ZNE and High Performance – The Perfect Partnership for Schools

COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS
Better buildings. Better students.

Stephany Mason, Technical Director / Program Manager, Collaborative for High Performance Schools (CHPS)
Heather Flint Chatto, ZNE Project Manager, New Buildings Institute (NBI)
John Balfe, High Performance Buildings Associate, Northeast Energy Efficiency Partnerships (NEEP)
Sean O'Donnell, Principal, Perkins Eastman

What is ZNE????

ZNE = Zero Net Energy

NZE = Net Zero Energy

ZEB = Zero Energy Building

Carbon Neutral*

.

.

.

From DOE:

“produces enough renewable energy to meet its own annual energy consumption requirements”

* Uses no Fossil Fuel Greenhouse Gas Emitting Energy to Operate

The 2030 Challenge

"All new buildings, developments, and major renovations shall be carbon-neutral by 2030"

What is High Performance????

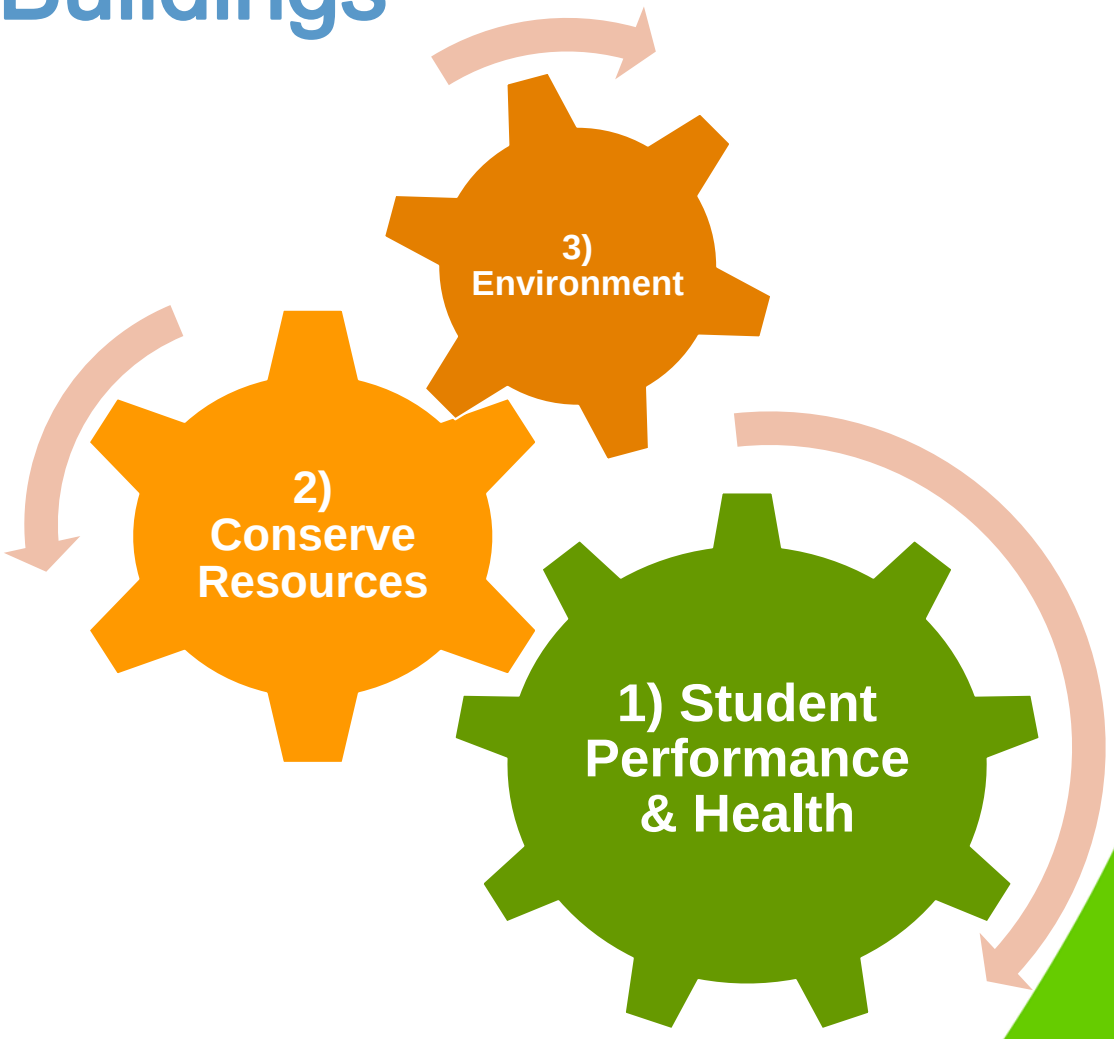
Aka: Sustainable, Green…

From EPA:
“High performance schools are energy and resource efficient”

From NIBS:
“a building that integrates and optimizes all major high-performance building attributes, including energy efficiency, durability, life-cycle performance, and occupant productivity”

From CHPS – High Performance Buildings

1. Protect student and staff health and enhance the learning environment
2. Conserve energy, water and other resources thereby reducing operating costs
3. Minimize waste, pollution and environmental degradation



Green Schools Initiatives/Missions

- USGBC - **green schools** for everyone within this generation

- CHPS – make every school an ideal place to learn; working towards the day when a green, healthy school is simply called a school

ZNE

High Performance

The Three Pillars

Reduced Environmental Impact and Costs

Improved Health and Wellness

Effective Environmental and Sustainability Education

High Performance and ZNE

CHPS CRITERIA

Design:

- Integration – 8.5%
- Indoor Environmental Quality – 33%
- Energy – 25%
- Water – 8%
- Site – 9.5%
- Materials & Waste Management – 8.5%
- Operations & Metrics – 7.5%

CHPS CRITERIA: ENERGY

Design Toward Zero Net Energy (ZNE)

- Energy Prerequisite
- Superior Energy Performance
- ZNE Bonus
  - ZNE Ready
  - ZNE Capable
  - ZNE (Innovation)

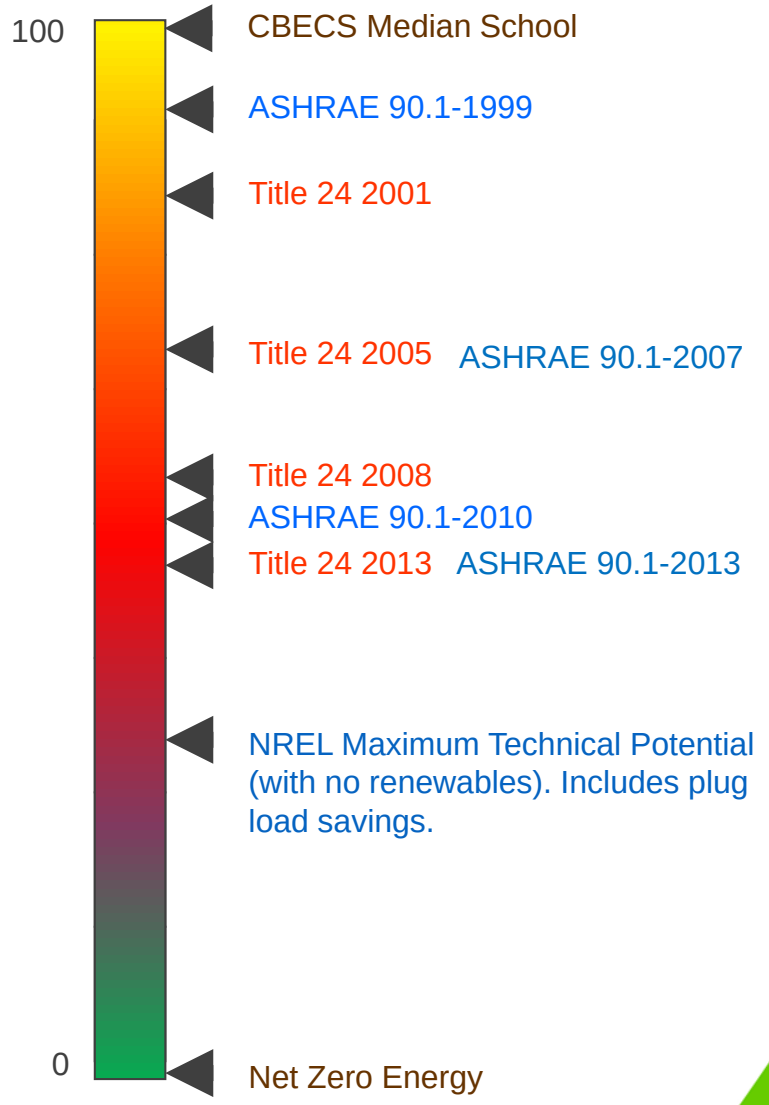
East Bay Met, Newport, RI

DESIGN TOWARD ZNE

zEPI Scale

Moving down the scale can be achieved by:

