



getting to zero national forum
at the
2013 NASEO Annual Meeting
Framing the policies, programs and projects that will drive zero net energy buildings

Getting to Zero: Policies and Programs

February 26, 2014

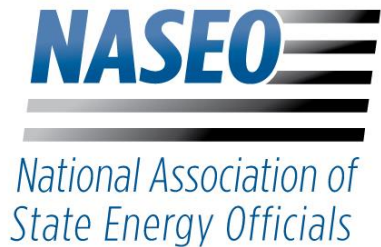
David Hewitt

Director of Strategic Partnerships

nbi new buildings
institute



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Today's Topics

- Why is supporting ZNE important?
- Options for effective ZNE related policies and programs at the state and local level.
- Examples of policies in action and their impact.



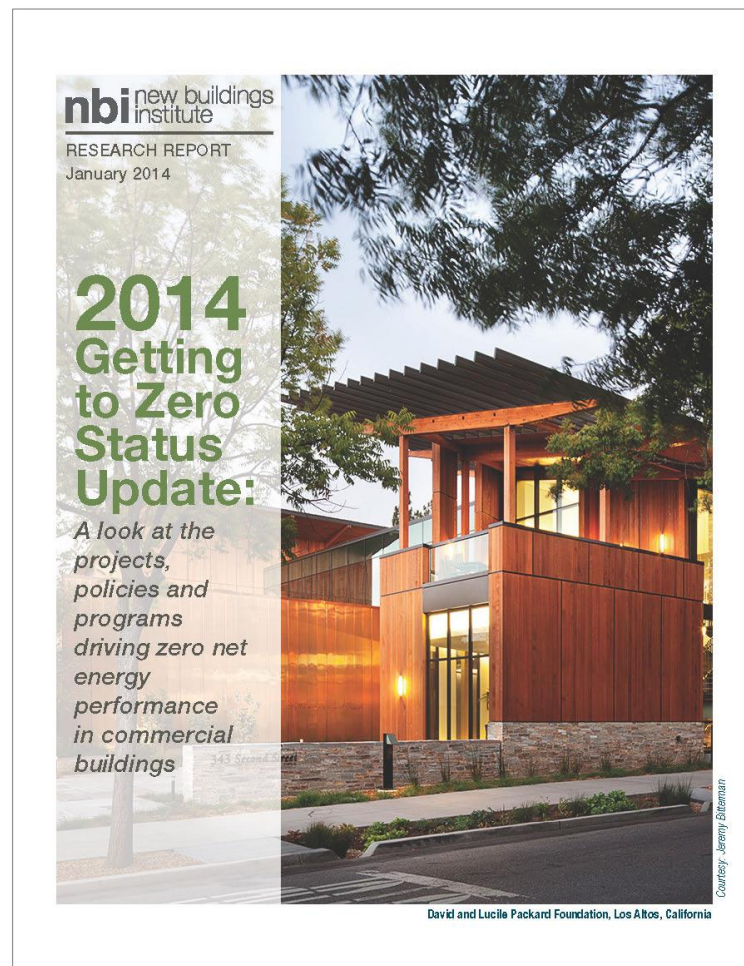
Speakers

- **Jim Edelson – Policy Director, NBI**
Broad ZNE policies and codes
- **Christopher Wagner – Program Manager, NASEO**
Strategies to support market leadership
- **Janet Streff – Manager, Minn. Energy Office and Tom McDougall– President, The Weidt Group**
One state’s path, legislation through initial implementation

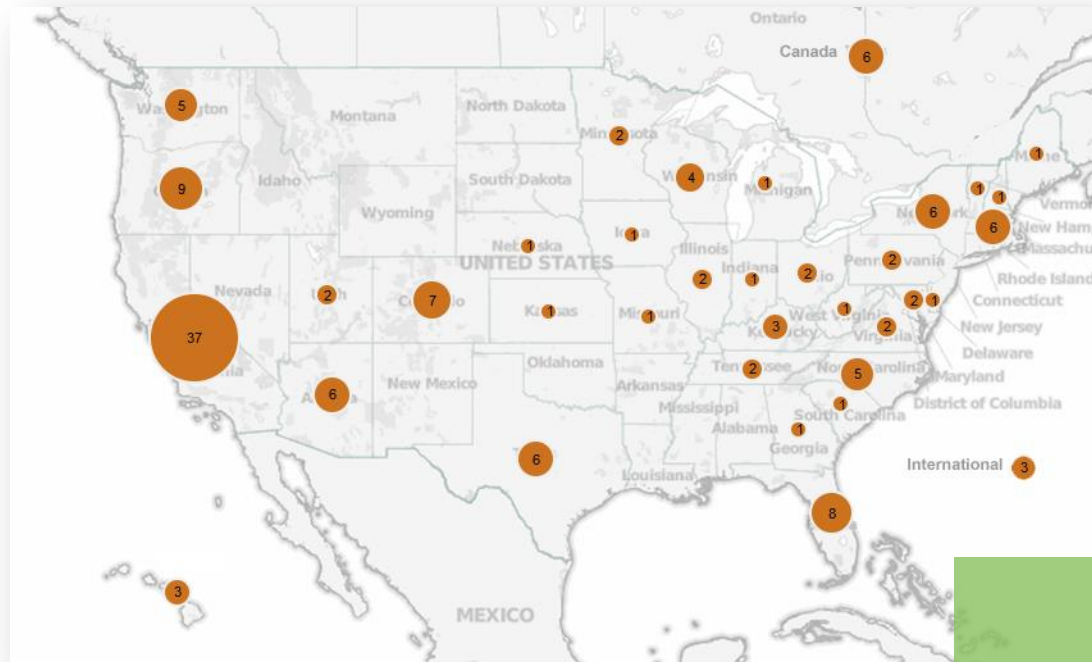
Q &A at the end – we may go long

Background

- Zero Net Energy Building - a building that generates onsite at least as much energy as it uses over the course of a year
- ZNE Buildings proven as a concept; clearly can be a major part of our buildings future
- Costs of PV dropping



Locations: 2014 ZNE Commercial Buildings



~ 160 buildings
in 37 states!

ZNE; the beginning of a trend

| | ZNE Commercial Buildings | | Total ZNE |
|------|--------------------------|----------|-----------|
| Yr | Actual | Emerging | |
| 2012 | 21 | 39 | 60 |
| 2014 | 33 | 127 | 160 |

ZNE and Ultra-Low Energy Buildings have doubled in two years

Benefits

- Provides a critical step towards a reduced carbon society
- ZNE offers a clear and aspirational target
- Moves energy efficiency from incremental to game changing
- Contributes to resilience
- Part of a distributed resource grid

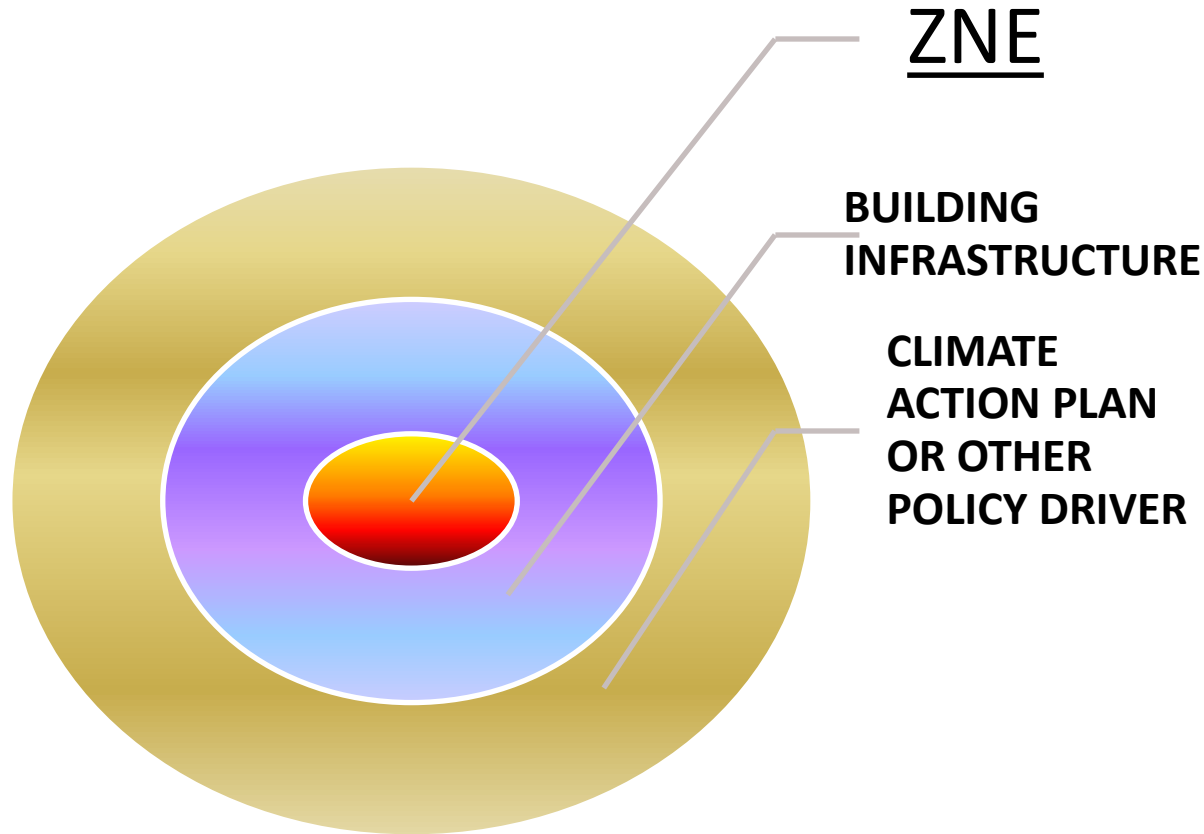
ZNE Building Policy Update

“a journey of a thousand miles begins with a single step”

