an easy-to-use protocol to be followed by the facility management and building operations staff. The Operations Program is available to all participants in the B3 Guidelines and SB 2030 Energy Standard programs. It is also available to participants in the State of Minnesota PBEEP Program for existing buildings. Currently, Operations Manuals may be created using a set of Excel-based templates that have been developed for the purpose. Beginning in late 2013, a website will be deployed. Like the existing templates, this website will allow the creation of custom manuals. But it will also enable enhanced functionality like task documentation, task supervision, and e-mail alerts. For further information on the SB 2030 Building Operations Program, contact: Garrett Mosiman, operations@b3mn.org.

The SB 2030 Energy Standard guides the design of an energy efficient building and the typical building commissioning process ensures that all systems are operating as designed. Periodically (every 5 years or so), buildings may be re-commissioned to see if things are still working and identify opportunities for upgrades to more efficient equipment. Energy Management Systems provide real time information on the operation of a building but are seldom used as a tool to optimize energy efficiency. None of these activities and programs address sustaining day-to-day operations at an optimal level.

Energy Efficient Operations in the PBEEP Program

The Energy Efficient Operations Program is being applied to participating projects in the State of Minnesota PBEEP Program for existing buildings. Contact the [Center for Energy and the Environment](#) for further information.

Developing an Operations Manual

An Energy Efficient Operations Manual can be developed by a design engineer, a commissioning agent, a specialized energy consultant, or a combination of these three. The initial manuals developed so far address the most common systems where inefficient operation can go unnoticed. These are:

- Air handling unit timer control schedules
- Air handling unit air temperatures
- Lighting timer control schedules

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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SB 2030 ENERGY STANDARD
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**ENSURE ENERGY-EFFICIENT
OPERATIONS**

B3 ENERGY EFFICIENT OPERATIONS

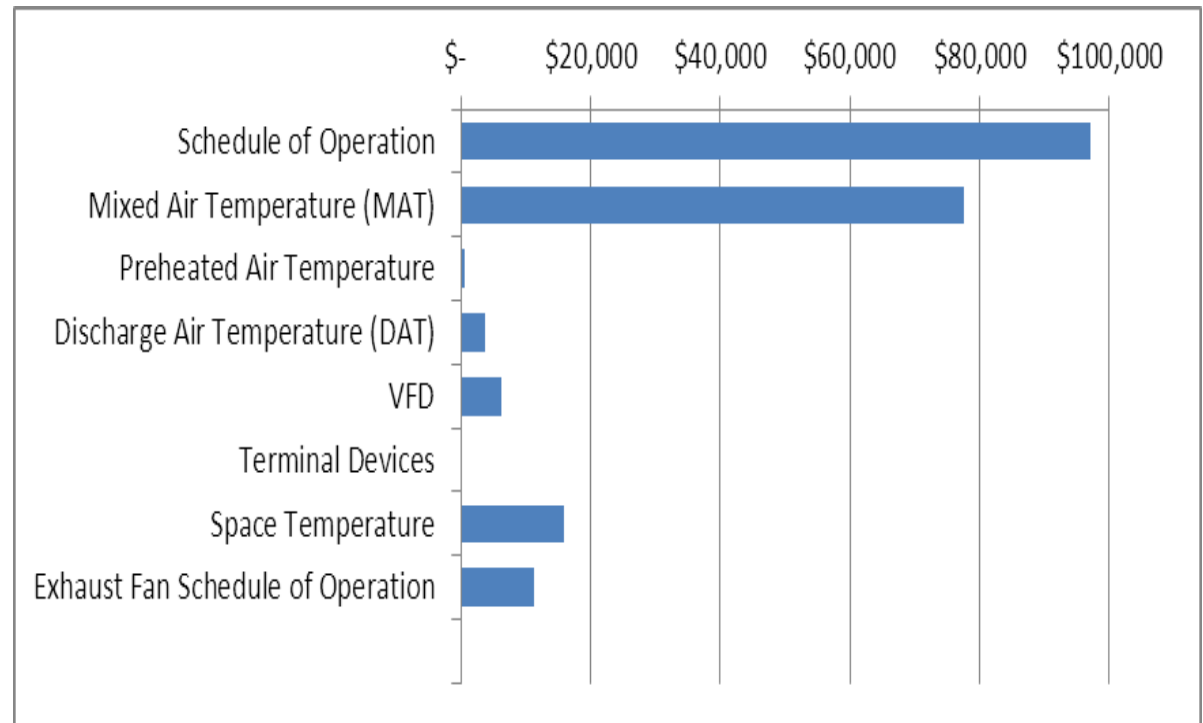
- Problem: 15 to 20% of energy use is wasted and is not detectable by normal operation
- Solution: A practical, cost effective easy-to-use early waste detection method
- The necessary elements of the method are:
 - Knowledge of largest energy wasting systems
 - A simple task to detect waste
 - A calendar to perform the task
 - The capability to correct the problem

USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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SB 2030 ENERGY STANDARD
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**ENSURE ENERGY-EFFICIENT
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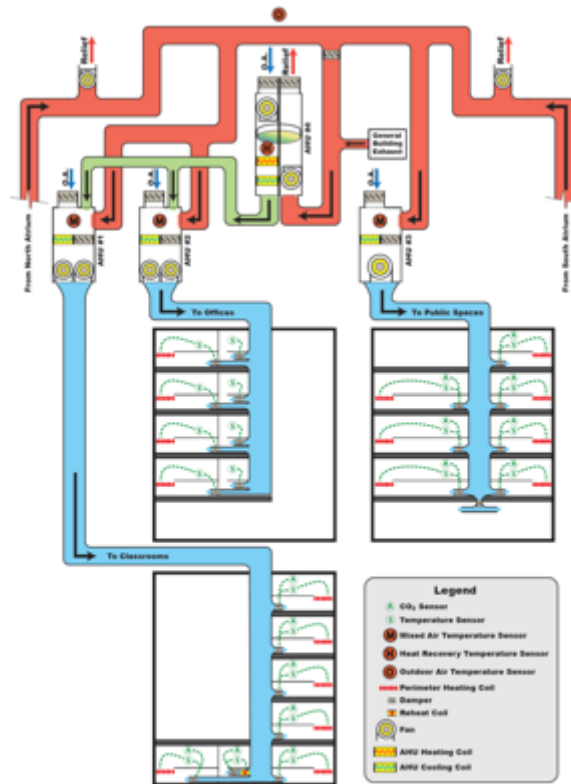
EXISTING BUILDING SAVINGS OPPORTUNITIES (Based on PBEEP Program)



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

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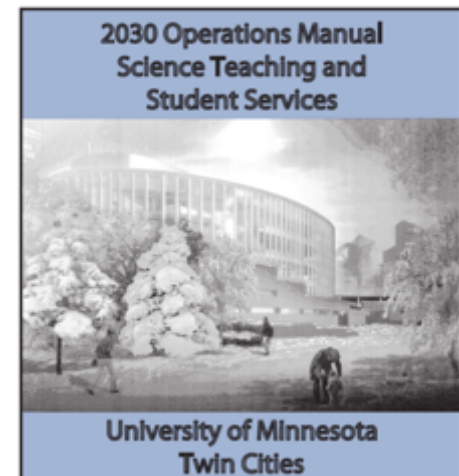


Space Conditioning
System Cartoon

Science Teaching
and Student Services Building
University of Minnesota
Twin Cities

SYSTEMS INCLUDED IN OPERATIONS MANUAL

- Lighting schedule
- AHU schedule
- AHU air temp
- Plug loads



USING AN INTEGRATIVE PROCESS TO MEET SB 2030

DETERMINE AVERAGE USE
SB 2030 ENERGY STANDARD
OPTIMIZE ENERGY USE
OPTIMIZE ENERGY SOURCES
PERFORM COMMISSIONING
TRACK PERFORMANCE