- Code compliance
- More efficient
  - Windows
  - HVAC
  - Lighting
- Integrated design
  - Daylighting
  - Natural ventilation
- Plug load reductions
- Renewables



High Performance -> ZNE

- Integration=2
  - ZNE Bonus=2
- IEQ=29
- Energy=12
  - Sup EE=40
  - ZNE Capable=2
- Water=3
- Site=3
- Materials=4
- O&M=4
- TOTAL=101 of 110 needed points

Getting to Zero Net Energy in Schools

Green Schools Conference
Pittsburg, PA

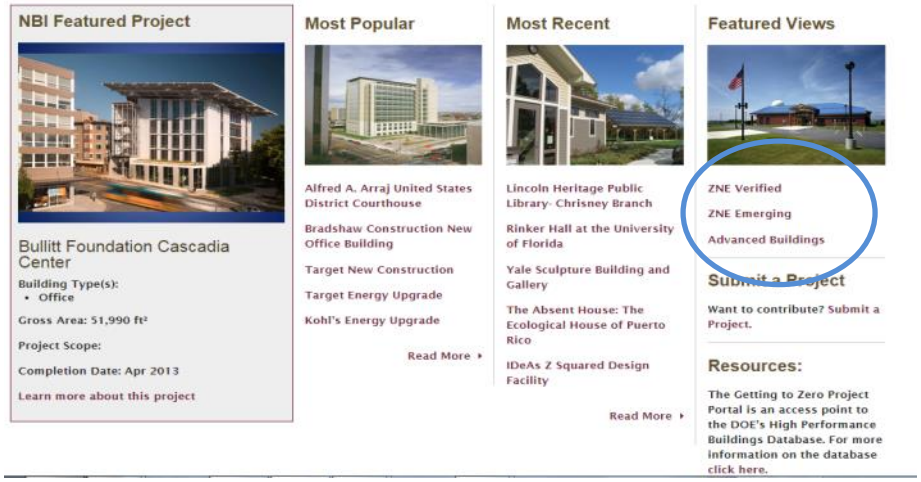
April 1, 2016

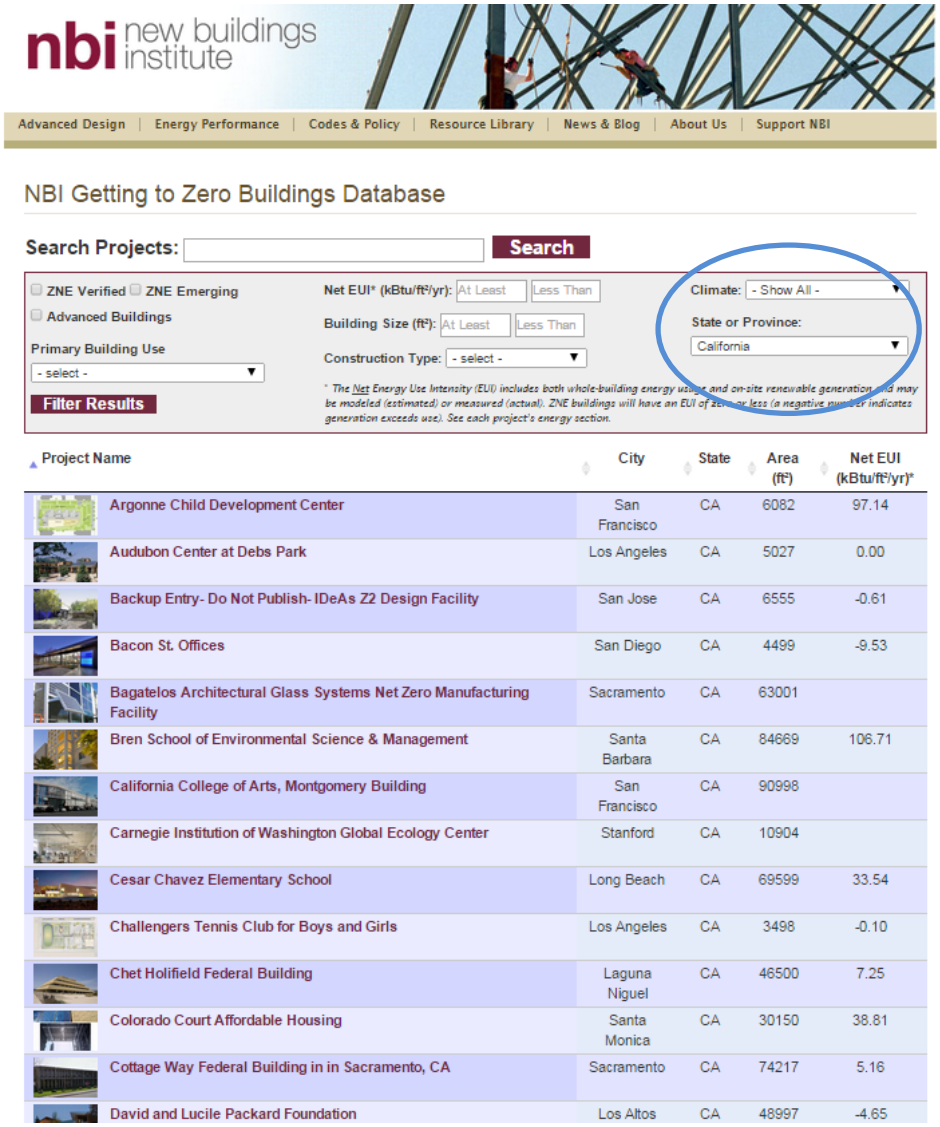
Heather Flint Chatto
ZNE Project Manager
New Buildings Institute

nbi new buildings institute

GETTING TO zero BUILDINGS DATABASE

New Buildings Institute is proud to introduce our Getting to Zero Buildings Database.

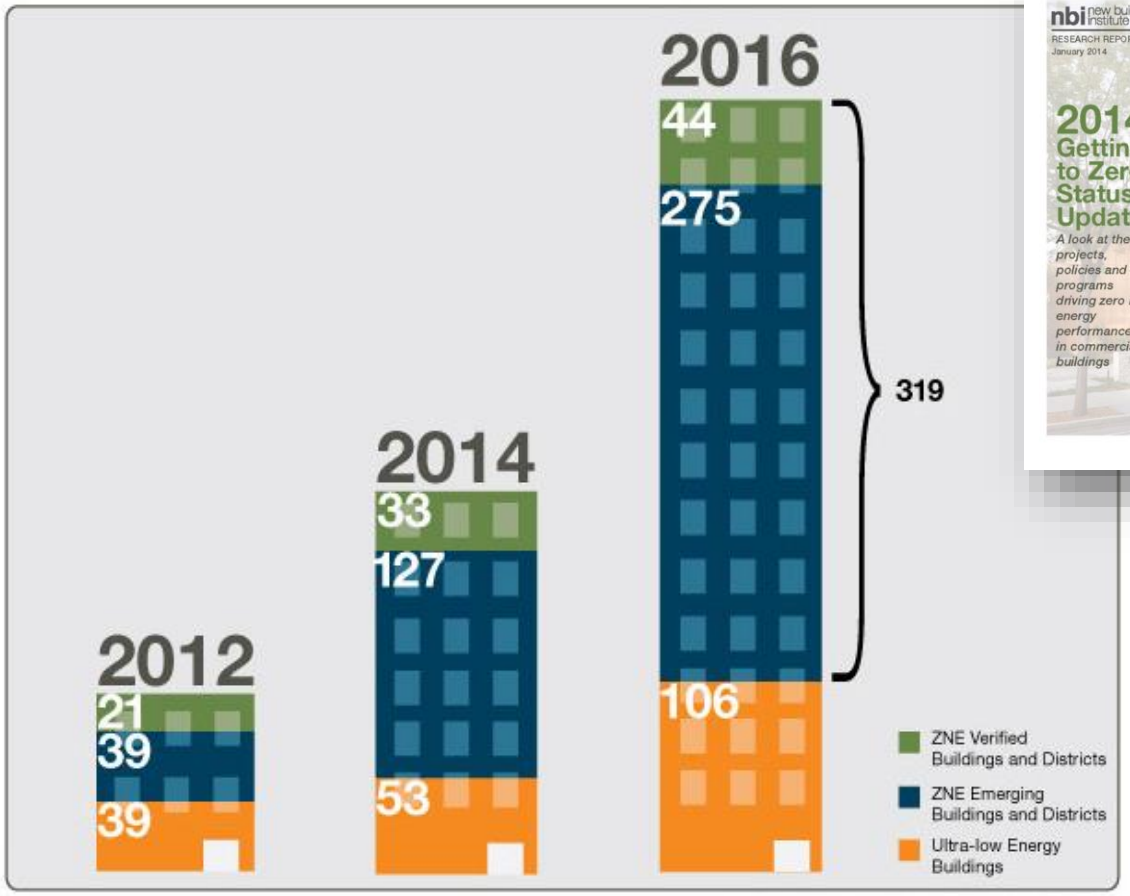




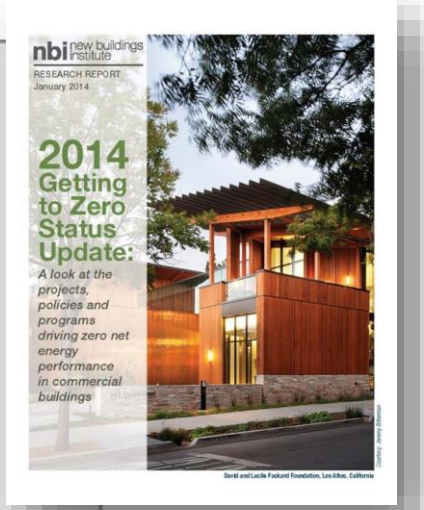
The largest database on ZNE buildings in North America and the only database searchable by ZNE Status & Energy Performance