Lao Tzu

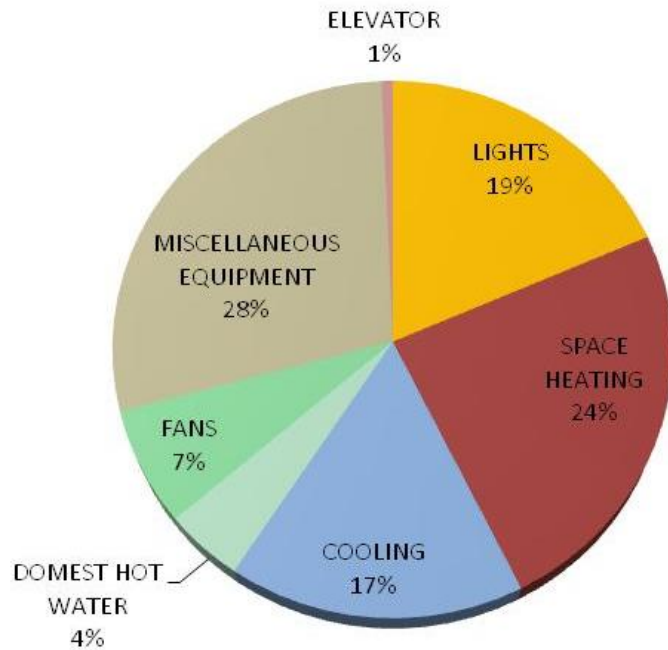
Jim Edelson
jim@newbuildings.org

The Policy Level Context

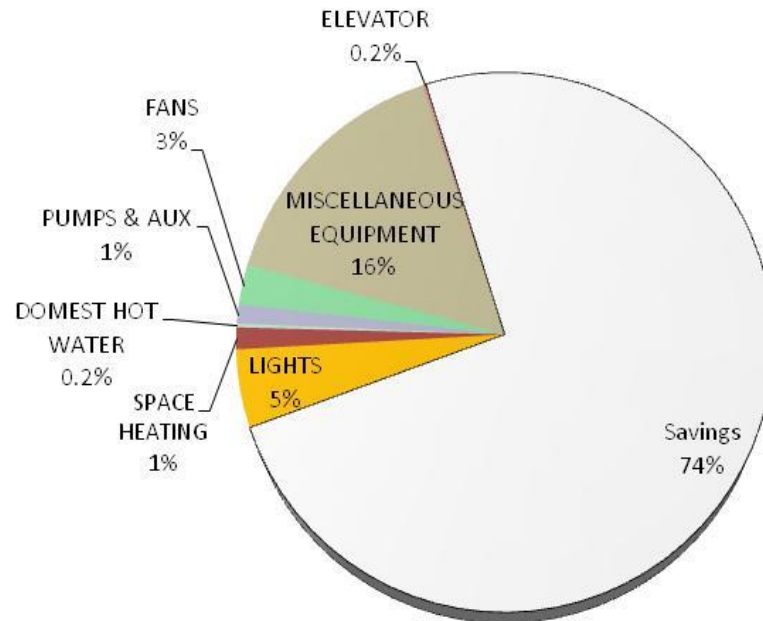


The Building Level Context

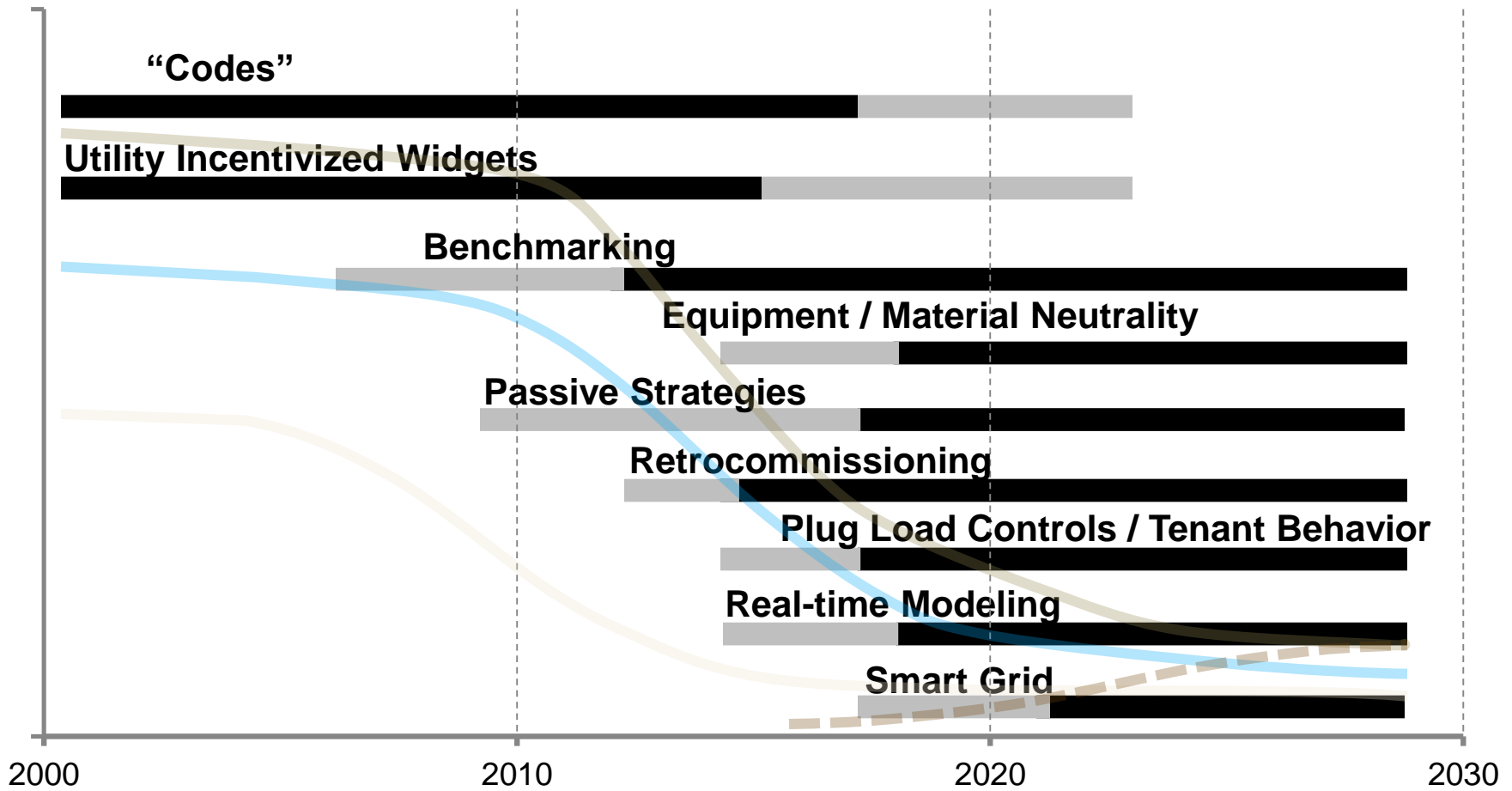
Percent Energy Consumption by End Use Before Energy Conservation Measures



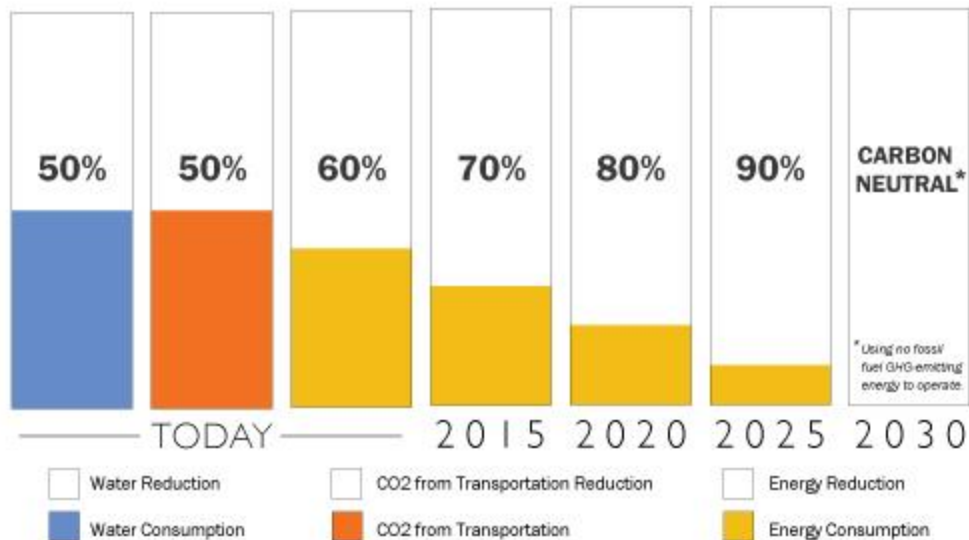
Percent Energy Consumption by End Use After Energy Conservation Measures