**ENSURE ENERGY-EFFICIENT
OPERATIONS**

The screenshot shows a web browser window displaying the 'B3 Energy Efficient Operations' application. The URL is 'http://localhost:33384/Building/Detail'. The page title is 'B3 ENERGY EFFICIENT OPERATIONS'. The navigation bar includes 'Home' and 'About'. The main content area is titled 'Science Teaching and Student Services' with the address '222 Pleasant Street SE, Minneapolis, MN 55455, 268,000 BuSF'. The left sidebar lists building controls: 'Building', 'AHU Timer Controls', 'AHU 1', 'AHU 2' (selected), 'Negotiate Schedule', 'Verify Schedule In Timer', 'Verify Timer Operation', 'AHU 3', 'AHU 4', 'Negotiate Schedule', 'Verify Schedule In Timer', 'Verify Timer Operation', 'AHU Air Temps', and 'Lighting Timer Controls'. The main panel shows a calendar for November 2013, with tabs for 'General', 'Schedule', 'Tasks', 'Assets', and 'Notes'. The calendar view shows a grid of dates with blue boxes indicating scheduled events for AHU 1 and AHU 2. The bottom right corner shows a zoom level of 100%.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	27	28	29	30	31	01
		AHU 1 Verify Timer			AHU 1 Monitor	AHU 2 Monitor
	03	04	05	06	07	08
		AHU 1 Verify Timer				09
	10	11	12	13	14	15
	AHU 1 Monitor				AHU 1 Monitor & Air	16
	17	18	19	20	21	22
		AHU 1 Monitor		AHU 2 Monitor		AHU 1 Monitor
	24	25	26	27	28	29
					AHU 1 Verify Timer	30
01	02	03	04	05	06	07



B3 CASE STUDIES DATABASE

MINNESOTA


B3 CASE STUDIES DATABASE

Search for a project by name

Home Projects Contact

Buildings, Benchmarks & Beyond Case Studies Database

The B3 Case Studies Database provides design and performance information on projects using the B3 Guidelines and the SB 2030 Energy Standard. Each project case study includes a Scorecard with several performance metrics including energy, carbon, water, stormwater, and waste. The case study also includes an SB 2030 Label indicating the projects Energy Use Intensity (EUI) during design and actual performance.



Bioscience and Health Careers Center
SB 2030 Energy Standard EUI: 172 kBtu/sf
Design Model EUI: 68 kBtu/sf

Get Started...

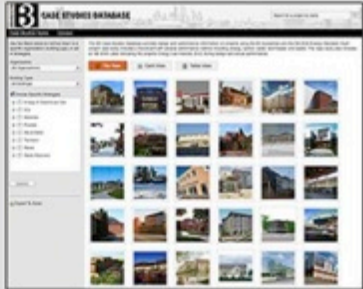
To begin using the Case Studies Database, select the default view in which you want to begin to display and sort data, Tile, Card or Table View.

Tile View

Card View

Table View

Once you have chosen how to view the case studies, filters in the left sidebar will allow you to select the specific information in which may want to display.





B3 CASE STUDIES DATABASE

The screenshot displays the B3 Case Studies Database website. At the top left, the logo features a large white '3' on a black background, with 'MINNESOTA' written vertically to its left. To the right of the logo, the text 'CASE STUDIES DATABASE' is prominently displayed. A search bar on the top right contains the placeholder text 'Search for a project by name' and a magnifying glass icon. Below the header, a navigation bar includes links for 'Home', 'Projects', and 'Contact'. On the left side, a filter section instructs users to 'Use the filters below to narrow down to a specific organization, building type, or set of strategies.' It includes two dropdown menus for 'Organization:' (set to '(All Organizations)') and 'Building Type:' (set to '(All Buildings)'). There is also an unchecked checkbox for 'Choose Specific Strategies' and a 'Submit' button. The main content area shows a grid of project thumbnails in 'Tile View' mode. The view mode selector at the top of the grid includes 'Tile View' (selected), 'Card View', and 'Table View'. The grid contains 24 thumbnails, some of which are labeled with project names: 'CAMP RIPLEY EDUCATION CENTER', 'CRYSTAL SPRINGS HATCHERY MANAGER'S RESIDENCE', 'HECTOR - TRIPLE J FARMS', and 'JACKSON ARMORY'. The bottom of the slide features a decorative graphic of colorful, overlapping lines and a large white '3' on a black background.

B3 CASE STUDIES DATABASE

MINNESOTA

B3

CASE STUDIES DATABASE

[Home](#)
[Projects](#)
[Contact](#)

Use the filters below to narrow down to a specific organization, building type, or set of strategies.

Organization:

Building Type:

☐ Choose Specific Strategies

Table Views:

Columns:

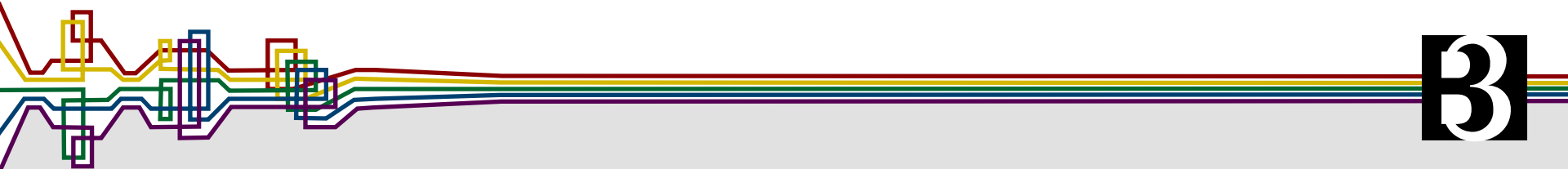
- ☒ Project
- ☒ Organization
- ☐ City
- ☒ Building Type(s)
- ☐ Construction Type(s)
- ☒ SF
- ☐ Vegetated Area
- ☐ Owner
- ☒ Architect
- ☐ Mechanical Engineer
- ☐ ...