http://newbuildings.org/getting-to-zero-buildings-database

Zero Energy Buildings



Courtesy of New Buildings Institute | newbuildings.org



zero net energy

40 States with ZNE Buildings

nbi new buildings institute

2015 List of Zero Energy Buildings

In 2011 and 2013 NBI conducted research to identify buildings with targets or actual outcomes of net zero energy. These results were published in "ZNE Status Reports" by NBI in early 2012 and 2014. NBI continues to track and document buildings with low and zero energy to support the market and policy interest in this data. This 2015 list of buildings is an interim count based on this ongoing work.

Verified Zero Energy Buildings (or Districts) are those with greatly reduced energy loads that have been documented to have met, over the course of a year, all net energy use through onsite renewable sources of energy. The energy use of all fuels (electric, natural gas, steam, etc.) is counted and offset. ***Buildings new to the list are in bold italics.***

Verified Zero Energy Buildings

Year Completed	Name	Location	State	Building Type	Size (sf)	Total Building Actual EUI	Site Renewable EUI	Net Building EUI*
2000	Oberlin College Lewis Center	Oberlin	OH	Education- higher	13,600	32	36	-4
2001	Environmental Technology Center Sonoma State	Rohnert Park	CA	Education- higher	2,200	3	4	-1
2002	Challengers Tennis Club	Los Angeles	CA	Other	3,500	9	9	0
	Leslie Shao-Ming Sun Field Station	Woodside	CA	Education- higher	13,200	4	6	-2
2003	Audubon Center at Debs Park	E Los Angeles	CA	Other	5,020	17	17	0
	Science House	St. Paul	MN	Other	1,532	18	18	0
2005	Hawaii Gateway Energy Center	Kailua-Kona	HI	Other	5,600	28	31	-3
2007	Aldo Leopold Legacy Center	Baraboo	WI	Office	11,884	16	18	-2
	IDeAs Z2 Design Facility[L]	San Jose	CA	Office[R]	6,557	21	25	-4
2008	Camden Friends Meeting Social Hall	Camden	DE	Public Assembly	2,864	18	20	-2
	Environmental Nature Center	Newport Beach	CA	Other	8,535	18	28	-10
	Hudson Valley Clean Energy Headquarters	Rhinebeck	NY	Other	5,470	13	13	0
2009	Bacon Street Offices	San Diego	CA	Office[R]	4,500	13	22	-9
	Chrisney Library	Chrisney	IN	Library	2,400	15	18	-3
	Living Learning Center at Tyson Research Center[L]	Eureka	MO	Education- higher	2,968	24	24	0
	Omega Center for Sustainable Living[L]	Rhinebeck	NY	Laboratory	6,200	13	21	-8
	Pringle Creek Painter's Hall[L]	Salem	OR	Public Assembly[R]	3,600	21	21	0

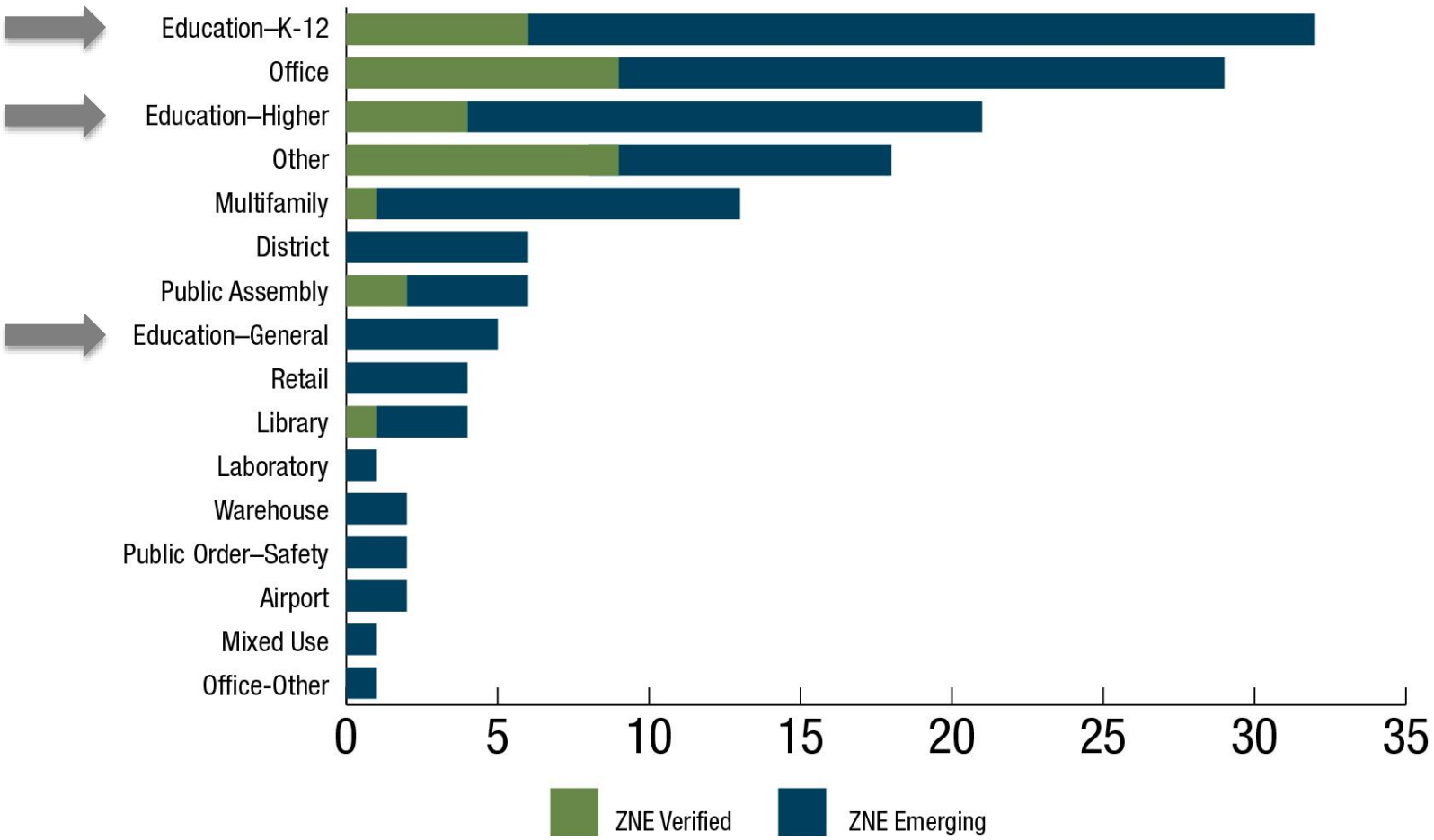
R - Indicates a building renovation project
L - Building is ZNE certified by the International Living Future Institute
*The Net Energy Use Intensity (EUI) includes both whole-building measured energy usage and on-site renewable generation. Buildings will have an EUI of zero or less, with a negative number indicating generation exceeds use.