Building Policies / Tools Context



Seattle 2030 District

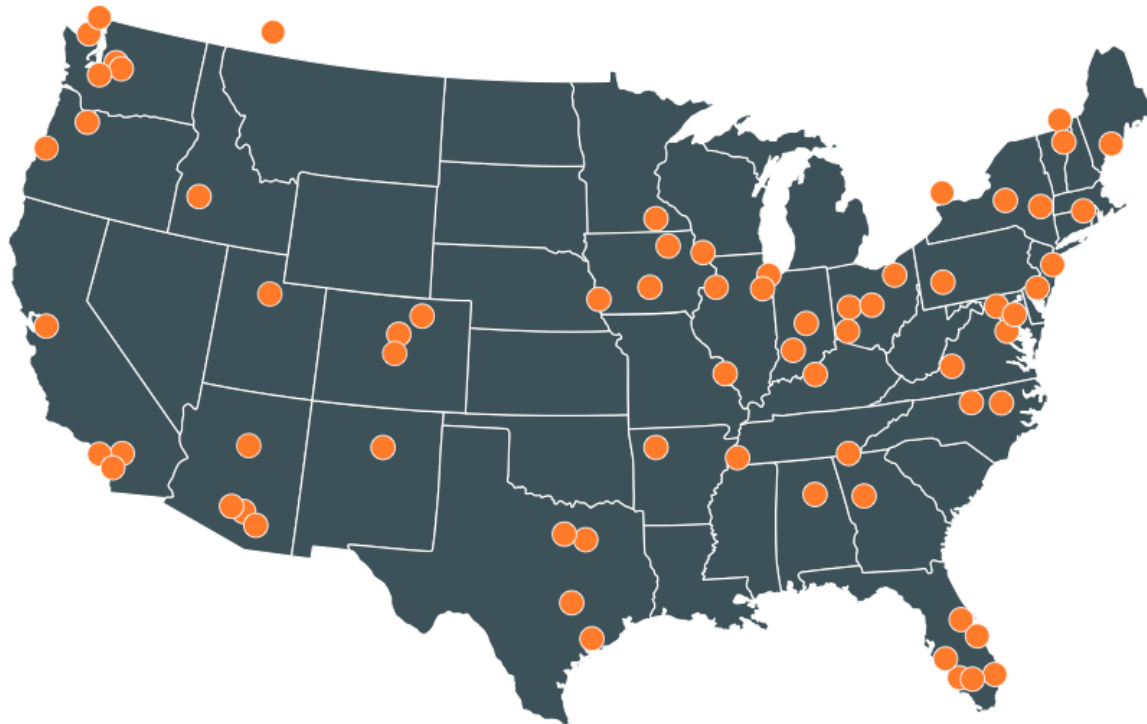


The 2030 Challenge for Planning: New Buildings & Major Renovations

Source: © 2011 2030, Inc. / Architecture 2030. All Rights Reserved.

Star Communities Index

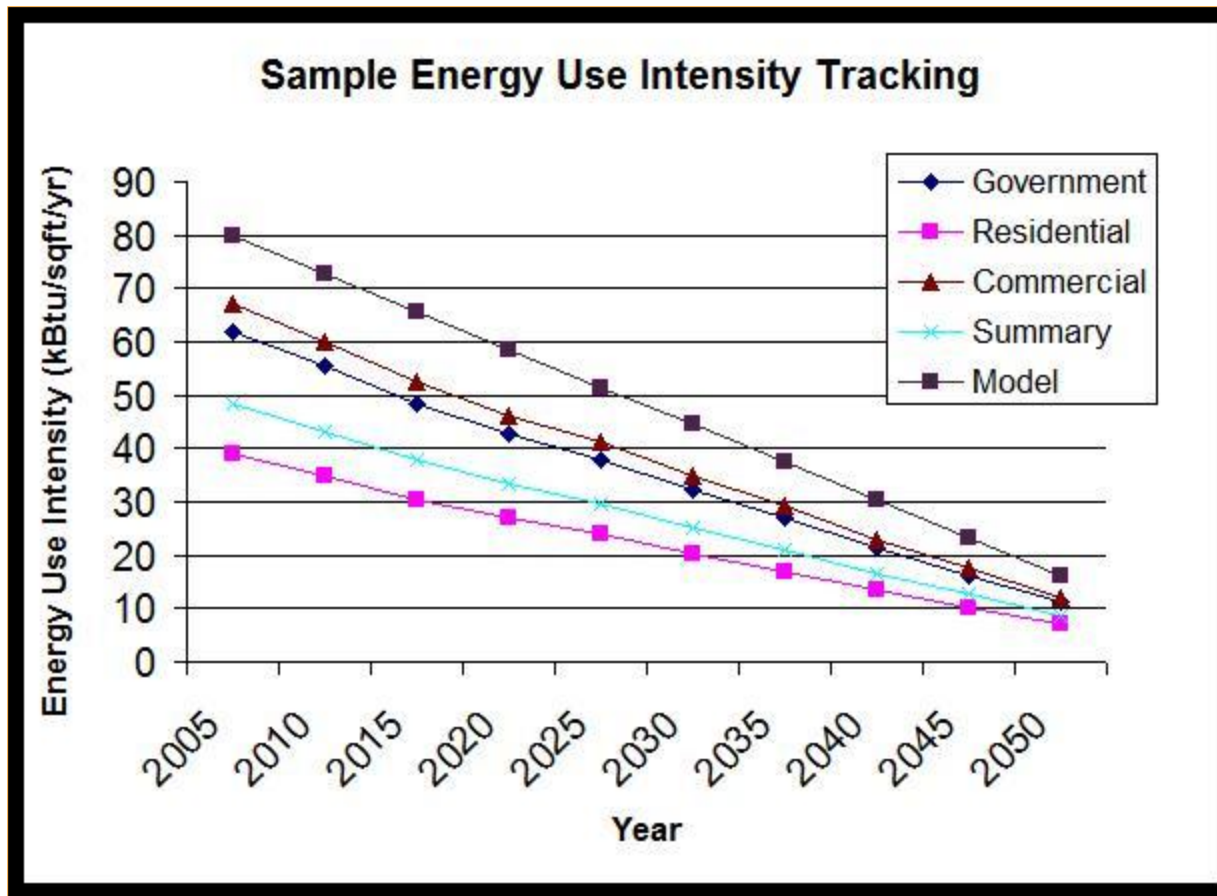
www.starcommunities.org/



*As of January 2014

Star Communities Index

www.starcommunities.org/



California



Key Concepts

- California Global Warming Solutions Act of 2006 (Assembly Bill 32)
- California Public Utility Commissions ordered **Big Bold Goals for New Construction**
- California Energy Efficiency Strategic Plan guides utilities; leads to **Path to Zero** in Savings by Design
- CEC sets **path to ZNE codes** in their bi-annual Energy Plan
- Savings by Design Path to Zero program produced at least 30 ZNE or ultra-low energy buildings in 4 years
- **CalGreen (stretch code)** supports ZNE code path
- Executive order for new **state buildings to be ZNE by 2025**

Vermont



Key Concepts

- Comprehensive Energy Plan says VT should establish a “...clear path to achieve a goal of having all new buildings built to net zero design by 2030.”
- “Path” means it’s not one step to net zero- rather (up to incremental improvements to achieve net-zero goal 5 more code updates before 2030)
- Balance any construction cost increases and construction/technology changes with reducing energy use

**WASHINGTON
ENGROSSED SECOND
SUBSTITUTE SENATE BILL 5854
61st Legislature
2009 Regular Session**



Key Concepts

- . **Sec. 5. (1) Except as provided in subsection (2) of**
- this section, **residential and nonresidential construction permitted**
- **under the 2031 state energy code must achieve a seventy percent**
- **reduction in annual net energy consumption**, using the adopted 2006
- Washington state energy code as a baseline.
- (2) The council shall adopt state energy codes from 2013 through
- 2031 that **incrementally move towards achieving the seventy percent**
- **reduction** in annual net energy consumption as specified in subsection
- (1) of this section. The council shall report its progress by December
- 31, 2012, and every three years thereafter.

**WASHINGTON
ENGROSSED SECOND
SUBSTITUTE SENATE BILL 5854
61st Legislature
2009 Regular Session**



Key Concepts

- **The strategic plan** will identify barriers to achieving net zero energy use in homes and buildings and identify how to overcome these barriers in future energy code updates and through complementary policies.
- (2) The department must complete and release the strategic plan to the legislature and the council by December 31, 2010, and update the plan every three years.
- (3) The strategic plan must include recommendations to the council on energy code upgrades. At a minimum, the strategic plan must:
 - (a) **Consider development of aspirational codes** separate from the state energy code that contain economically and technically feasible optional standards that could achieve higher energy efficiency for those builders that elected to follow the aspirational codes in lieu of or in addition to complying with the standards set forth in the state energy code;

Tucson and Pima County *Net-Zero Energy Building Standard*



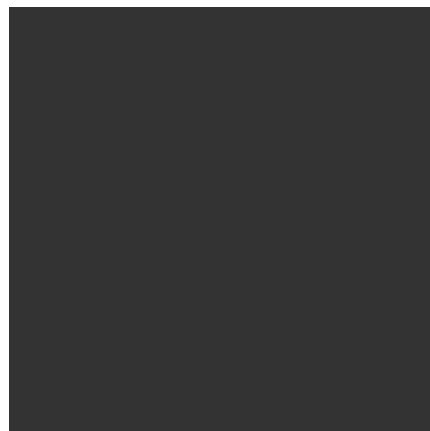
Key Concepts

- 1. The development of a primary metric called **Energy Use Intensity (EUI)** to measure the predicted and actual energy use. This is analogous to miles per gallon for a car.
- 2. The **Embedded Energy To Deliver Water** to the building must be offset by on-site energy production to achieve net zero status.
- 3. **Net zero potential** is defined by the ability of the building to generate on-site energy with the energy producing area limited to the building roof (and covered parking in commercial buildings). This requires that buildings be energy efficient.
- 4. The Net zero certification will be issued **after one year of performance demonstrates net-zero achievement**. Meeting the requirements in either the prescriptive path or performance path shall be deemed to be in compliance with the requirement of the IECC without regard to the issuance of the net-zero certificate.