Tile View

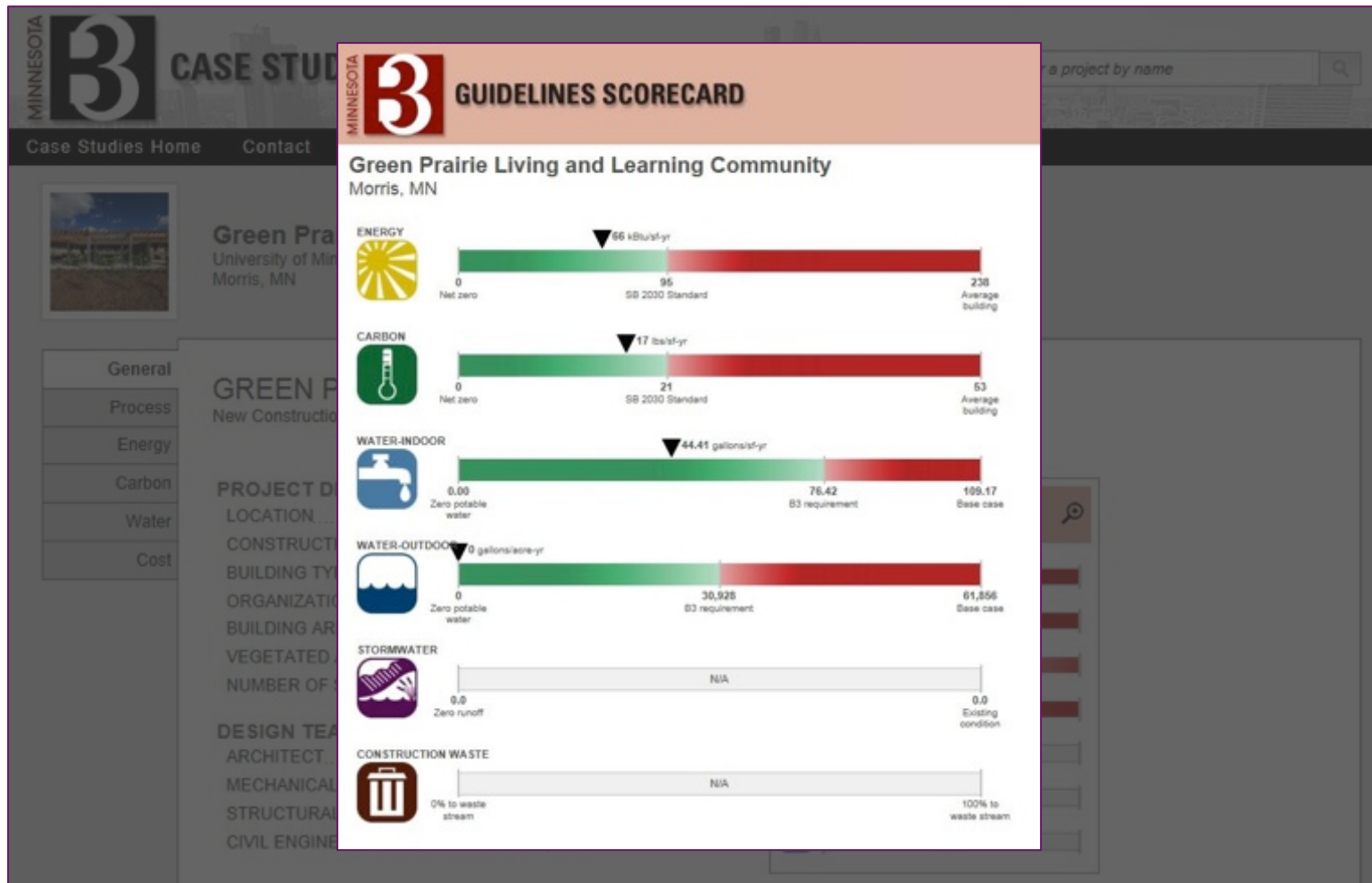
Card View

Table View

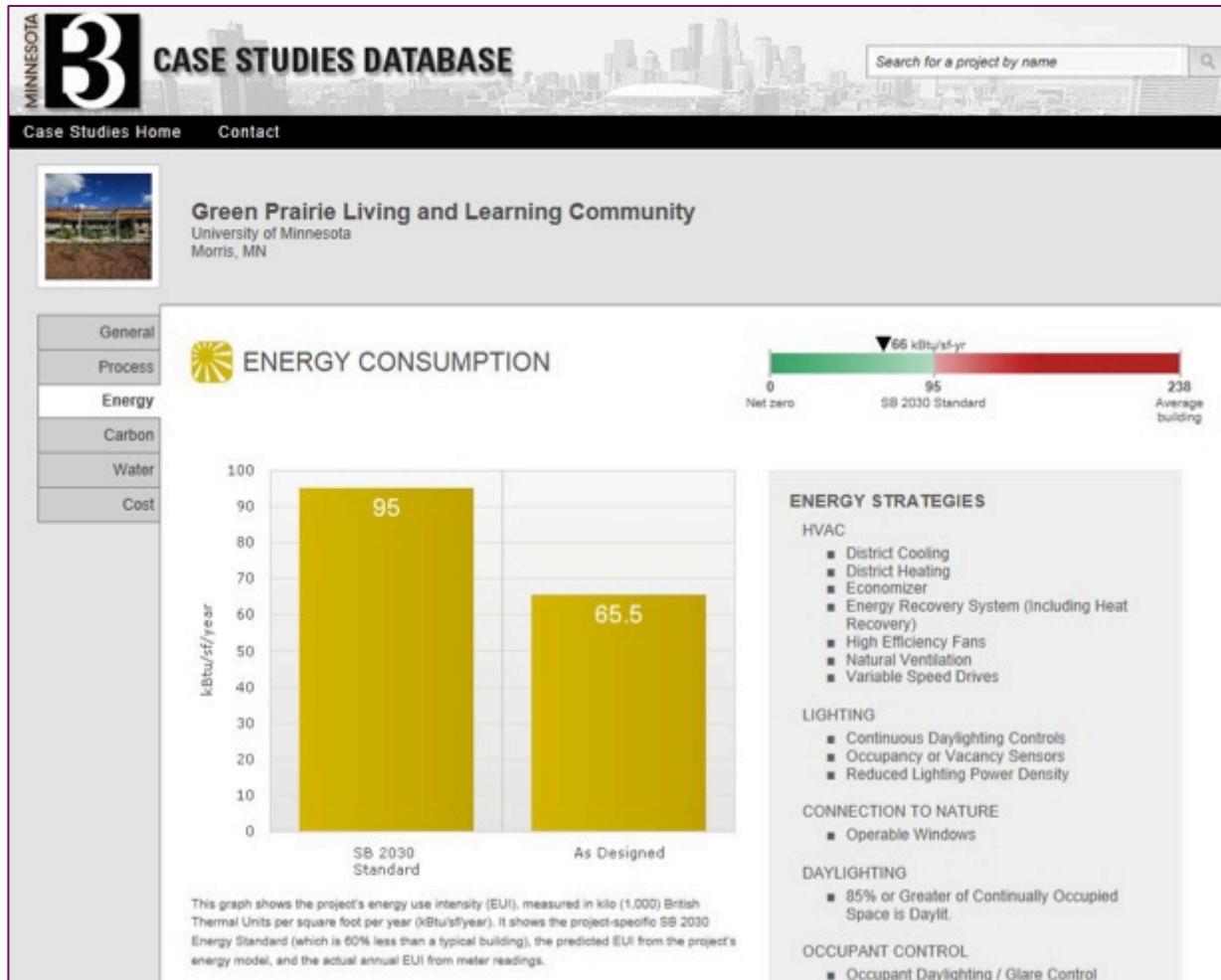
Project	Organization	Building Type(s)	SF	Architect	Energy Standard EUI (kBtu/SF/Yr)	Energy Design EUI (kBtu/SF/Yr)	Energy Ratio Std/Design	Energy Ratio Graphic
Hamline Station East	City of Saint Paul	Housing, Parking	86,437	Elness Swenson Graham Architects	102	43	0.43	
Hamline Station West	City of Saint Paul	Housing, Parking, Retail	86,796	Elness Swenson Graham Architects	87	49	0.57	
Kendall's Payne Avenue Hardware	City of Saint Paul	Retail, Mech/Storage, Office	14,594	Lunning Wende Associates	53	42	0.79	
Western U Plaza	City of Saint Paul	Housing	99,916	Sand Companies	161	44	0.27	
Hennepin County New 911/Emergency Communications Facility	Grants to Political Subdivision	Communications Facility	59,222	Wold AE	151	115	0.76	
Shantz Hall Building Restoration	Grants to Political Subdivision		81,021	SEH	96	71	0.74	
Maplewood Mall Parking Structure	Metro Transit	Parking	274,927	Bentz/Thompson/Rietow	35	1	0.03	
Camp Rietow COE								