9-21-15

PV cost trend makes ZNE accessible

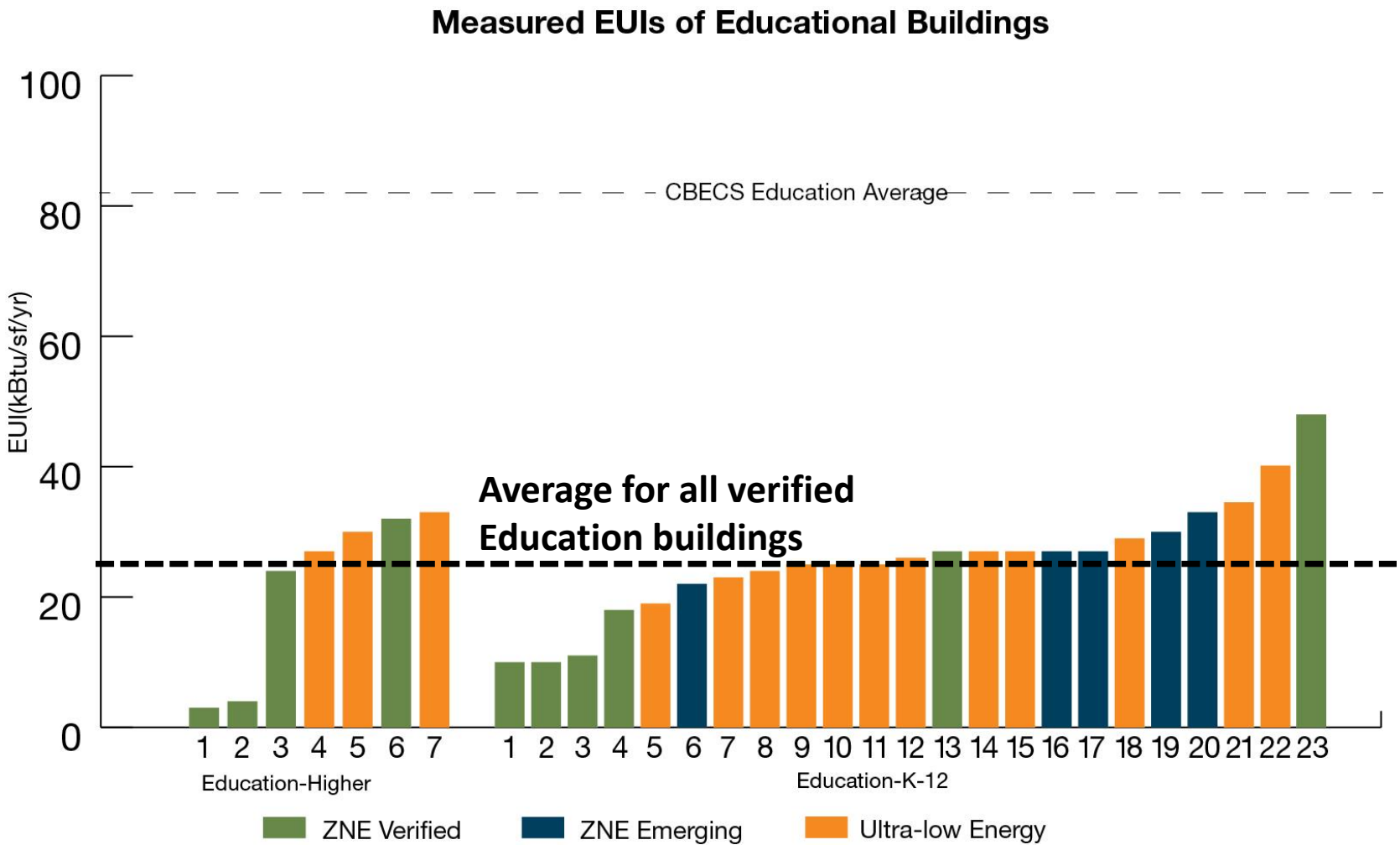
Source: P. Mints, Navigant Solar Services Program, 2011

Building Types



nbi new buildings institute

Performance Range - Education



ZNE Schools: Developing the Next Generation of Leaders

- ZNE is possible within the cost of a conventional school
- Anticipate a significant expansion of ZNE school activity across the U.S

ZNE Workshop for Schools
CA Green Schools Summit, 2014

Richardsville Elementary School

- Bowling Green, KY
- 72,300 SF
- Education K-12
- Completed in 2010
- LEED Gold
- $206/SF
- Warren County Public Schools
- Sherman Carter Barnhart, Architect
- CMTA, Mechanical and Electrical

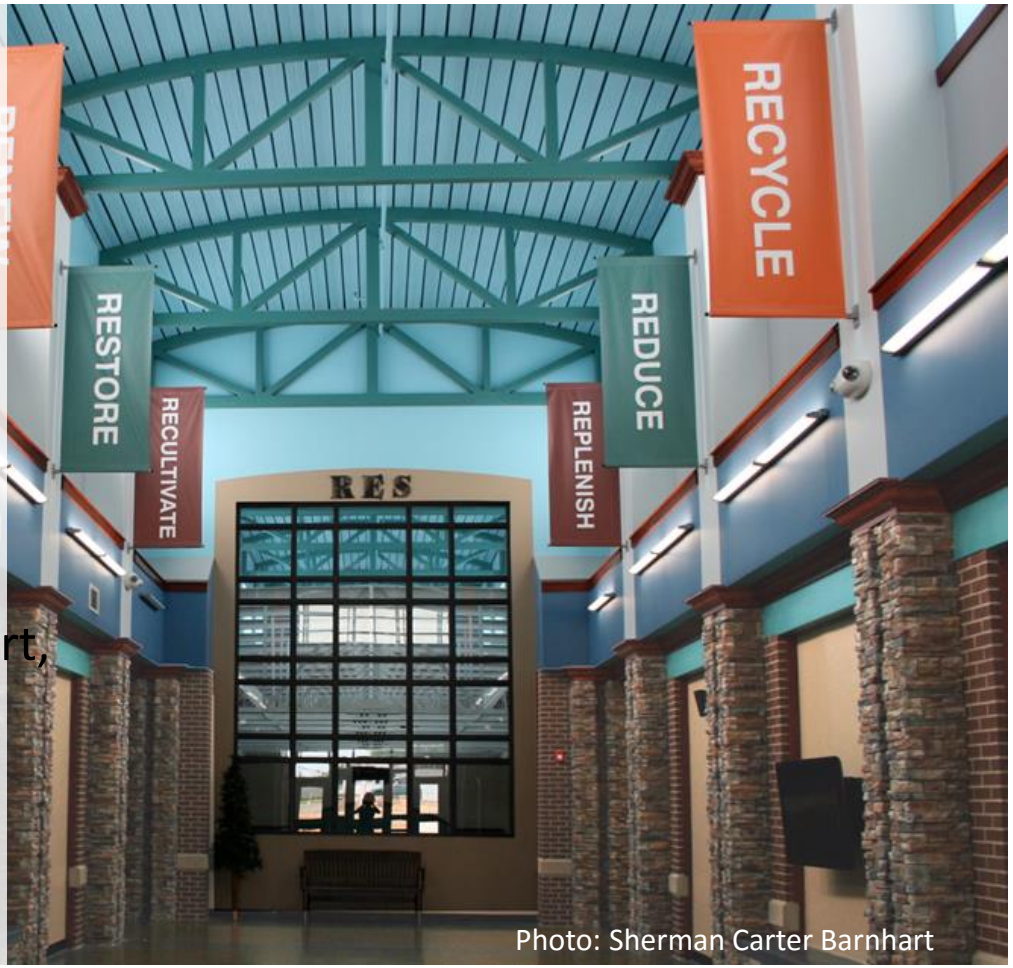
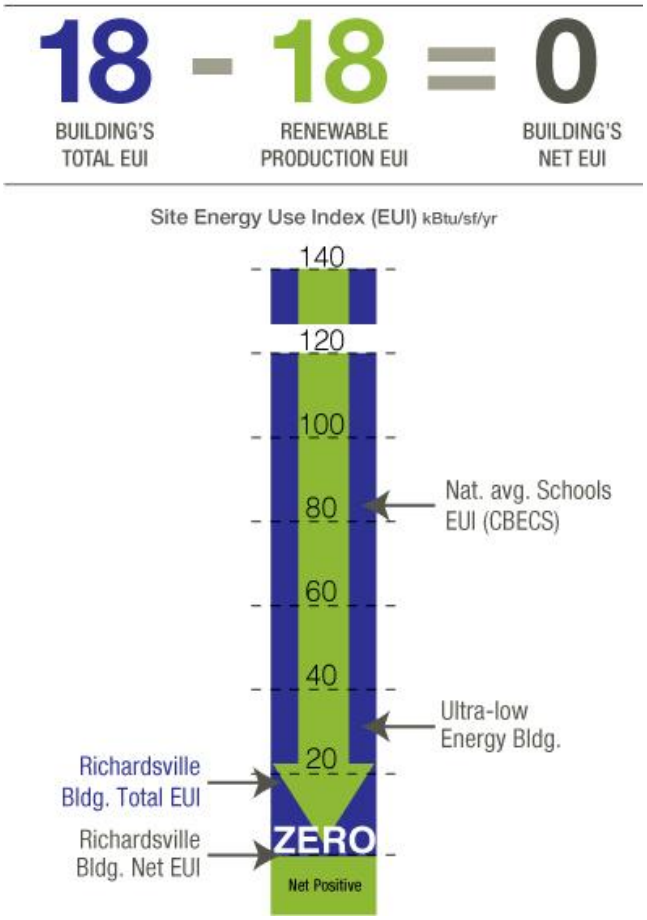


Photo: Sherman Carter Barnhart

Richardsville Elementary School



Efficiency Measures:

- Ground source heat pump
- DOAS
- CO2 sensors
- Daylighting
- High performance lighting system with controls
- EMS & Energy Dashboard

Redding (CA) School for the Arts

Hood River Middle School (OR)

Hood River Middle School, OR . Courtesy: Michael Mathers

nbi new buildings institute

Establishing your ZNE Target

– The Energy Loading Order

Why ZNE Schools?