ZNE Policy

Concepts and Themes

- ZNE Objective based within a Larger Policy Context
- Executive or legislatively driven
- Buildings strategy to 2020, 2030, or 2050
- Incremental with interim milestones
- Actual performance at ZNE
- “Public” buildings lead; codes follow
- Rapidly expanding field of ZNE policy !



State and Local Policies and Programs to Promote Zero Net Energy Buildings

Chris Wagner, NASEO Program Manager
February 26, 2014
cwagner@naseo.org

About NASEO and State Energy Offices

- NASEO is a non-profit representing the 56 governor-designated energy offices from each state/territory.
- State Energy Offices develop programs/policies related to:
 - Energy efficiency in manufacturing and residential, commercial, and public buildings
 - Renewable energy
 - Oil, gas, electricity production and distribution
 - Energy emergency preparedness and resiliency
- NASEO has collaborated with NBI over the past several years on zero net energy (ZNE) policies and programs.

Presentation Overview

- **Examples of State Activity in the Following Areas:**
 1. **ZNE/High Performance Buildings Tax Credits and Mortgage Incentives**
 2. **Executive Orders/Governor Action**
 3. **Catalyzing the Schools Sector**
- **Summary of Trends and Opportunities**

New Mexico Sustainable Buildings Tax Credit

- 2007 Senate Bill 463; administered by New Mexico Energy, Minerals and Natural Resources Department
- Residential:
 1. Build Green NM or LEED-H Silver
 2. HERS score of 60 or lower
 - 2,000 sq. ft. home → \$10,000 tax credit
 - \$4 million annual cap (2014, 2015, 2016)
 - Over 4,000 credits to date (HERS average ~54/55)
- Commercial:
 1. LEED Silver, Platinum, or Gold
 2. Modeled energy reduction of 60% vs. national average (EPA Target Finder)
 3. Enhanced commissioning (and exploring operational tracking)
 - \$1 million annual cap (2014, 2015, 2016)



New Mexico Sustainable Buildings Tax Credit



Commercial 2013:

- 2 Macy's
- 1 Church
- 3 Offices
- 1 hotel
- 9-10
multifamily

[Link to
program
details and
tiers](#)

Hotel Clovis: 1930-era hotel turned apartments and commercial space (Clovis, NM) – had been abandoned

Colorado Energy Saving Mortgage Incentive

- [HB 13-1105](#) – June 2013
- Grew out of previous ENERGY STAR New Homes program and Architecture 2030 research
- Administered by Colorado Energy Office (CEO)
- Provides tiered mortgage incentives for both new & existing (e.g. refinance) homes
- Homebuyers select “energy package”
- Secondary goal of **training mortgage lenders/brokers**
- CEO providing building science/sales training



New Town Builders Zero Energy Home

Colorado Mortgage Incentives

Incentive structure (“energy package”)

| New Homes HERS | Mortgage Incentive |
|----------------|--------------------|
| 50 – 40 | \$1,000 |
| 39 – 25 | \$2,500 |
| 24 – 11 | \$3,000 |
| 10 and below | \$8,000 |

[Link to program details and tiers for existing buildings](#)

- **Non-state match** of mortgage balance required: .5% for existing homes; .6% for new homes
 - Can come from lender, builder, realtor, etc.
 - \$300,000 new-home mortgage: state - \$6,200; match - \$1,800
- Approx. 300 mortgages ready to be reserved (~80% new construction)

Executive Orders/Governor Action

■ Executive Orders:

■ California Governor Brown Executive Order B-18-12:

- All new state buildings and major renovations starting design in 2025 shall be ZNE; 50% of new state facilities beginning design after 2020 shall be ZNE

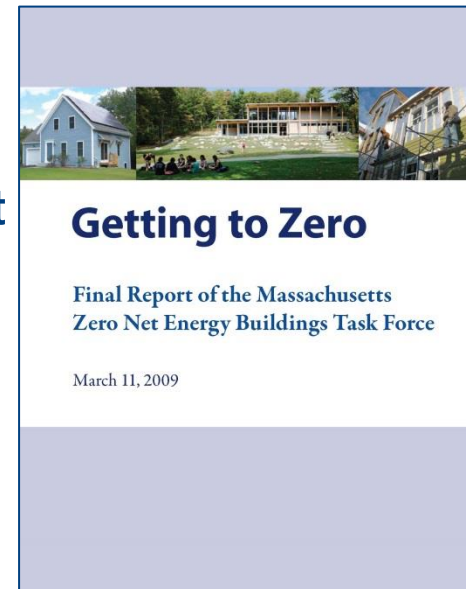
■ New Mexico: Governor Richardson Executive Order 2009-002 “Clean Energy State”

■ Governor Action:

■ Governor Patrick formed the Massachusetts Zero Net Energy Buildings Task Force

- Final report contained 44 recommendations for advancing on path toward ZNE buildings

Links to more info on [CA](#) and [MA](#)



Catalyzing the Schools Sector

- Maryland Energy Administration awarded \$9 million as part of utility merger to design and build 3 ZNE public schools
 - 2 counties have been chosen: Howard County and Baltimore City
 - Funds will provide design assistance and pay for “incremental cost”
- Kentucky: Home of two verified ZNE schools and one ZNE Emerging school (Turkey Foot Middle School)



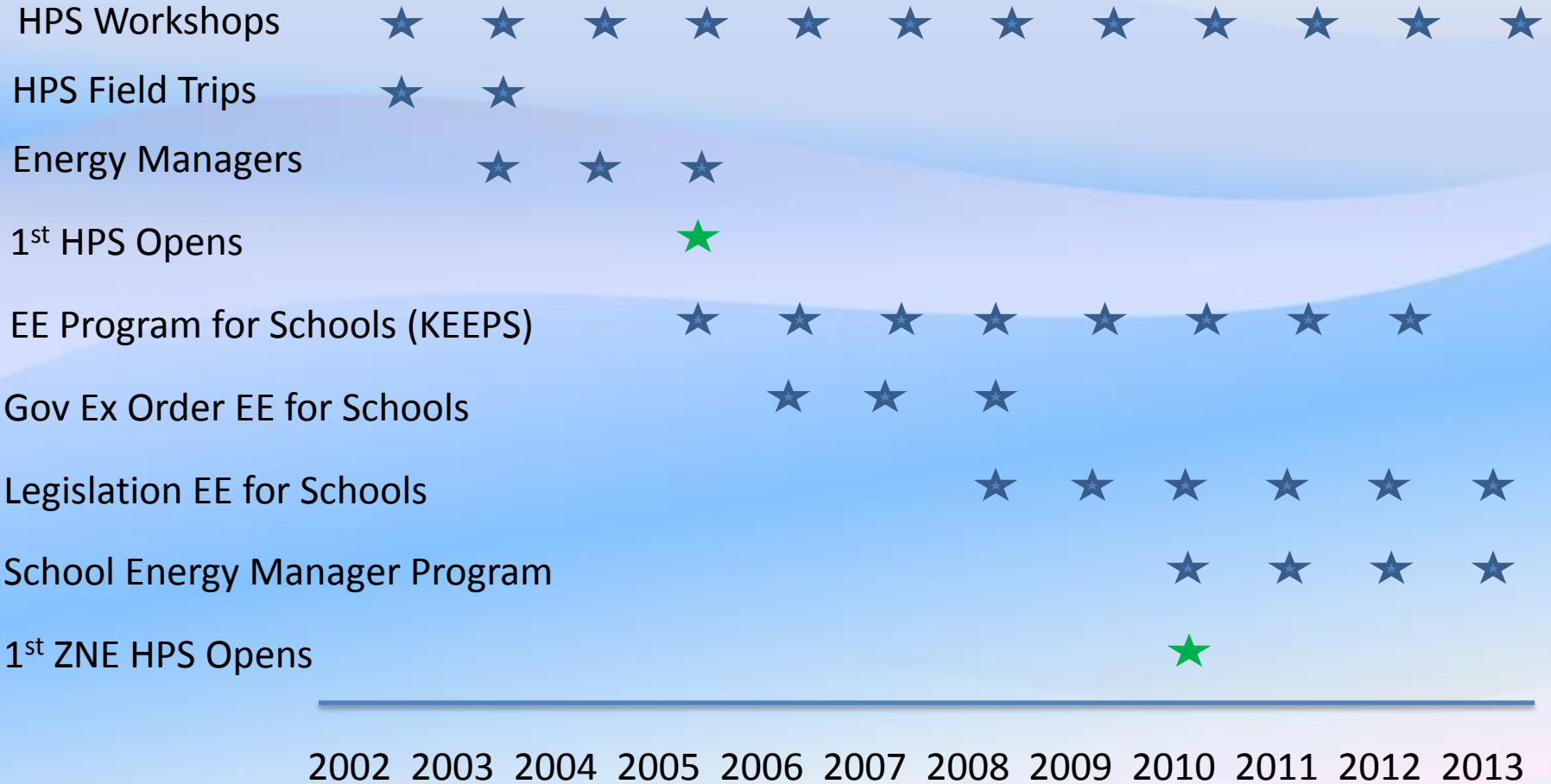
Locust Trace AgriScience High School Campus