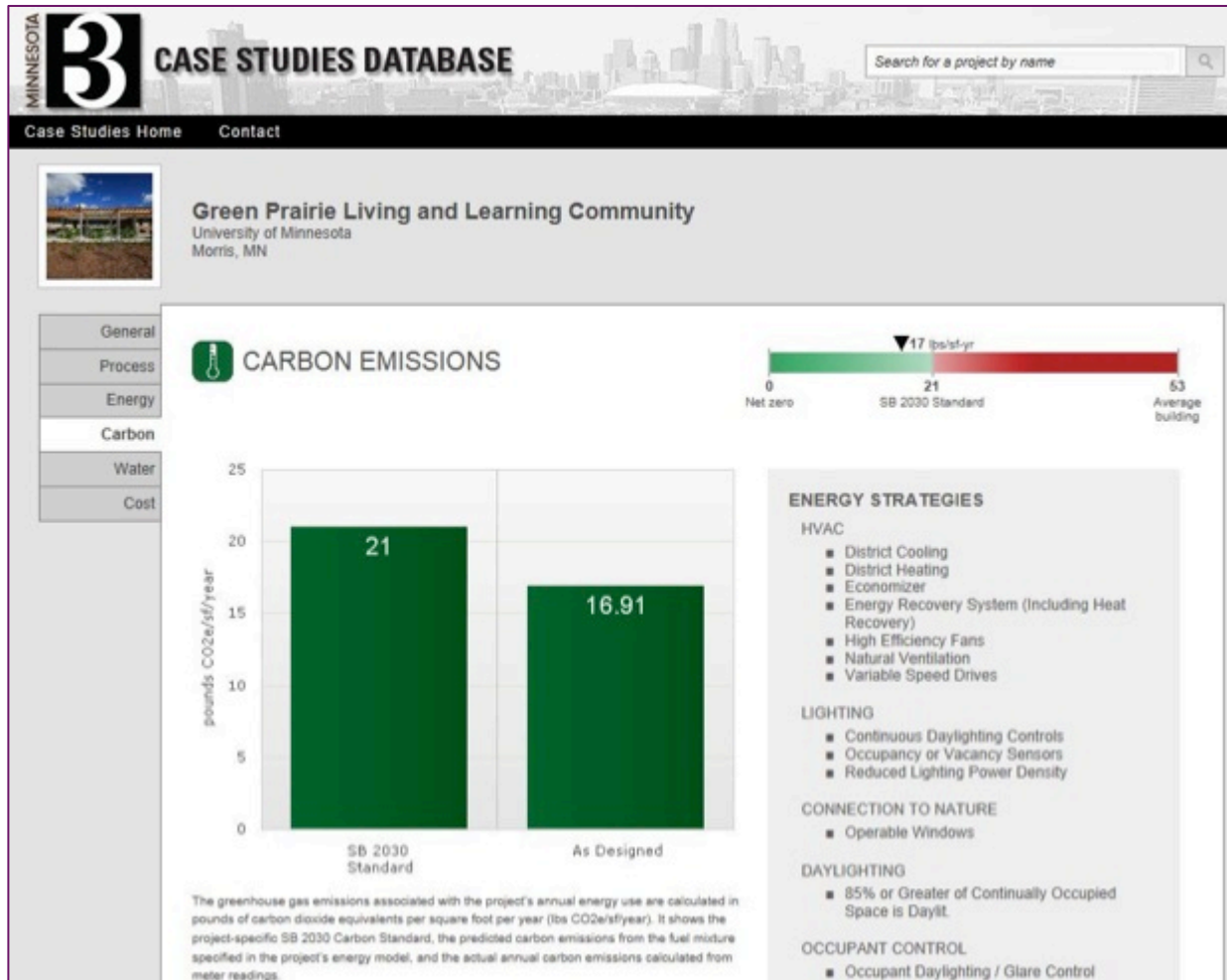
B3 CASE STUDIES DATABASE



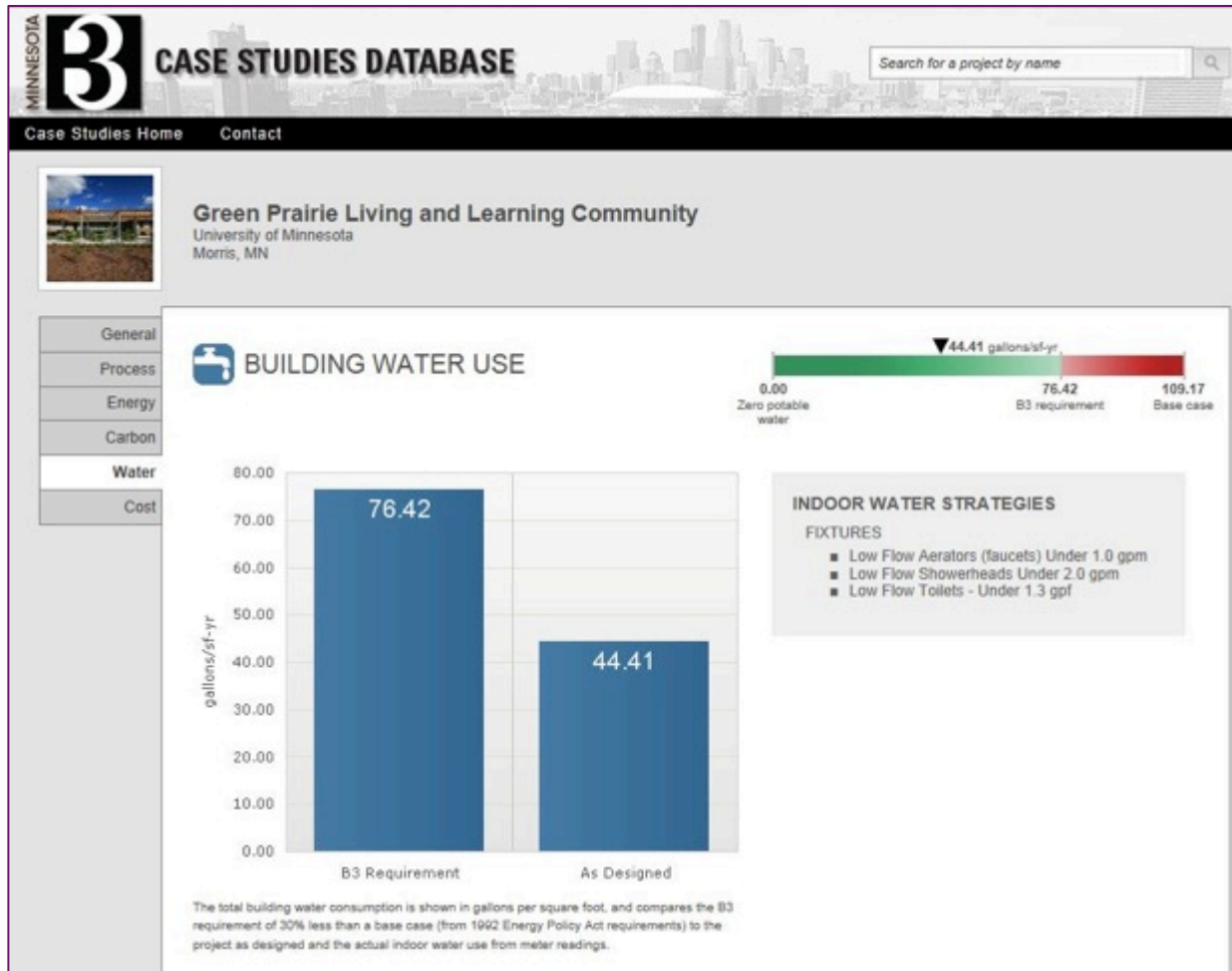
B3 CASE STUDIES DATABASE



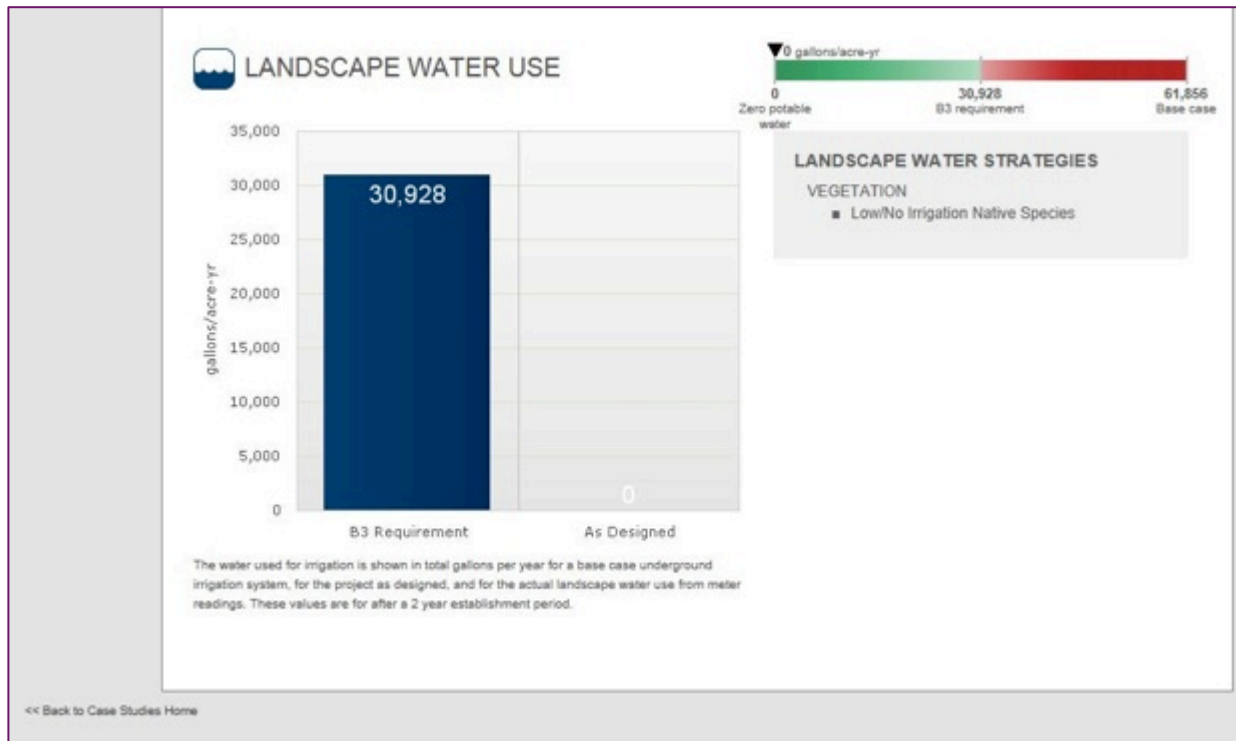