- **Innovation & Leadership** - When public sector leads, others will follow. A commitment to zero energy buildings is an important demonstration of leadership, and innovation in education.
- **Resiliency** – School facilities often serve as community centers for refuge in times of emergency.
- **Climate & Environmental Sustainability Goals** – Climate Action Plans, State goals, Green Schools Sustainability Roadmap
- **Energy & Cost Savings mean more financial resources are available** to support students, educational programs and facilities
- **Long Term Savings** in efficiency, cost, operations, climate
- **Innovative Educational Approaches** – Experiential Learning

What Buildings Make Sense for ZNE?

Most Building Types are feasible

- Administrative buildings
- Classrooms
- Service buildings
- Warehouses
- Recreation & environmental centers
- Libraries
- Low occupancy buildings/facilities

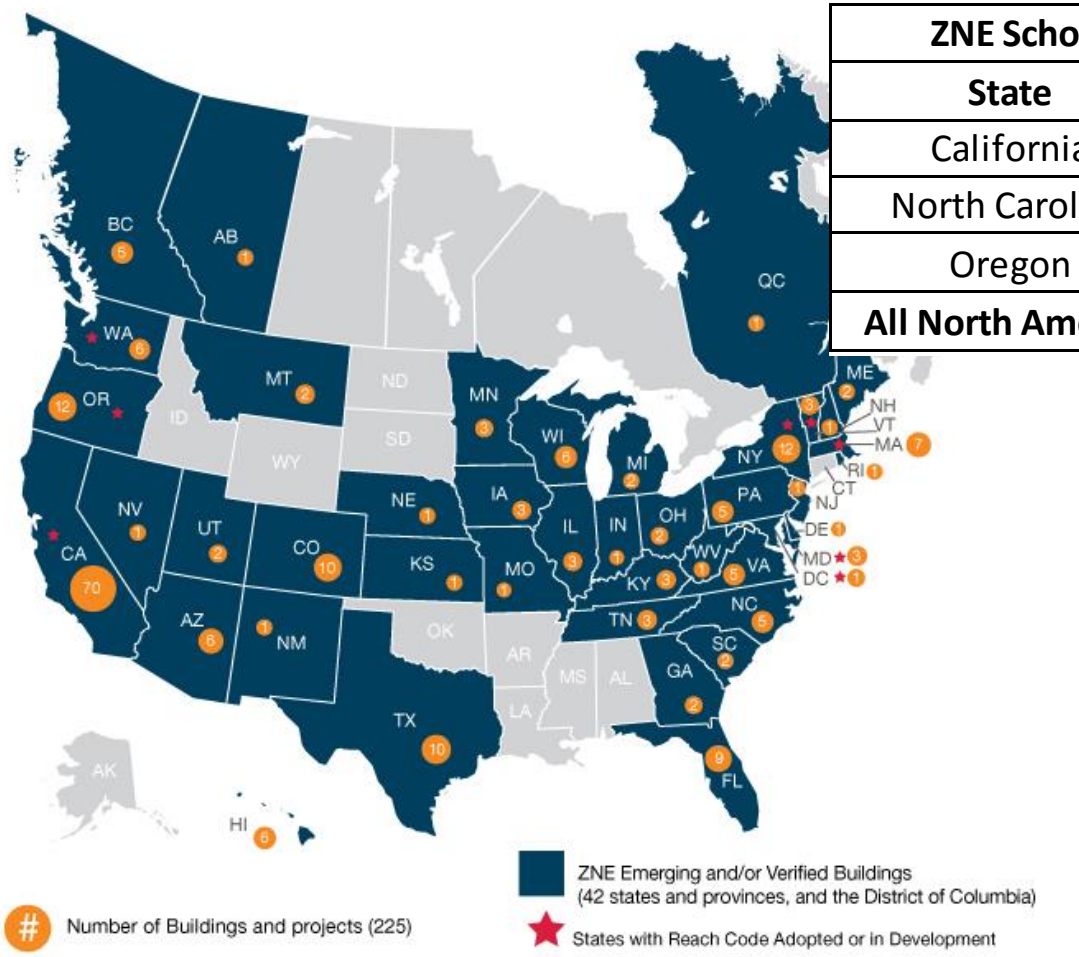
Priority Buildings

- New school buildings/campuses
- Buildings needing major replacement, big energy hogs, buildings where systems are needing major retrofits

How are Schools Getting to ZNE?

- **Assessment of existing building stock** to find opportunities
- **Capital improvement projects** - Look at pipeline of coming up needed
- **Existing building renewal -** Making major retrofits to get to ZNE when significant system or structural upgrades are made
- **Pilot ZNE Building** for new and existing facilities – CA Prop 39 ZNE retrofit pilots
- **Campus-wide ZNE** – OUSD high school, Hi-tech High School in Chula Vista, Redding School for the Arts
- **Prototype Approach** – Campbell School District targeting 8 ZNE schools
- **Portfolio-wide Policy Approach** – IUSD, LASD energy and solar investments

California Leads in ZNE Schools



ZNE School Buildings - Top Three States			
State	**Verified**	**Emerging**	**Total**
California	3	20	23
North Carolina	1	5	6
Oregon	1	5	6
All North America	**12**	**65**	**77**

9-21-15

zero net energy

“Big Bold” Goals for ZNE in California

Exploratorium | San Francisco, CA

1 All new commercial construction will be ZNE by 2030

2 50% of existing buildings will be retrofit to ZNE by 2030

3 All new residential construction in California will be ZNE by 2020

The California Efficiency Strategic Plan (Sep 2008)
californiaenergyefficiency.com/docs/
EEStrategicPlan.pdf

zero net energy

ZNE Early Adopters Leadership Trainings

Support for Schools, Local Governments, Higher Ed & State Agencies

nbi new buildings institute

Email heather@newbuildings.org to sign up

5 GREAT NEW TOOLS FOR ZNE BUILDINGS

1 **ZNE Message Platform**
Key messages for target audiences on the what and why of ZNE.

2 **"Intro to ZNE" Presentation**
Customizable powerpoint presentation provides an overview of California's goals and policies for ZNE, key strategies, and case study examples.

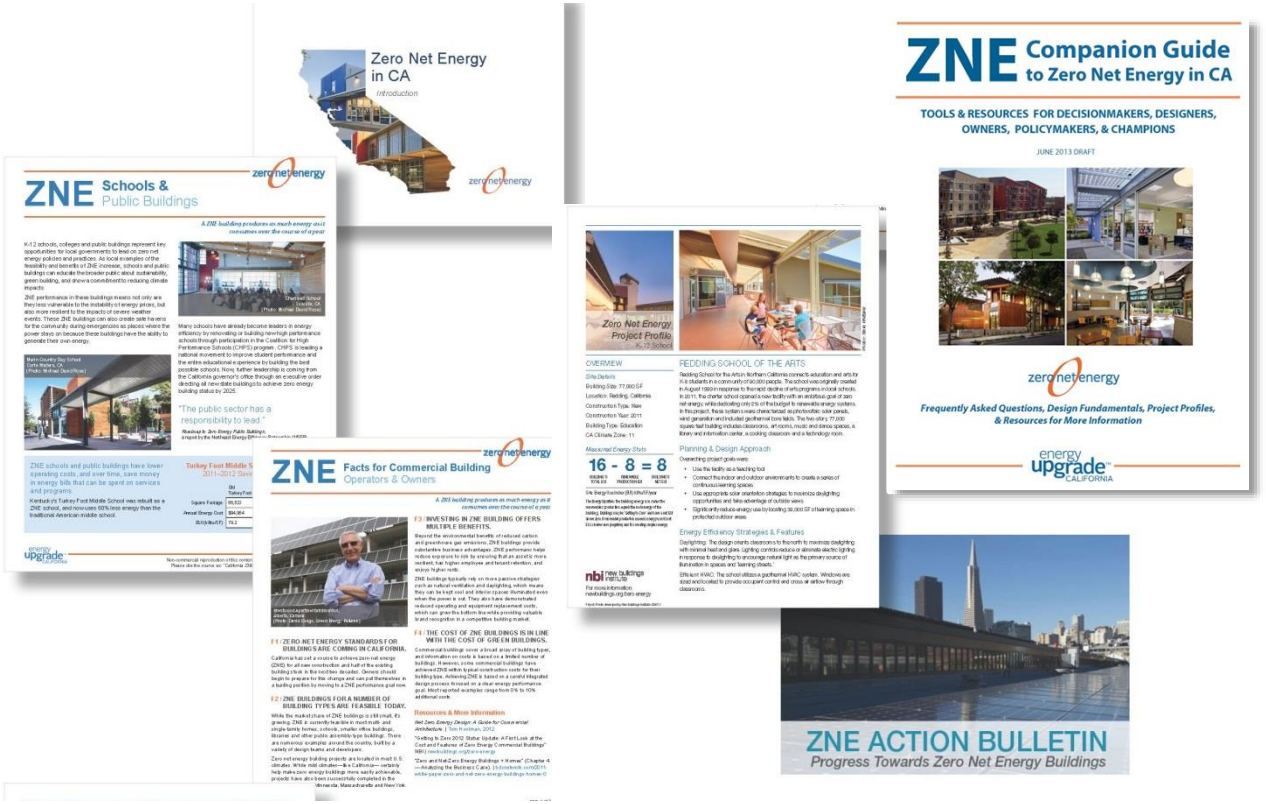
3 **ZNE Companion Guide/Fact Sheets**
Collection of FAQs, resources, design strategies, and key messages for designers, commercial building owners, policymakers, and decisionmakers of schools and public buildings.