Richardsville Elementary

Kentucky's High Performance School (HPS) Journey

"Our Path"

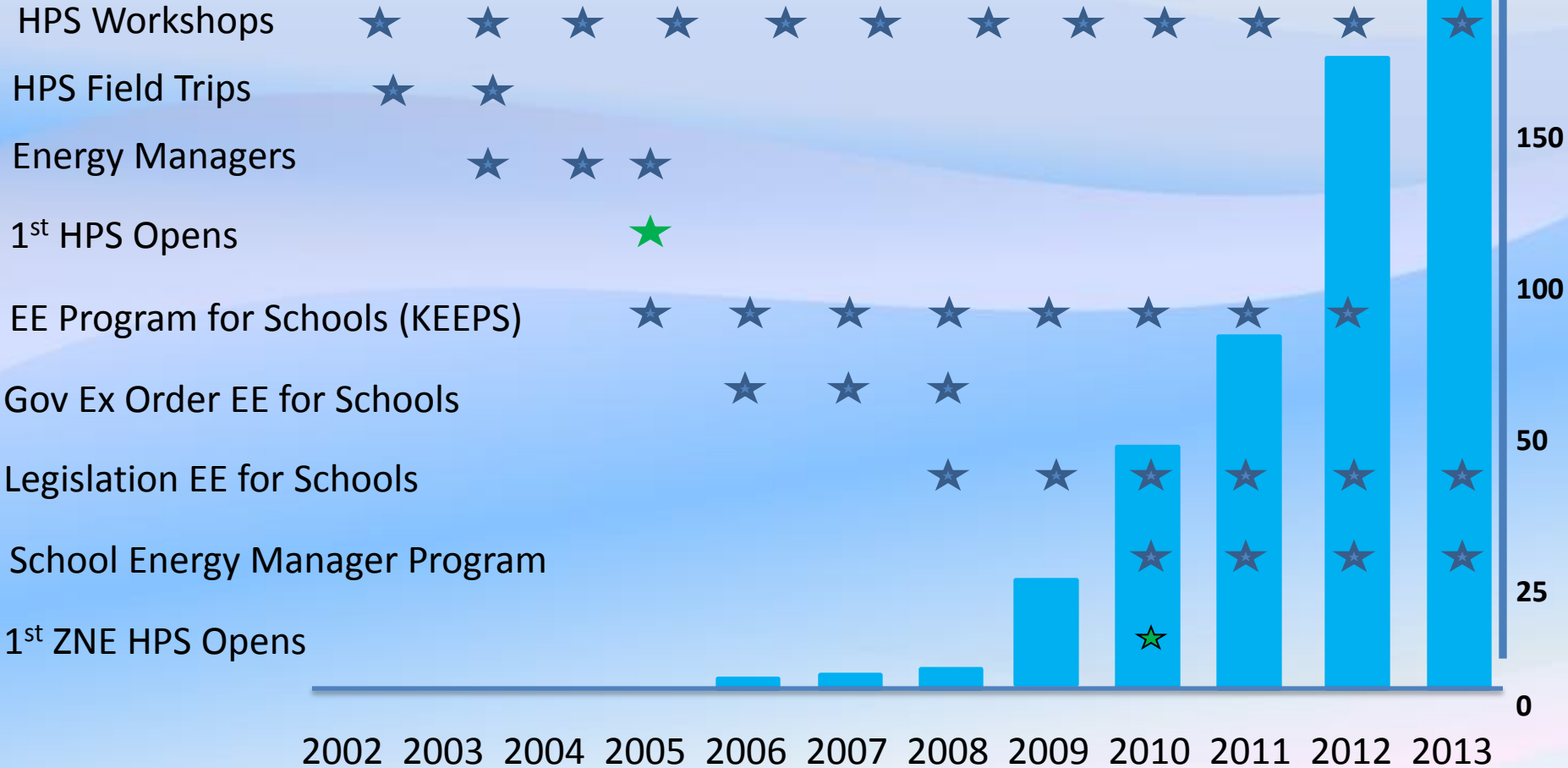


[Full KY DEDI presentation](#)



Kentucky's High Performance School (HPS) Journey

"Our Path"



[Kentucky schools program website](#); [CMTA presentation on KY Schools](#)



Trends and Opportunities

1. States are utilizing ZNE as part of **market transformation** efforts that can have wider impact on energy efficiency
2. Energy Offices can leverage convening power and implement successful policies/programs over time
3. Demonstration projects are a key first step
4. Other policies (e.g. benchmarking) help support path to ZNE
5. Progress is incremental: need to meet stakeholders where they are
6. Partnerships, education, and persistence are key



Path to Net Zero Energy Buildings

State of Minnesota



Janet Streff Minnesota Department of Commerce

Tom McDougall The Weidt Group



Path to Net Zero Energy Buildings

State of Minnesota



- Minnesota's journey to NZE has been a long and winding road, called B3 which stands for Buildings, Benchmarks & Beyond
- Journey—mapped by Legislature—financed through utility assessments
 - \$500K/yr for Guideline and Benchmarking tool maintenance and improvements
 - \$500K/yr for SB2030 development and continued training and education
- Utilities also required to integrate its conservation programs (Energy Design Assistance) with these programs
- Initial team chosen in 2004 for development of tools —UMN's Center for Sustainable Building Research, The Weidt Group and LHB Architects—has remained in place, contributing to ongoing success of project



Timeline to Net Zero Energy Buildings

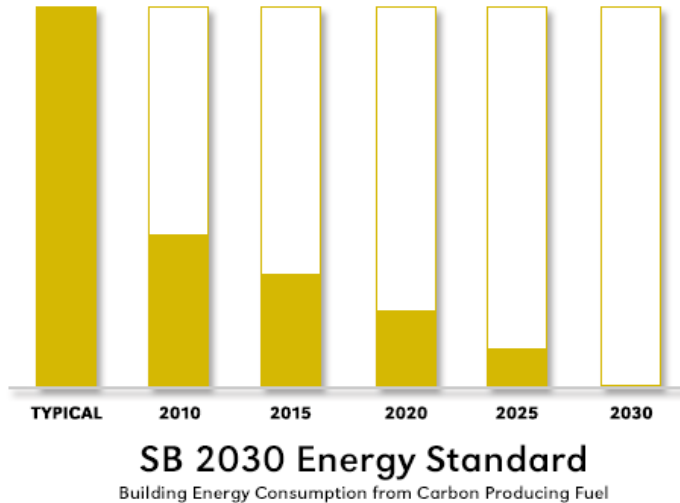
State of Minnesota



- 1998: Hennepin County (Minneapolis) Sustainable Building Guidelines developed
- 2001: State required all public buildings to be benchmarked and that all projects using state bond funds must use Minnesota Sustainable Building Guidelines
- 2004: B3 Benchmarking tool and B3 Minnesota Sustainable Building Guidelines (MSBG) launched
- 2008: Sustainable Building 2030 (SB2030) passed, requiring all public buildings receiving bond funds to integrate SB2030 Energy Standard into design
- 2009: SB2030 Energy Standard inserted into B3 Sustainable Building Guidelines