B3 CASE STUDIES DATABASE



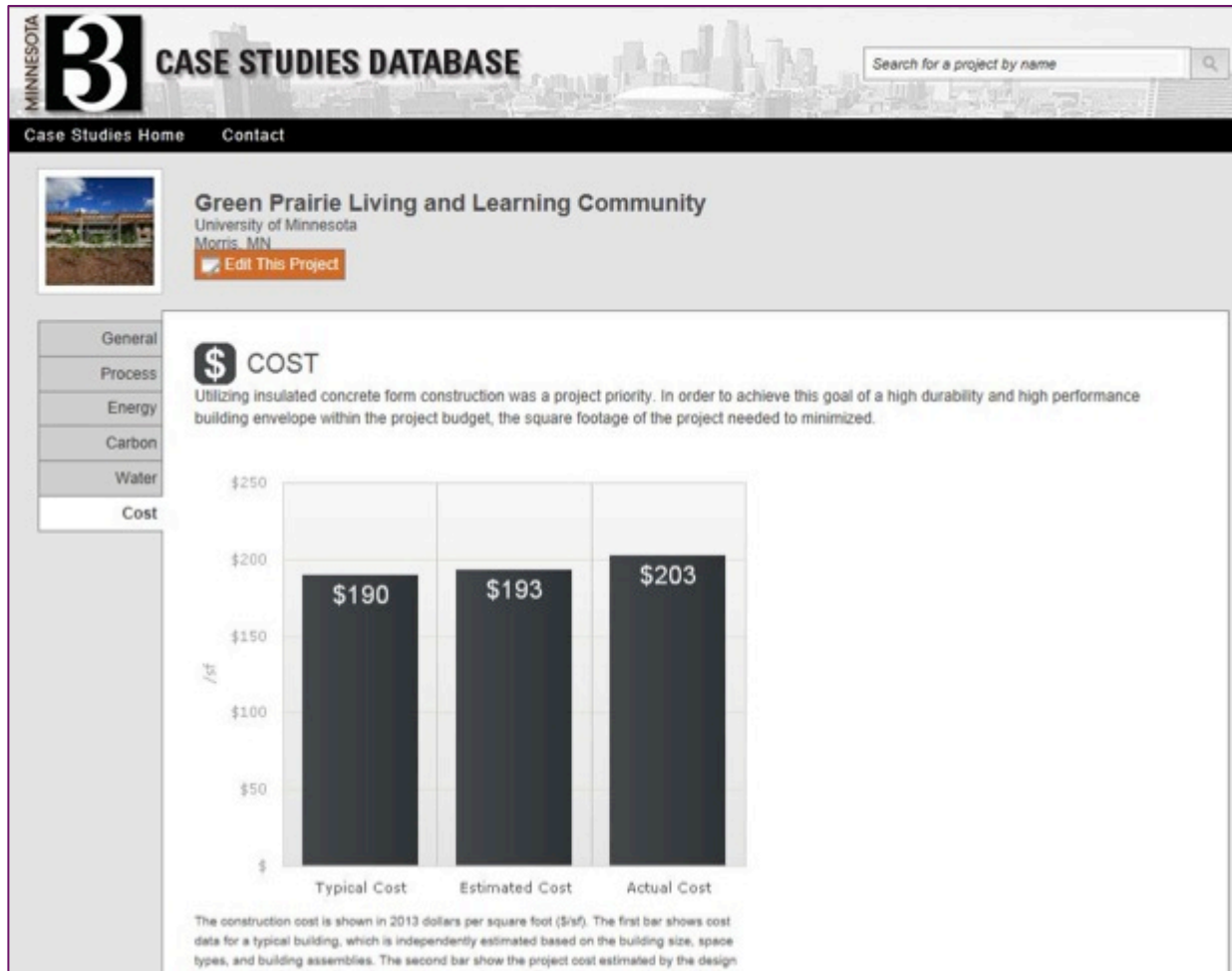
B3 CASE STUDIES DATABASE



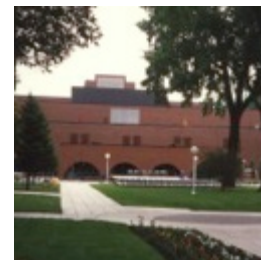
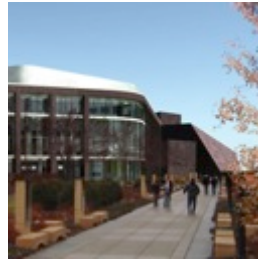
B3 CASE STUDIES DATABASE