4 **Case Studies: ZNE & Ultra-Low Energy Buildings**
Read about ZNE and ultra-low energy building examples, including design strategies, costs, and lessons learned.

5 **ZNE Action Bulletin**
Sign up for our quarterly e-newsletter for updates on ZNE news, events, trainings, case studies, planning, policy, and research. To sign up, or to get more info about the toolkit, email heather@newbuilding.org.

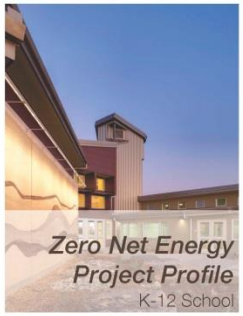
zero net energy

ZNE Communications Toolkit



www.newbuildings.org/zne-communications-toolkit

Case Study Briefs



Photos: Steve Whittaker

OVERVIEW

Site Details

Building Size: 77,000 SF

Location: Redding, California

Construction Type: New

Construction Year: 2011

Building Type: Education

CA Climate Zone: 11

Measured Energy Stats

16 - 8 = 8

BUILDING'S TOTAL EUI | RENEWABLE PRODUCTION EUI | BUILDING'S NET EUI

Site Energy Use Index (EUI) kBtu/SF/year

The Energy Equation: **the building energy use** *minus* **the renewables production** *equals* **the net energy of the building**. Buildings may be 'Getting to Zero' and have a net EUI above zero. If renewable production exceeds energy use its net EUI is below zero (negative) and it is creating surplus energy.

REDDING SCHOOL OF THE ARTS

Redding School for the Arts in Northern California connects education and arts for K-8 students in a community of 90,000 people. The school was originally created in August 1999 in response to the rapid decline of arts programs in local schools. In 2011, the charter school opened a new facility with an ambitious goal of zero net energy, while dedicating only 2% of the budget to renewable energy systems. In this project, these systems were characterized as photovoltaic solar panels, wind generation and included geothermal bore fields. The two-story, 77,000 square feet building includes classrooms, art rooms, music and dance spaces, a library and information center, a cooking classroom and a technology room.

Planning & Design Approach

Overarching project goals were:

- Use the facility as a teaching tool
- Connect the indoor and outdoor environments to create a series of continuous learning spaces
- Use appropriate solar orientation strategies to maximize daylighting opportunities and take advantage of outside views
- Significantly reduce energy use by locating 39,000 SF of learning space in protected outdoor areas

Energy Efficiency Strategies & Features

Daylighting: The design orients classrooms to the north to maximize daylighting with minimal heat and glare. Lighting controls reduce or eliminate electric lighting in response to daylighting to encourage natural light as the primary source of illumination in spaces and 'learning streets.'

Efficient HVAC: The school utilizes a geothermal HVAC system. Windows are sized and located to provide occupant control and cross air airflow through classrooms.

nbi new buildings institute

For more information:
newbuildings.org/zero-energy

Photos: Steve Whittaker

Improved envelope: The building envelope consists of a rain screen wall system with cement siding and ultra-high-efficiency glazing and rammed earth walls.

Maximize outdoor learning spaces: Despite being in a climate with hot, dry summers and rainy, cool winters, more than half of the school's learning spaces are outdoors, protected by roof overhangs and operable garage-style doors.

Building dashboard: The web-based building dashboard system monitors and reports energy and water use, separating out lighting energy use and renewable systems production. Information from the dashboard is used to teach students about the school and their environment.

Renewables: Photovoltaics (PV) systems include a large roof-mounted PV array, vertical axis wind turbine and solar thermal hot water systems. Both the PV and wind turbine are connected to the utility grid via net metering, thus allowing the school to be credited for energy it produces in the summer even when the school's energy use is minimal.

Team/Owner Details

Owner: The McConnell Foundation

Architect: TRILOGY Architecture

Contractor: Gifford Construction

Structural Engineering: Kibler & Kibler Architecture and Engineering

Mechanical/Plumbing: M/E Systems Engineering

Electrical Engineering: PACE Engineering

Lighting Designer: Benya Lighting Design

Sustainability Consultant: Green Building Services

Financing & Cost

Total Construction Cost: $28 million

Awards

LEED® Platinum for Schools 2009

Lessons Learned

- Building occupant use in summer is higher than expected. Ongoing commissioning would be helpful to draw attention to minimizing HVAC operating hours, managing set points and ensuring that lighting and plug loads are turned off when the building is unoccupied.
- Lighting systems are operating at an average of 0.35 watts per square foot, or 60% less than code. Two occupant use factors that may be impacting daylighting performance are that window blinds are closed more often than was expected during design and the windows themselves are used to pin up student's art work, which may be contributing to less-than-optimal daylighting performance.
- Plug load energy use, such as refrigeration, space heaters and terrarium lights, is higher than expected. Procurement of high efficiency equipment is recommended to manage plug loads. For example, using powerful display projectors to increase contrast and/or locating projection screens on walls perpendicular to windows to help prevent use of blinds may help optimize daylighting performance.

zero net energy

energy upgrade CALIFORNIA

ZNE & Ultra-Low Energy Case Studies

CPUC Case Study Briefs & NBI ZNE Case Studies
http://newbuildings.org/case-studies-zne-projects

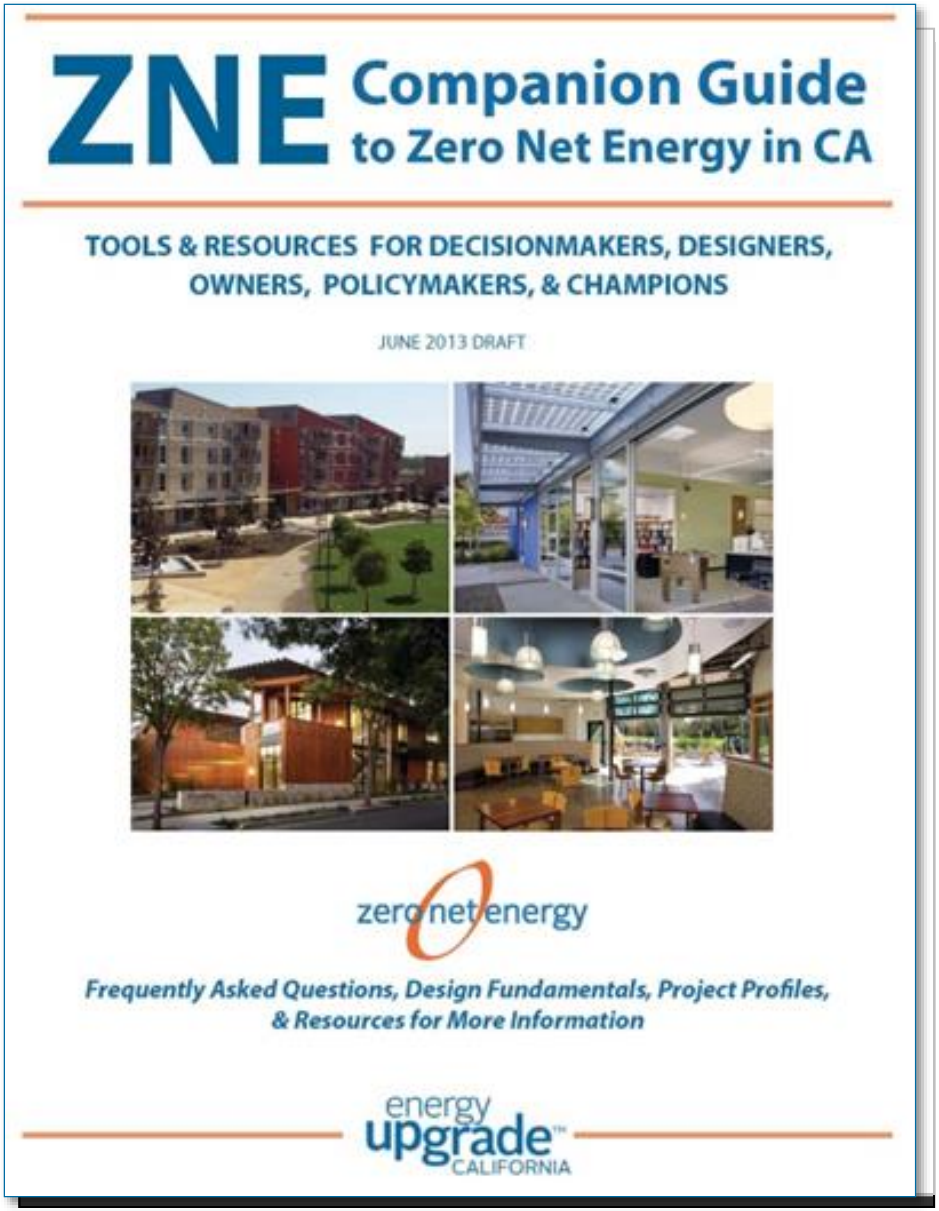
PG&E Case Studies
http://energydesignresources.com/resources/publications/case-studies/case-studies-zne-non-residential-buildings.aspx