Sustainable Buildings 2030



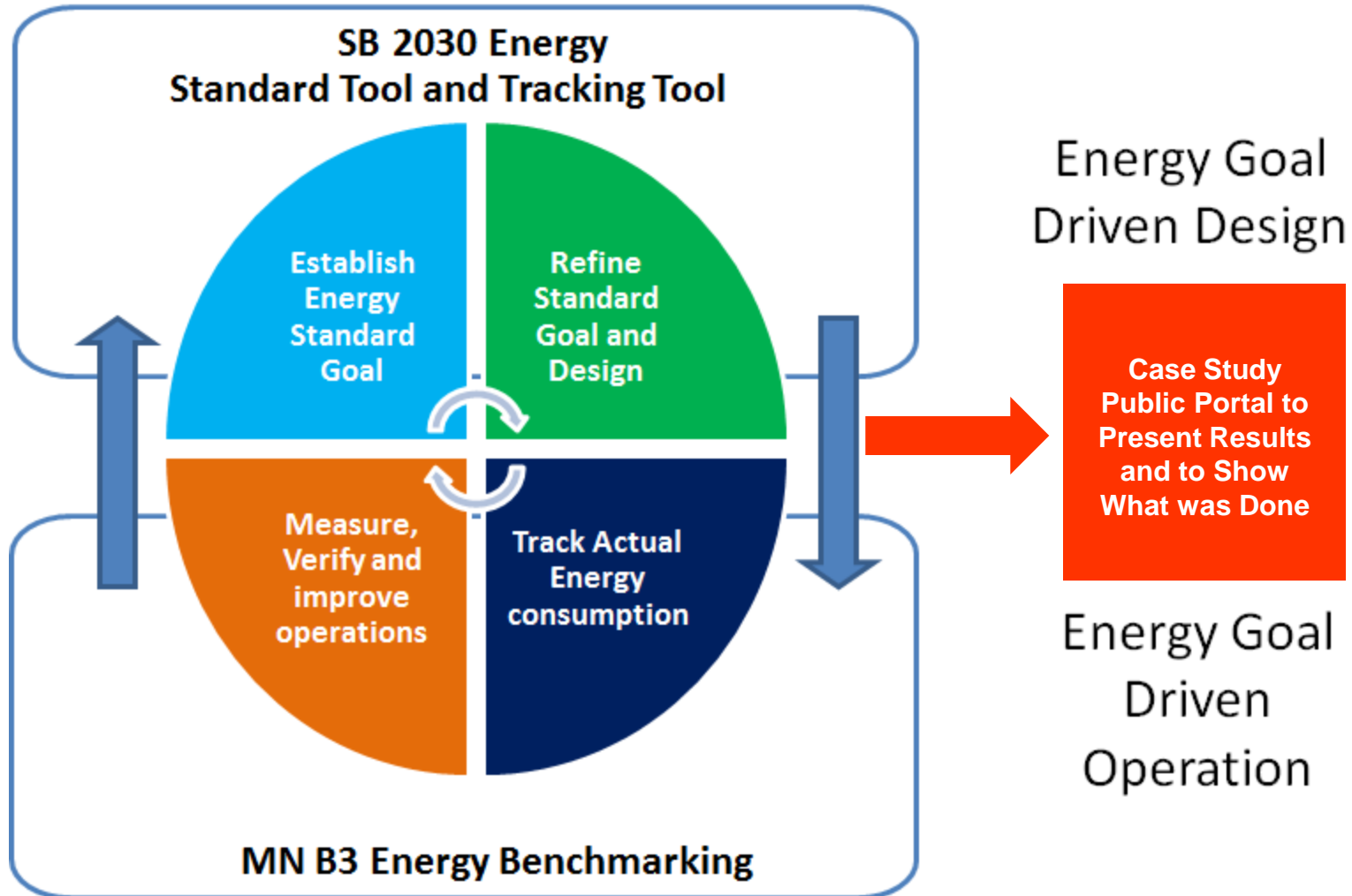
■ Purpose

- The purpose of SB2030 is to establish cost-effective energy efficiency performance standards for new and substantially reconstructed commercial and institutional buildings, meeting the goals of the Architecture 2030 program to achieve Net Zero Energy Buildings.

■ Legislatively Required Elements

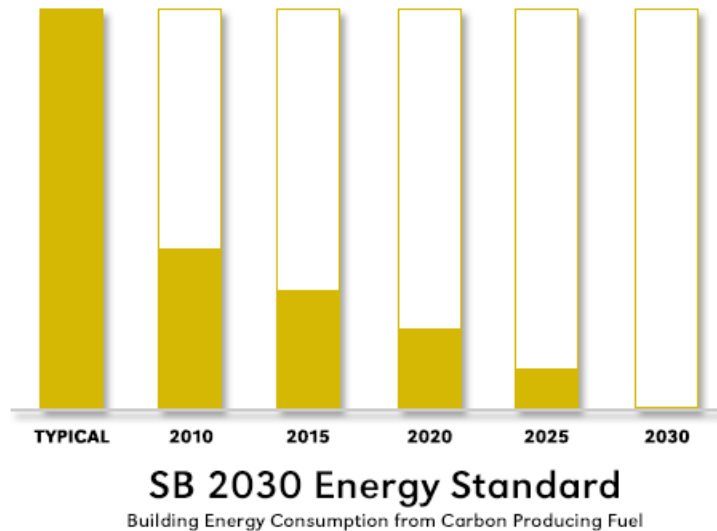
- Develop a program for setting SB2030 Energy Standard targets and meeting them in design
- Assist in development of utility incentive programs incorporating the SB2030 program
- Develop case study database and track building performance
- Deliver training program for design professionals
- Develop an energy efficient operations program

Influencing Building Performance During Design and Ongoing Operations



Sustainable Buildings 2030

Program Elements – 5 Steps

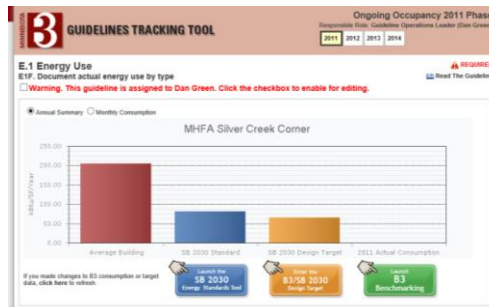
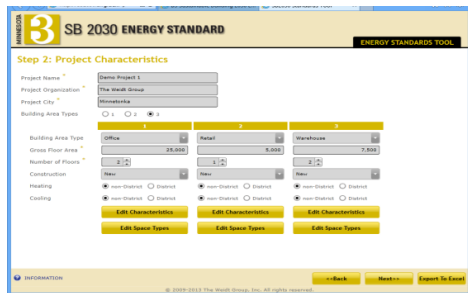


1. Set Arch 2030 EUI design goal based on custom project program characteristics
2. Track design team energy performance and implementation strategies through design phases
3. Verify design model characteristics with design goal characteristics
4. Track ongoing actual energy consumption and compare to design target on a monthly basis
5. Disclose building results, label, performance and the strategies implemented by project in a case study posted on public website



How the Program Works

- Uses a web-based workflow tool that makes all building owners and design teams accountable for the projects' performance
- Establishes a custom energy target for specific building program parameters and climate location
- Set Target by Building Program and Climate
- Enter Design Performance and Strategies
- Track Actual Energy and Compare to Target



Impact of B3 Programs



- B3 Guidelines
 - 258 projects in B3 Guidelines (including SB2030 projects)



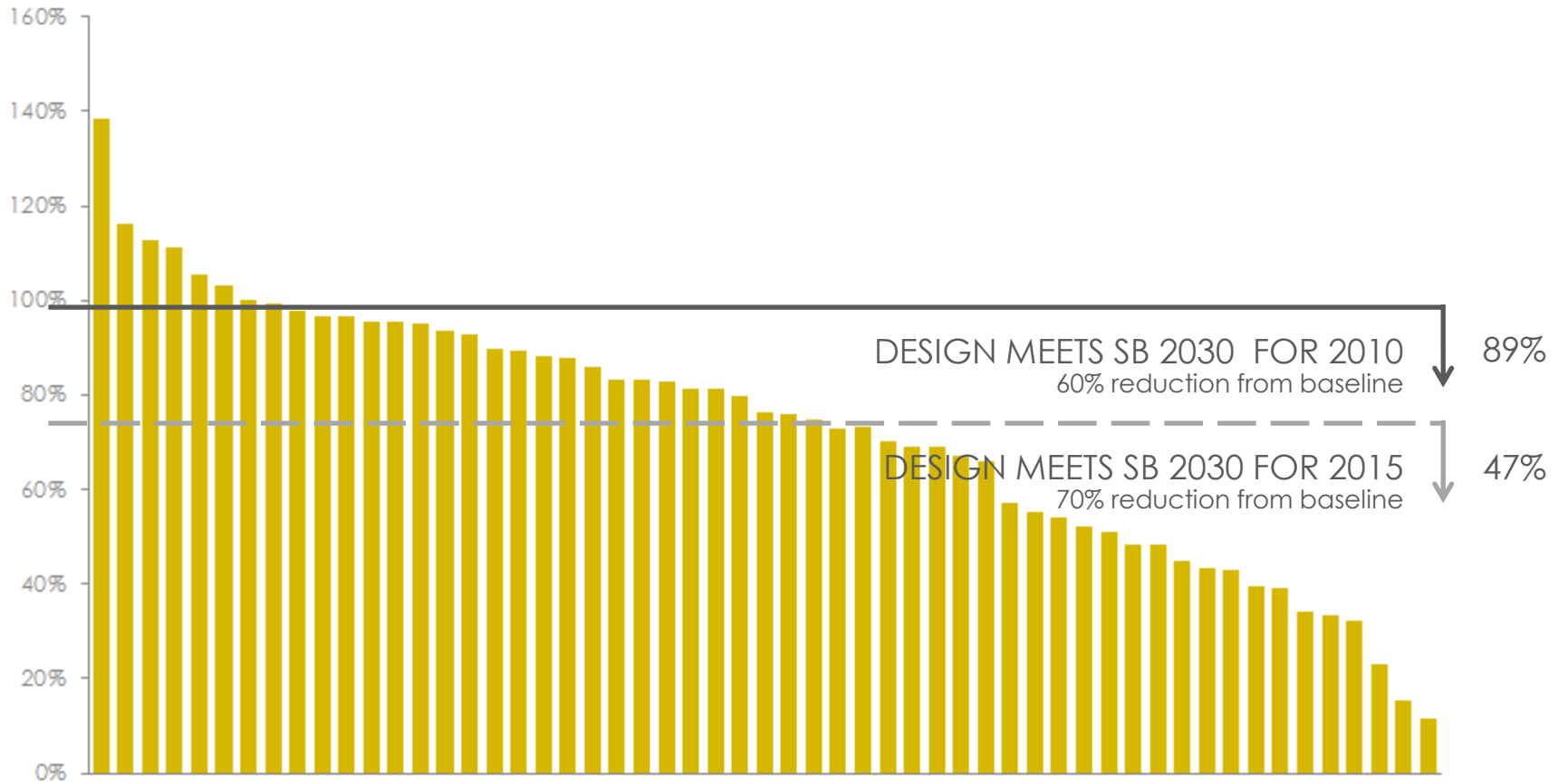
- SB2030 Program
 - 40 buildings from 2009-2012 (now over 70)
 - Savings of 250 million kBtus/year
 - Savings of \$3.25 million per year



- B3 Benchmarking from 2004
 - Over 7,500 buildings representing over 300 million SF in program
 - Identified over 1,500 building candidates for improvement
 - Potential Savings of 23 million dollars per year identified