B3 CASE STUDIES DATABASE



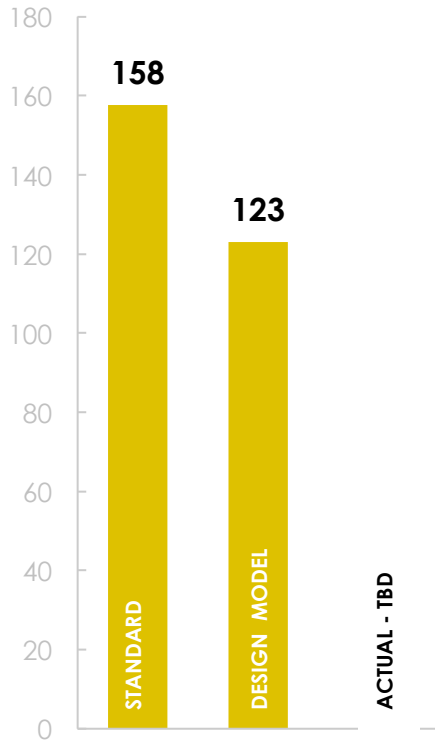
RESULTS – SB 2030 PROJECTS



RESULTS - SUMMARY

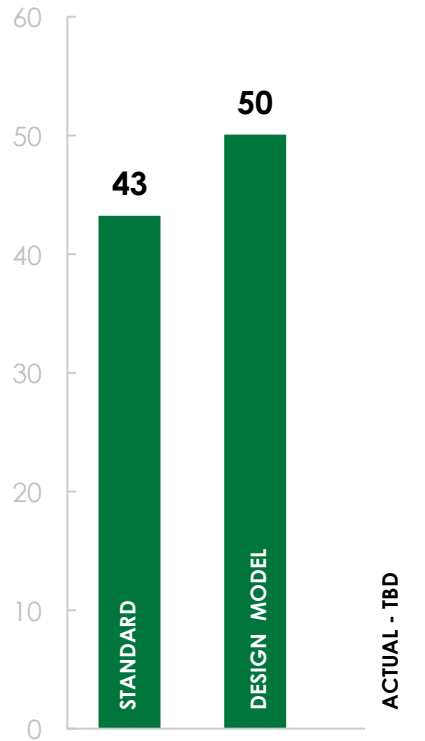
- * Mean EUI of all 39 projects, weighted by area
- ** Mean CO₂e of all 39 projects, weighted by area
- *** Mean cost of 32 projects with both typical and estimates, weighted by area