NBI Registry
http://newbuildings.org/share

Getting to Zero Database
http://newbuildings.org/getting-to-zero-buildings-database

Fact Sheets/ZNE Companion Guide

- Policymakers
- Decisionmakers of Schools & Public Buildings
- Architecture & Engineering
- Commercial Owners
- FAQ's



Jeffrey Trail Middle School & Irvine Unified School District

PEOPLE, POLICY & PROCESS

- CHPS High Performance schools resolution
- Irvine pursued a district-wide approach to energy efficiency
- Bonded for solar on all schools
- Power Purchase Agreement (PPA) to fund solar
- Capital outlay=$0

Irvine Unified School District saves money and enriches learning with solar

Located in Orange County, California, the Irvine Unified School District (IUSD) comprises a community of learners, committed to the highest quality educational experience. IUSD educates a diverse population of more than 30,000 K-12 students in 22 elementary schools, six middle schools, four comprehensive high schools and one continuation high school.

Project Profile: Irvine Unified School District	System Type: Roof and Canopy-Mounted Solar Panels
Industry: K-12 Education	System Size: 6 MW over 27 Operational Projects
Location: Irvine, California	Savings: $5-11 million over 20 years
Company: Irvine Unified School District	Capital Outlay: $0

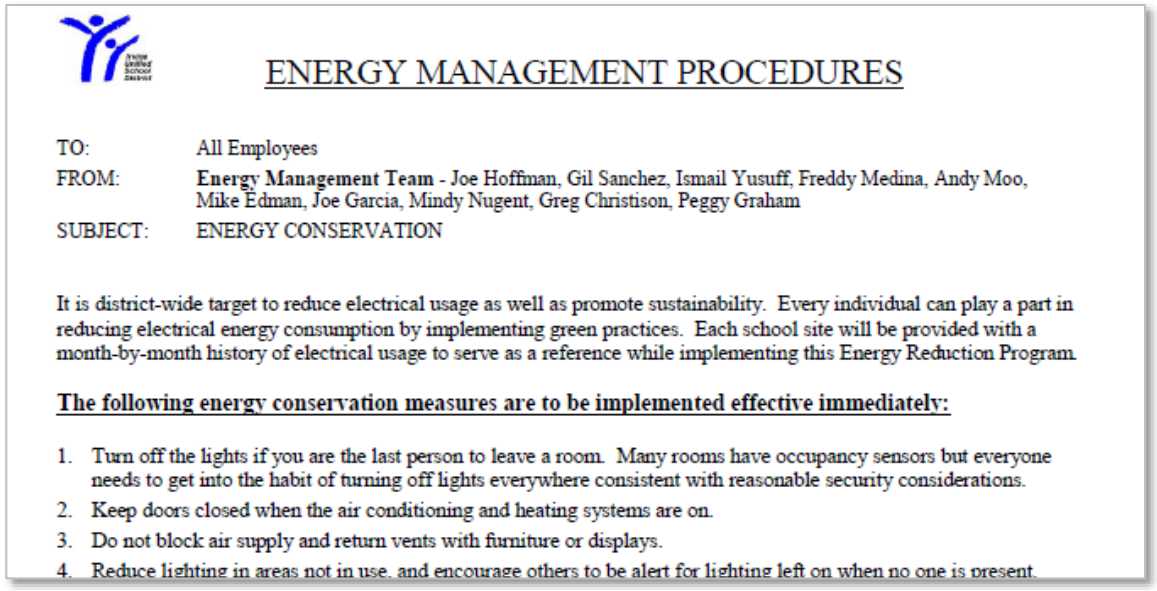
nbi new buildings institute

Jeffrey Trail Middle School & Irvine Unified School District

PEOPLE, POLICY & PROCESS

- Behavior - Energy Conservation/Management Protocols

IUSD set energy-wise guidelines to help make its heating, ventilation, and air conditioning systems (HVAC) more efficient. The District also issued conservation mandates for lighting, thermostat settings, classroom and office equipment, and a variety of other areas. These measures are intended to reduce district-wide electrical usage by 15 percent.



ENERGY MANAGEMENT PROCEDURES

TO: All Employees

FROM: **Energy Management Team** - Joe Hoffman, Gil Sanchez, Ismail Yusuff, Freddy Medina, Andy Moo, Mike Edman, Joe Garcia, Mindy Nugent, Greg Christison, Peggy Graham

SUBJECT: ENERGY CONSERVATION

It is district-wide target to reduce electrical usage as well as promote sustainability. Every individual can play a part in reducing electrical energy consumption by implementing green practices. Each school site will be provided with a month-by-month history of electrical usage to serve as a reference while implementing this Energy Reduction Program.

The following energy conservation measures are to be implemented effective immediately:

1. Turn off the lights if you are the last person to leave a room. Many rooms have occupancy sensors but everyone needs to get into the habit of turning off lights everywhere consistent with reasonable security considerations.
2. Keep doors closed when the air conditioning and heating systems are on.
3. Do not block air supply and return vents with furniture or displays.
4. Reduce lighting in areas not in use, and encourage others to be alert for lighting left on when no one is present.

nbi new buildings institute

Jeffrey Trail Middle School & Irvine Unified School District

PEOPLE, POLICY & PROCESS

Buildings & Technologies inform the district's Curriculum - Science, Technology, Energy, Math (STEM)

"We have developed our own fifth and sixth grade curriculum that lets students learn about a variety of types of renewable energy. We discuss the pros and cons of different types of renewable energy. We are hearing that kids are more aware of things like conservation, recycling, and global warming. And the community appreciates the nonpartisan way we present the education."

– Mark Sontag, UC Irvine Energy Consultant

nbi new buildings institute

CA ZNE Schools Pilot 2016

NEW SCHOOL CASE STUDIES, ZNE TRAININGS & RECOGNITION

"The business case for making the building net zero energy is that it will not just lower our energy bill, but it also will allow us to put those savings straight back to the top line of our operations budget for maintaining programs for kids."

- Assistant Superintendent Kathy Gomez, Evergreen School District

George V. Leyva Middle School Administration Building

nbi new buildings institute

energydesignresources

Your guide to energy efficient design practices.

Search: GO

Home | Design | Codes | Technology | Buildings | Programs | Resources | Training | About

Home » Programs » Prop 39 ZNE Schools | Register | Login

Programs

Prop 39 ZNE Schools

Energy Design Resources is funded by California utility customers under the auspices of the California Public Utilities Commission.

Prop 39 Zero Net Energy Schools - Pilot Program

Proposition 39, the California Clean Energy Jobs Act of 2012 (Prop 39), provides up to $550 million per year to improve energy efficiency and increase the use of clean energy in public schools and community colleges.

The Prop 39 ZNE Schools Pilot will assist schools in retrofitting existing facilities to ZNE by leveraging Prop 39 funding. The Pilot will establish "proof of concept" that ZNE retrofits of schools is feasible across California. The utilities are targeting approximately 13-18 projects in 13-18 school districts or community colleges for the Pilot.

Interested K-12 public school districts and community colleges were invited to respond to the **Opportunity Announcement** posted to this website prior to **May 22nd 2015**. Interested schools are encouraged to revisit this website for updates.

Prop 39 ZNE School Retrofit Workshops

Sort by: Most recent

October 9, 2015 0 comments

A zero net energy (ZNE) building generates as much energy as it consumes annually. With energy bills at California's schools totaling more than $700 million a year, innovative energy solutions for schools like ZNE buildings are being proposed as a way to save energy and put money back into classrooms

Follow EDR on

EDR California @edrcalifornia 9 Oct

To help #schools make #ZeroNetEnergy retrofits @SCE @PGE4Me and other CA #utilities offer no-cost #prop39 workshops energydesignresources.com/zneworkshops

Related EDR Resources

Updated - Opportunity Announcement: Prop 39 ZNE Schools Pilot

Phase I Screening Questionnaire: Prop 39 ZNE Schools Pilot

Other Resources

The inclusion of links does not imply endorsement by EDR of any other site, or its contents, or any association with any of its operators.