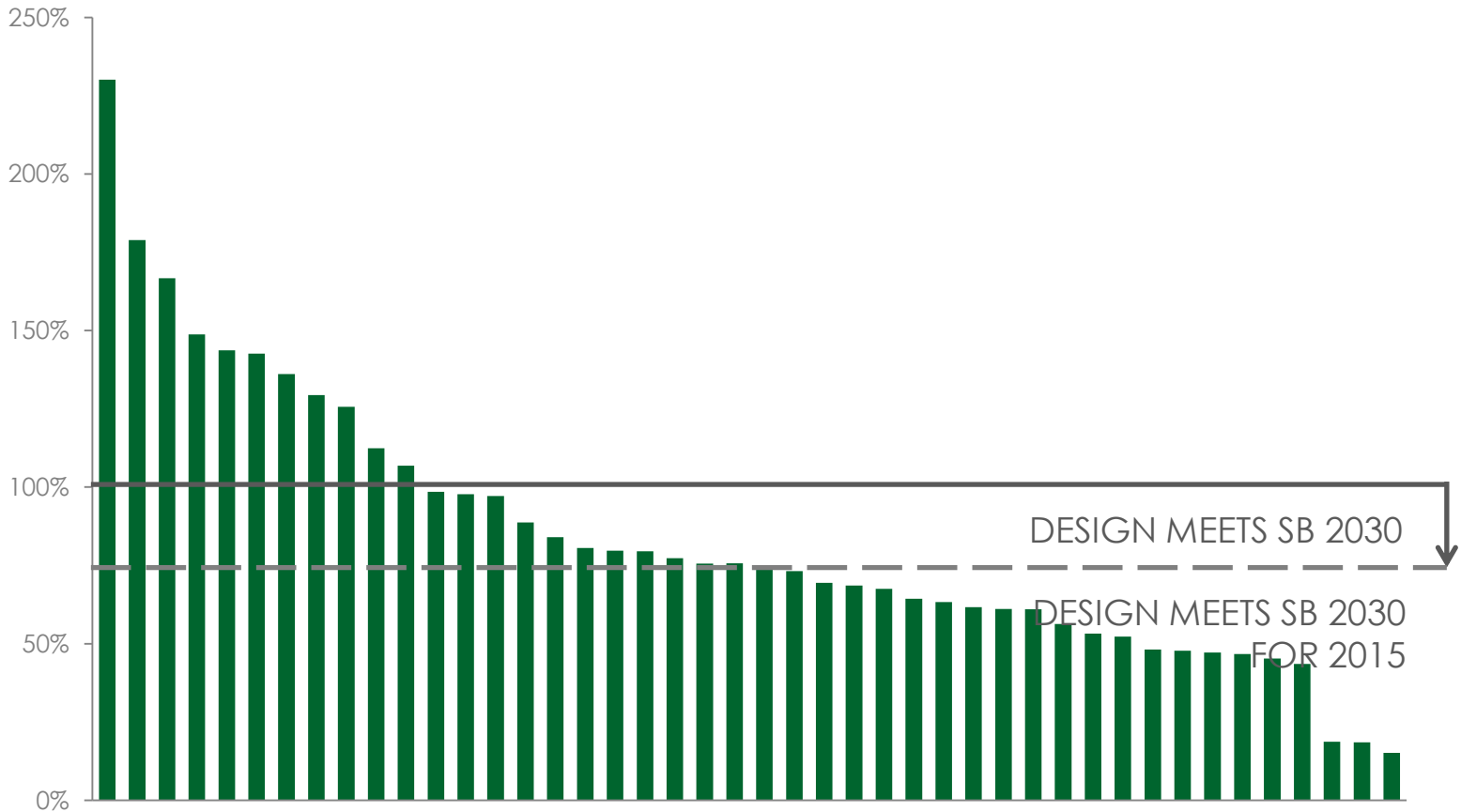


Building Performance



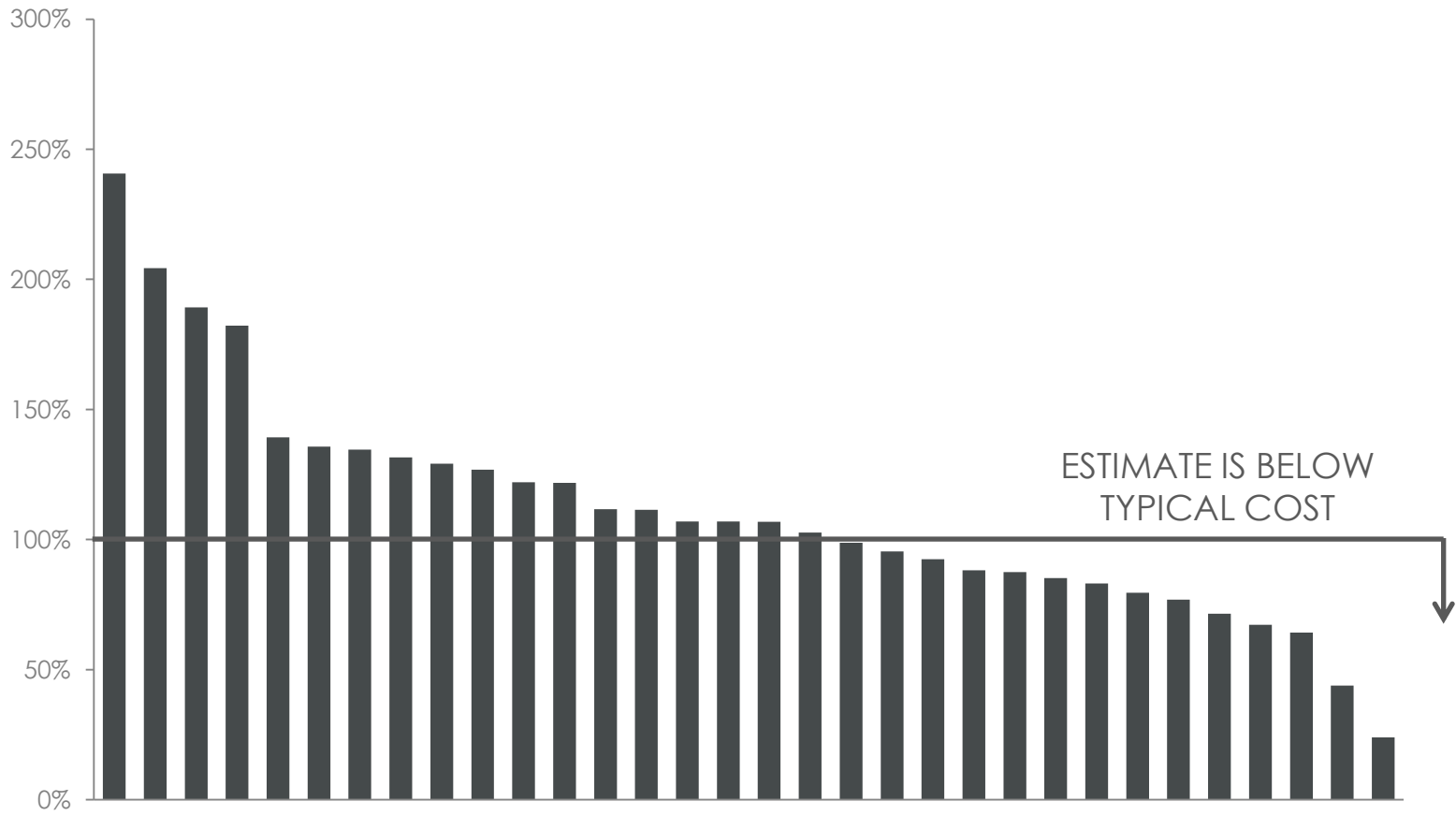
Results

Carbon Dioxide Equivalents



Results

Construction Costs



SB 2030 On-Going Label

MINNESOTA **3** SB 2030 ENERGY STANDARD

Silver Creek Corner
Rochester, MN



Case Study Database

Public Disclosure and Education

MINNESOTA B3 CASE STUDIES DATABASE

Search for a project by name

Case Studies Home Contact

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

Organization: (All Organizations)

Building Type: (All Buildings)

Choose Specific Strategies

- Energy & Greenhouse Gas
 - Appliances
 - Domestic Hot Water
 - 95% or greater DHW Effic
 - Heat Pump DHW Heating
 - Recirculating Hot Water P
 - Envelope / Insulation
 - HVAC
 - Lighting
 - Massing

Search

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.

Tile View Card View Table View (Energy) Table View (Compliance)

Showing 43 projects

- BEAR HEAD LAKE TRAIL CENTER
- CRYSTAL SPRINGS HATCHERY MANAGER'S RESIDENCE
- ITASCA BIOLOGICAL FIELD STATION
- JACKSON
- CAMP RIPLEY EDUCATION CENTER

Case Study Database

Public Disclosure and Education

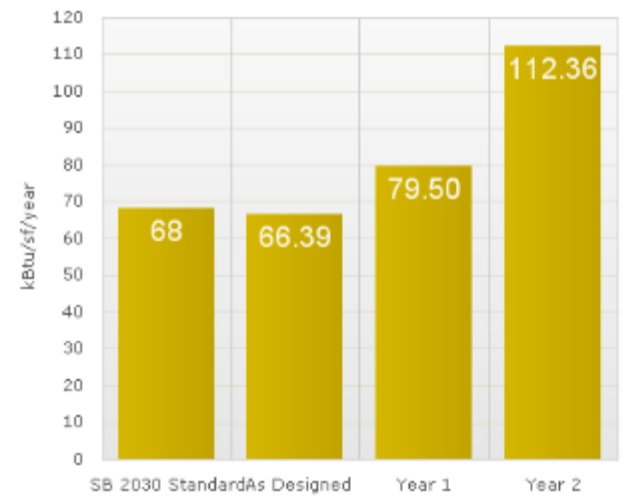
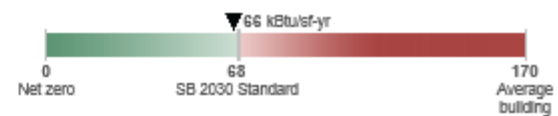


Silver Creek Corner
 Minnesota Housing Finance Agency
 21xx Silver Creek Road
 Rochester, MN

- General
- Process
- Energy**
- Carbon
- Water
- Stormwater
- Materials
- Cost

ENERGY CONSUMPTION

The project team opted to connect the building to the campus steam heating system for maximum efficiency.