KBTU/SQ.FT/YEAR



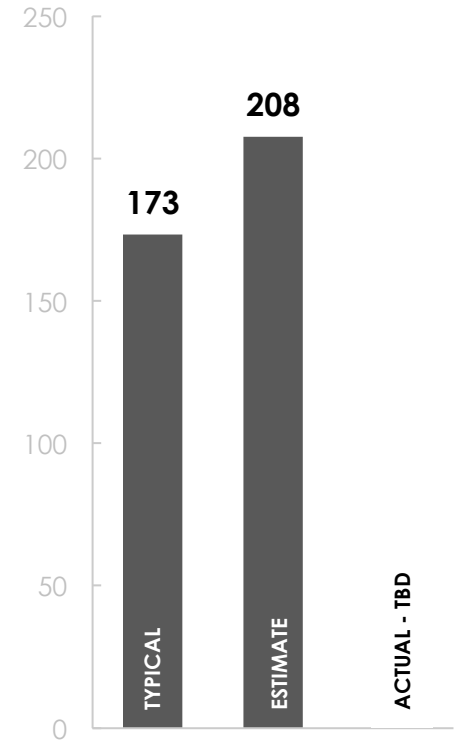
ENERG *

LB/SQ.FT/YEAR

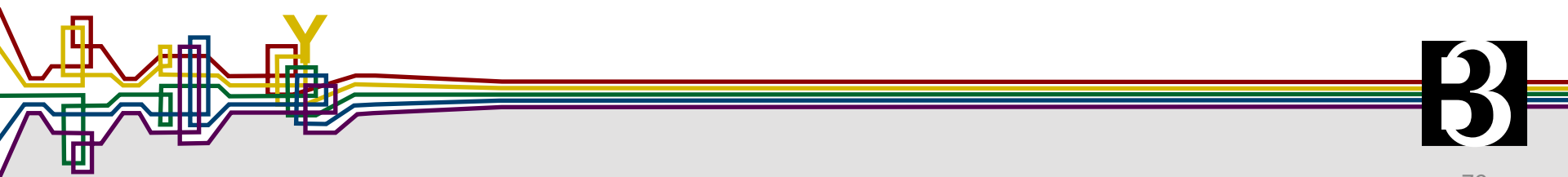


CO₂e **

\$/SQ.FT

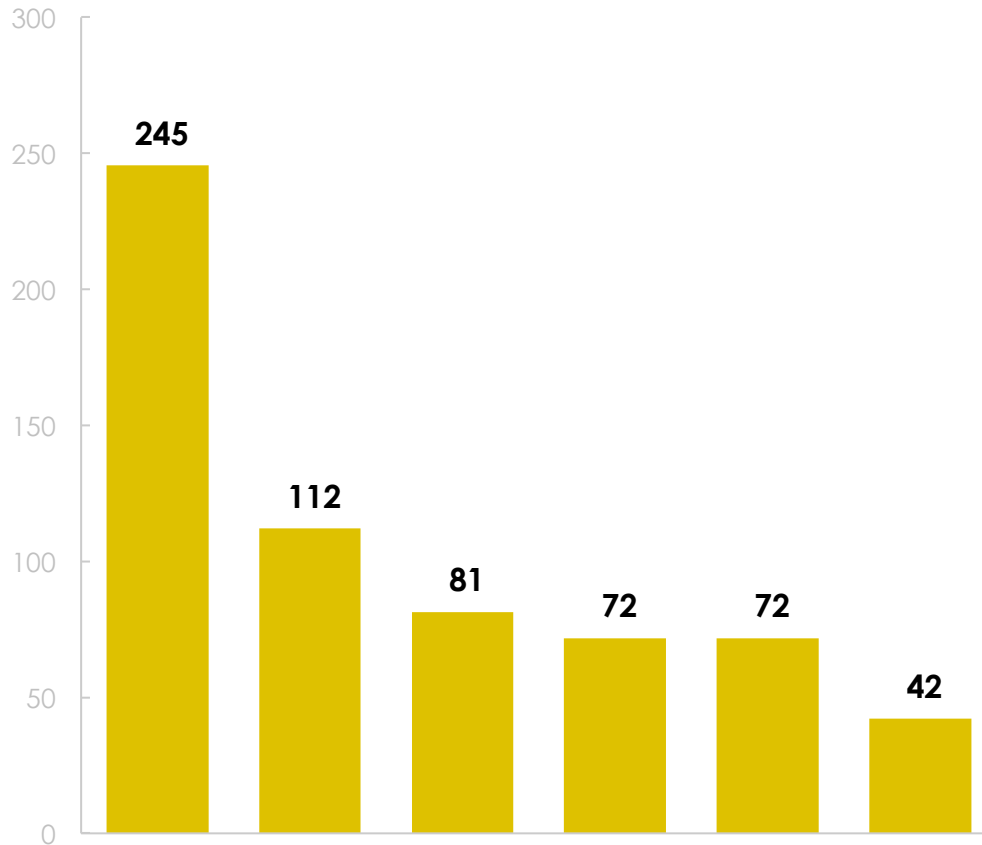


COST ***



RESULTS – BY BUILDING TYPE

KBTU/SQ.FT/YEAR

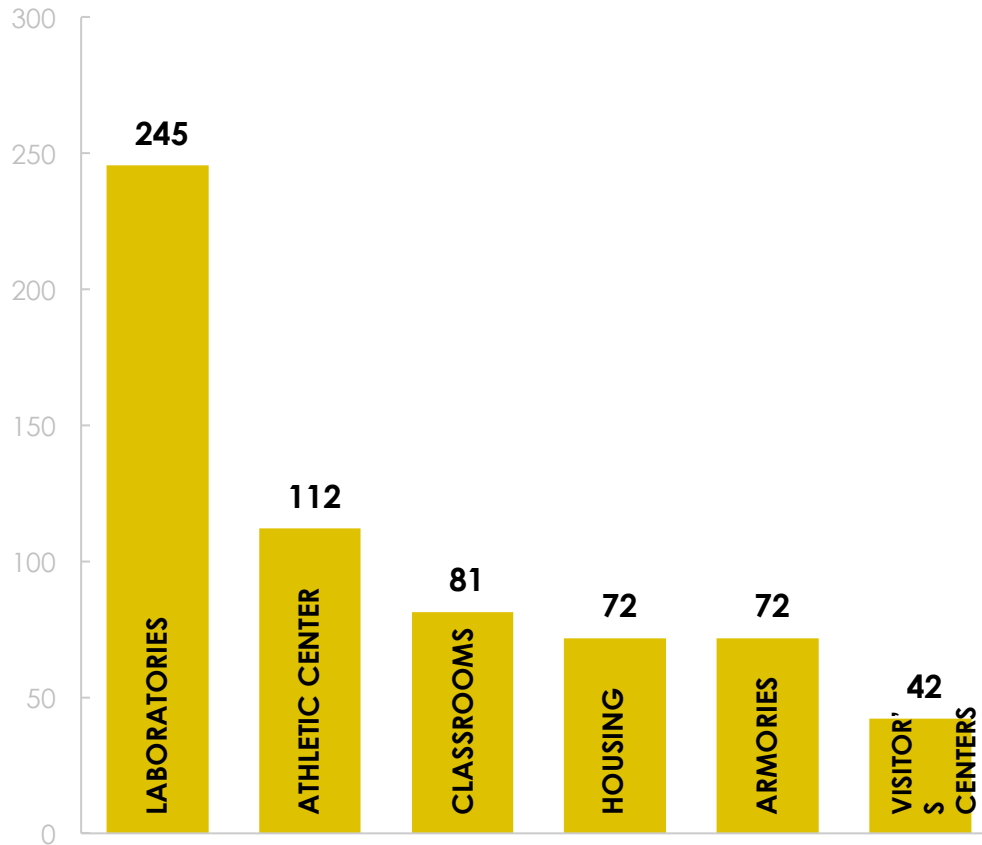


MATCH THE BUILDING TYPE
TO ITS AVERAGE DESIGN EUI

- Classrooms (9 projects)
- Laboratories (10 projects)
- Visitor's Center (5 projects)
- Athletic Center (2 projects)
- Armories (6 projects)
- Housing (11 projects)

RESULTS – BY BUILDING TYPE

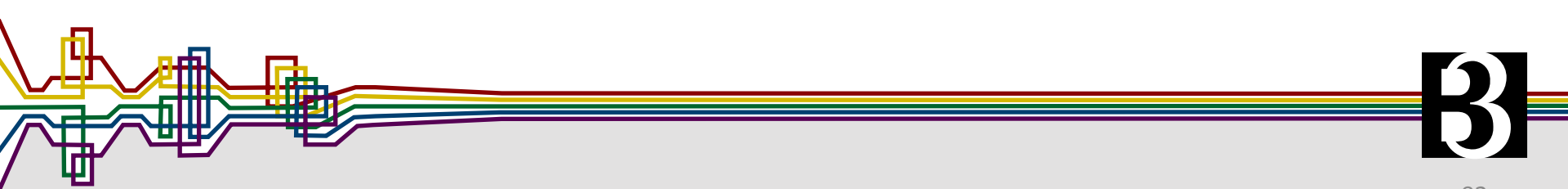
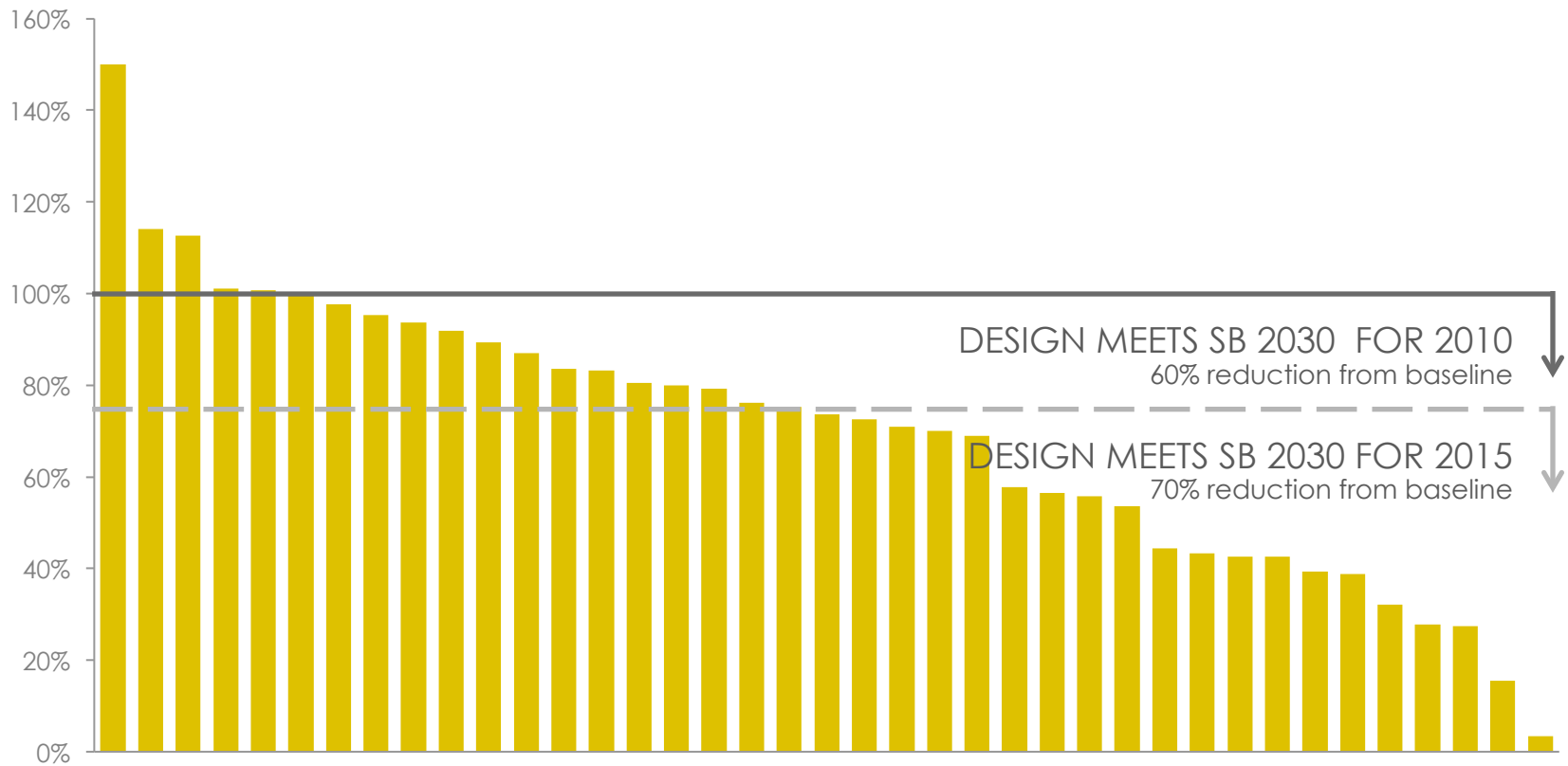
KBTU/SQ.FT/YEAR