This graph shows the project's energy use intensity (EUI), measured in kilo (1,000) British Thermal Units per square foot per year (kBtu/sf/year). It shows the project-specific SB 2030 Energy Standard (which is 60% less than a typical building), the predicted EUI from the project's energy model, and the actual annual EUI from meter readings.

ENERGY STRATEGIES

- APPLIANCES**
 - All Available Appliances Energy Star Certified
- ENVELOPE / INSULATION**
 - R-20 to R-30 Wall Insulation (for Opaque Walls)
 - R-40 to R-50 Roof Insulation
- HVAC**
 - District Heating
 - Economizer
 - Natural Ventilation
- LIGHTING**
 - Continuous Daylighting Controls
 - LED Lighting
 - Occupancy or Vacancy Sensors
 - Stepped Daylighting Controls
- MASSING**
 - Majority of Windows are North / South
- OPERATIONS**

Buildings, Benchmarks & Beyond

The B3 tools and programs are designed to help make buildings more energy efficient and sustainable. The B3 programs have been developed for and are required on State-funded projects in Minnesota, however they are easily applied to any project. The B3 Guidelines and the SB 2030 Energy Standard can be applied to new and renovated buildings during design. B3 Benchmarking, B3 Energy Efficient Operations and the B3 Post Occupancy Evaluation (POE) can be used to evaluate and improve existing buildings.

Design of New Buildings and Renovations



GUIDELINES

Use **B3 Guidelines** on new buildings or renovations to meet sustainability goals for site, water, energy, indoor environment, materials and waste.



SB 2030 ENERGY STANDARD

Use the **SB 2030 Energy Standard** to meet energy use goals only. If the B3 Guidelines are used, the SB2030 Energy Standard is automatically included in the process.

Operation of Existing Buildings



BENCHMARKING

Use **B3 Benchmarking** to track and compare energy use on existing buildings. The B3 Guidelines and SB2030 Energy Standard direct the user to the B3 Benchmarking tool.



ENERGY EFFICIENT OPERATIONS

Use **B3 Energy Efficient Operations** to minimize energy use during building operations. This program can be applied to any existing building.



POST-OCCUPANCY EVALUATION

Use **B3 Post Occupancy Evaluation (POE)** to determine occupants' perceptions of the buildings' indoor environmental quality. The POE survey is required for B3 buildings.

WELCOME

We have a new web site and graphic design to make it easier to understand and use the B3 tools and programs. Use the buttons on the left to access all of the major program components. The footer on every page of the web site also contains links to the programs as well as the B3 Case Studies and other background information.

B3 CASE STUDIES

The **B3 Case Study Database** provides design and performance information on projects using the B3 Guidelines and the SB2030 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 SB2030 Label indicating the projects Energy Use Intensity (EUI) during design and actual performance.

CONTACT US

If you have any questions or suggestions for improvements, please contact us.

B3 Program Overall

Patrick Smith, smit2059@umn.edu

B3 Guidelines

Patrick Smith, smit2059@umn.edu

B3 SB 2030 Energy Standard

Patrick Smith, smit2059@umn.edu

ZNE for Policymakers & Local Governments



A ZNE building produces as much energy as it consumes over the course of a year

Advancing ZNE policy means advancing economic development, energy leadership, ingenuity, and resilience. Planning for a ZNE future creates practical and achievable energy solutions for residents, and economic and environmental benefits for a city itself.

ZNE Policy Provides Multiple Benefits

Jobs, Skills, & Economic Development

- Local jobs and tax growth from more local construction
- Higher quality building stock that helps property values
 - Skill development and career opportunities for residents
 - Attract to companies that provide ZNE-related products and services
 - Create opportunities for a thriving clean energy industry with products that can be exported worldwide

Energy Independence & Local Resiliency

- Meet energy needs locally, achieve reach codes and sustainability goals
- Local communities become stronger and more resilient in severe weather events and natural disasters
- Increased stability of budgets and protection from uncertainty of changing energy costs.

Health & Productivity

- Supports healthier environments and higher productivity with reduced net monthly costs
- Create schools and public buildings with lower operating costs allowing the savings to be used for needed services and programs



A new 200,000 sq ft Public Safety Building is designed to achieve ZNE. Bonds funding for construction was approved by more than 65% of voters.

page 1 of 2

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States, cities and municipalities across the country are integrating zero-net energy building into energy policies, codes and standards.

Policymakers are using ZNE as a way to bring public buildings into the 21st century and put money back into classrooms.



Q and A

Please type questions into the comment box



NBI Resources: ZNE CA Communications Toolkit



Zero Net Energy (ZNE) MESSAGE

Zero net energy (ZNE) buildings are designed to produce as much energy as they consume over the course of a year. ZNE buildings are designed to be environmentally friendly, have low energy consumption, and are designed to be cost-effective. They are designed to be sustainable and to provide a high quality of life for their occupants.

ZNE Communication This Message Platform supplements the ZNE Message Platform by providing a way to help define ZNE to a wider audience.

energy upgrade COMMUNITY

ZNE for Policymakers & Local Governments

zeronetenergy

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Policymakers are using ZNE as a way to bring public buildings into the 21st century and put money back into classrooms.



A state-of-the-art City of Phoenix building is designed to achieve ZNE. Zero building for demonstration approved by local government.

page 1 of 2

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Getting to ZNE

1 DESIGN PROCESS

Addressing systems through integrated design.



2 TECHNOLOGIES

Daylight
Lighting
HVAC
Renewable

Why Should Building Owners Go ZNE?



The Exploratorium in San Francisco. The largest museum with a ZNE goal.

When committing to a high efficiency building, ZNE is the best business decision and adds the most value.



- Reduce
- Leverage
- Decrease

Leading by Example

Bacon St. Offices



- Former auto-repair shop turned architect's office.
- 1st commercial bldg. in SD to achieve ZNE usage.
- Monitoring system tracks the actual use of building systems, and 'real world' data for educating others.
- All electrical systems designed to reduce energy loads by over 42,000 kWh per year.
- Remaining energy is offset by renewable electrical and water heating energy located on the roof top.



ZNE Architecture & Engineering

zeronetenergy

A ZNE building produces as much energy as it consumes over the course of a year

The Value of ZNE

As a sustainable design process, ZNE is commonly accepted by communities, designers, and owners, providing a clear path to a more sustainable future. Demonstrating the exact performance targets and technology applications to achieve this goal. This is your year to lead and your clients.

Recognizing ZNE and preparing for future building codes that continues to raise energy efficiency levels and embrace of the State will adopt the 241 in 2014 for all new and existing commercial buildings.

Benefits of Design

Investment in ZNE practices and technologies creates local jobs and new products that can be exported worldwide, strengthens local economies, and helps us gain control of our energy future.

Q1 WHAT IS A ZERO NET ENERGY BUILDING?

A zero net energy building produces as much energy as it consumes over the course of a year. These buildings achieve ZNE that through high levels of energy efficiency, and then through the addition of on-site renewable power generation.

Q2 ARE ZNE BUILDINGS FEASIBLE?

Yes. While the market share of ZNE buildings is still small, there are numerous examples around the country, built by a variety of design teams and developers, across many different residential and commercial building types.

Q3 WHAT ARE THE BENEFITS OF ZNE BUILDINGS?

ZNE buildings and homes are higher performing, offering superior comfort and healthier spaces to work and live. Because ZNE buildings use passive strategies such as natural ventilation and daylighting, they are more resilient to the impacts of climate change, they are also less vulnerable to the instability of energy prices.

California homeowners and businesses will pay less for energy—money they can spend to grow their company or pay for necessities.

ZNE Frequently Asked Questions

zeronetenergy

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Investment in ZNE practices and technologies creates local jobs and new products that can be exported worldwide, strengthens local economies, and helps us gain control of our energy future.

Pursuit of ZNE means California's economy will be stronger and we will continue to lead the rest of the nation in clean energy.

Energy efficiency improvements in design and operations substantially reduce the costs and environmental impacts associated with buildings. The energy used in buildings is the second largest contributor to California's greenhouse gas (GHG) emissions.

ZNE buildings are an important strategy to help reduce GHG emissions to 1990 levels by 2020, a requirement of California's Global Warming Solutions Act of 2006. With rising energy costs, and increasing climate-related impacts and natural disasters, ZNE buildings help reduce our demand for energy and provide more resilience to climate impacts.

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Sample Presentation

Fact Sheets

Message Platform & ZNE for Policymakers

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ZNE ACTION BULLETIN
Progress Towards Zero Net Energy Buildings

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