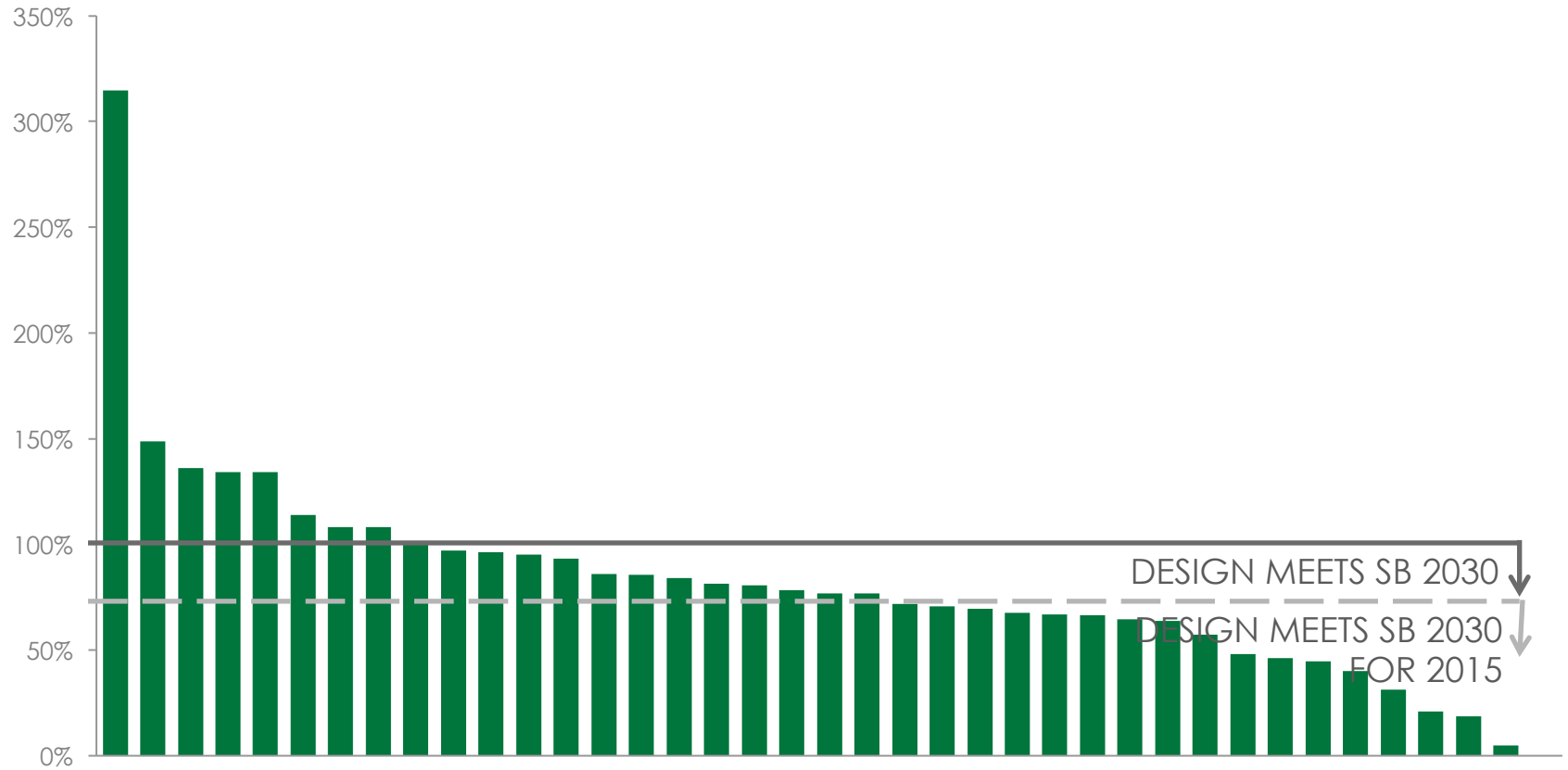
MATCH THE BUILDING TYPE
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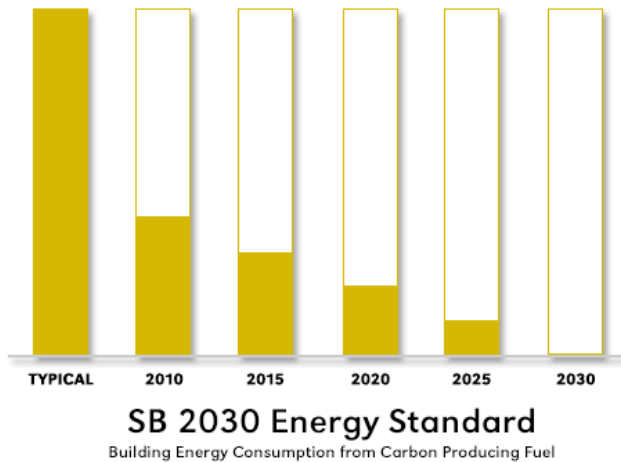
RESULTS – ENERGY (DESIGN/SB 2030 STANDARD)



RESULTS – CARBON DIOXIDE EQUIVALENTS



IMPACT OF B3 PROGRAMS

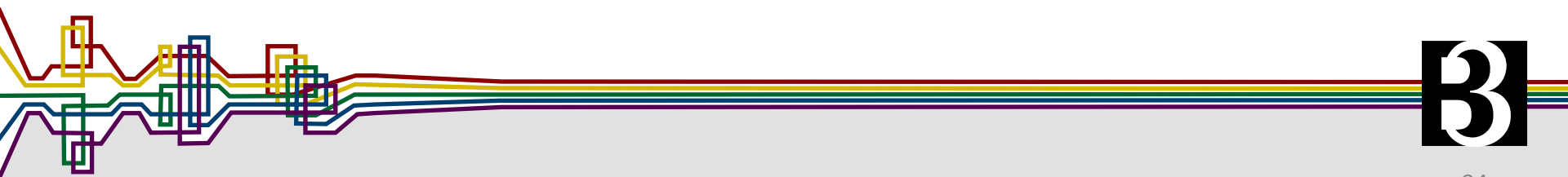


SB 2030 PROGRAM

- Savings of 327 million kBtus/year
- Savings of \$5.24 million per year

B3 BENCHMARKING

- Savings of 2,644 million kBtu per year
- Potential savings of 34.4 million dollars per year



SUMMARY – INTEGRATIVE PROCESS TOOLS



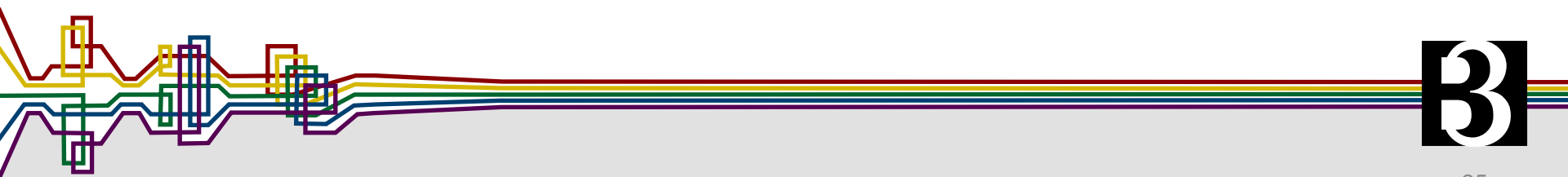
GUIDELINES, STANDARDS, AND RATING SYSTEMS

- B3 Guidelines – P.3 Integrated Design Process
- ANSI/MTS Integrative Process (IP) 2.0 Standard
- LEED v4 – Integrative Process
- Enterprise Green Communities – 1.1a Integrative Design
- Green Globes – 3.1.1 Integrated Design Process

OTHER RESOURCES



- 7group and Bill Reed. *The Integrative Design Guide to Green Building*. Hoboken, NJ: John Wiley & Sons, 2009.
- BC Roadmap to the Integrated Design Process (BC-IDP)
- AIA – Integrated Project Delivery (IPD)



SUMMARY – SB 2030 PROCESS AND TOOLS

DESIGN

SB 2030 ENERGY STANDARD TOOL DOES THIS FOR YOU.

1. Determine the average energy use for comparable buildings

USE BUILDING-SPECIFIC INPUTS IN SB 2030 ENERGY STANDARD TOOL. REFINE THROUGH DESIGN PROCESS.

2. Calculate the SB 2030 Energy Standard

3. Optimize energy use

- Implement energy reduction strategies
- Evaluate strategy bundles through energy modeling

USE EARLY ENERGY MODELING TO INFORM INITIAL DESIGN DECISIONS.

4. Evaluate the use of low carbon energy sources

OPERATIONS

ENTER UTILITY DATA INTO B3 BENCHMARKING MONTHLY.

1. Perform commissioning

2. Track actual performance using B3 Benchmarking

UTILIZE B3 ENERGY EFFICIENT OPERATIONS PROGRAM.

3. Ensure energy-efficient operations