Advanced Energy Design Guide - Schools: 50% over 90.1-2004

ASHRAE (with AIA/IES/USGBC/DOE)

For K-12 elementary, middle, and high school buildings, with a wide variety of heating and air-conditioning requirements. Options for daylighting, an important

zero net energy

ZERO NET ENERGY SCHOOL RETROFIT WORKSHOPS

Brought you by the Investor-Owned Utilities & Prop 39 Zero Net Energy Pilot

To help schools achieve successful ZNE retrofits, we're offering the following upcoming no-cost ZNE workshops:

ZNE Technical Training for School & Building Industry Professionals

10:00 am-4:00 pm	**February 26, Downey** | SoCalGas Energy Resource Center
	April 18, San Francisco | Pacific Energy Center
9:00 am-3:00 pm	**May 9, San Diego** | SDG&E Energy Innovation Center

ZNE & the School Community for Administrators and Stakeholders

1:00 pm-3:00 pm	**March 2, Webinar format,** will also be available on-demand
1:00 pm-4:00 pm	**March 14, San Mateo** | Office of Education
2:00 pm-5:00 pm	**April 20, Sacramento** | Green Technology Summit
9:00 am-12:00 pm	**May 10, San Diego** | SDG&E Energy Innovation Center

More dates to be announced soon

A zero net energy (ZNE) building generates as much energy as it consumes annually. With energy bills at California's schools totaling more than $700 million a year*, innovative energy solutions for schools like ZNE buildings are being proposed as a way to save energy and put money back into classrooms.

A number of upcoming, no-cost interactive workshops are being offered to explain how California's K-12 schools and community colleges can achieve ZNE through whole-building retrofits.

These workshops are part of an investor-owned utility (IOU) pilot program aimed at leveraging Proposition 39 dollars to test how some of the state's existing K-12 and community college buildings can be transformed into ZNE facilities.

Full-day technical sessions will focus on best practices in design and operations. Half-day school community workshops will cover design approaches, planning and financing.

School administrators, operations managers, business officers, construction managers, community stakeholders, building designers, operations staff and others interested in ZNE are invited to attend. Space is limited, so please register and reserve your spot today at energydesignresources.com/zneworkshops.

* Statistic from the CEC Consumer Energy Center http://www.consumerenergycenter.org/tips/schools.html

This program is funded by California utility customers and administered by California's investor-owned utilities under the auspices of the California Public Utilities Commission.

energydesignresources

Register or learn more at energydesignresources.com/zneworkshops

Actions to Get to ZNE Schools

1) Set ZNE Goals, Targets & Policy

- Engage leadership to adopt a formal policy for ZNE
- Assess existing facilities for opportunities & needs

2) Initiate one or more ZNE Pilots

- Amend contract RFP/RFQ Requirements for ZNE performance goals and priorities: for contractors, performance targets, required specifications, documentation and persistence

3) Explore funding opportunities for ZNE:

- Pilot programs, utility incentives, technology demonstration, bonds, establish efficiency reserve funds.

4) Engage and educate stakeholders (use the ZNE Toolkit!)

- Policymakers – Superintendent, School Boards, Principals
- Facilities and operations staff – much of ZNE happens downstream
- Internal staff – faculty, administration and maintenance need some operations training, as well as public facing staff (especially communication and media)
- Students – living classroom for experiential, scientific and climate-based learning

What you can do today to get started

1. Develop your ZNE Plan
2. Create the supporting policy
3. Get & Use the ZNE Communication Tools & Planning Workbook
4. Build capacity through education, collaboration, and convening

zero net energy

2015 Prop 39 ZNE School Retrofit Workshops

PHOTO: SF PUC, Low Energy Building, San Francisco

GETTING TO zero NATIONAL FORUM 2016

Save the Date

October 12-14, 2016 | Denver, CO

gettingtozeroforum.org/call-for-speakers/

Thank You!

Heather Flint Chatto, ZNE Project Manager | Heather@newbuildings.org

nbi new buildings institute

Northeast Energy Efficiency Partnerships

ZNE and High Performance

The Perfect Partnership for Schools

Green Schools Conference
Friday, April 1, 2016
2:00 – 3:00 PM
John Balfe

About NEEP

Mission

Accelerate energy efficiency as an essential part of demand-side solutions that enable a sustainable regional energy system

Approach

Overcome barriers and transform markets via

Collaboration, Education and Enterprise

Vision

Region embraces **next generation energy efficiency** as a core strategy to meet energy needs in a carbon-constrained world

One of six regional energy efficiency organizations (REEOs) funded by the US Department of Energy (US DOE) to link regions to US DOE guidance, products and programs

NEEP's Zero Energy Roadmap

- Developed by **regional stakeholders**
- Focused on new construction in the **public sector**
  - Lead by example
  - Longer investment horizon
- How do we get there from here?
  - Includes "**critical next steps**" and "**intermediate term steps**"
- 2016: Progress Report
  - "Zero Energy Buildings"

ZNEB's produce as much energy as they consume over the course of a year

Rhode Island and NE-CHPS

- NE-CHPS required for all schools in RI
- 6 NE-CHPS Verified Schools
- NEEP been engaged in this process since 2011
- NE-CHPS puts schools on the pathway to ZNE

RIDE Rhode Island Department of Education

NORTHEAST COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS

Case Study: East Bay MET Center

Newport, RI

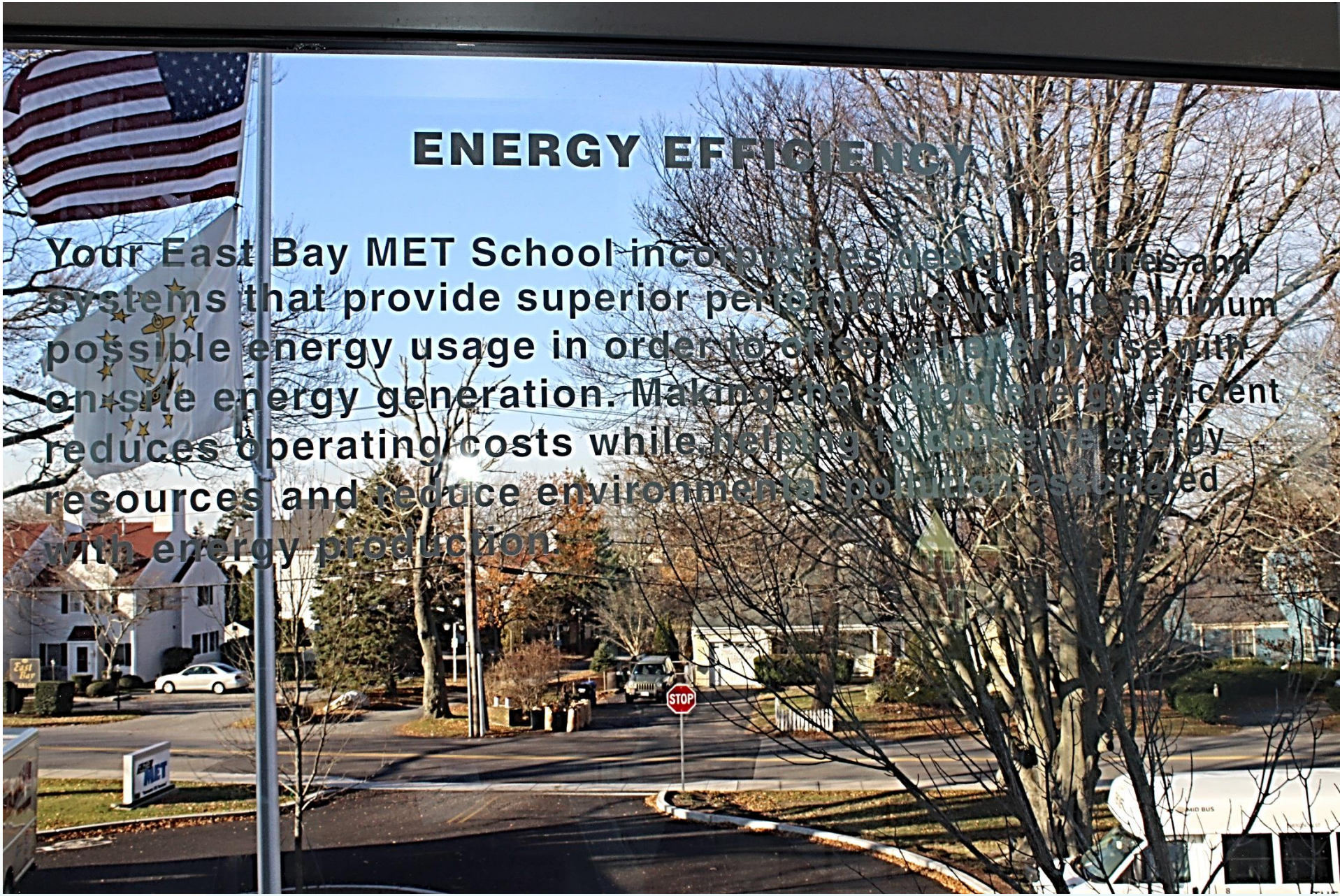
1st zero energy capable public school facility in the region

Case Study: East Bay Met Center

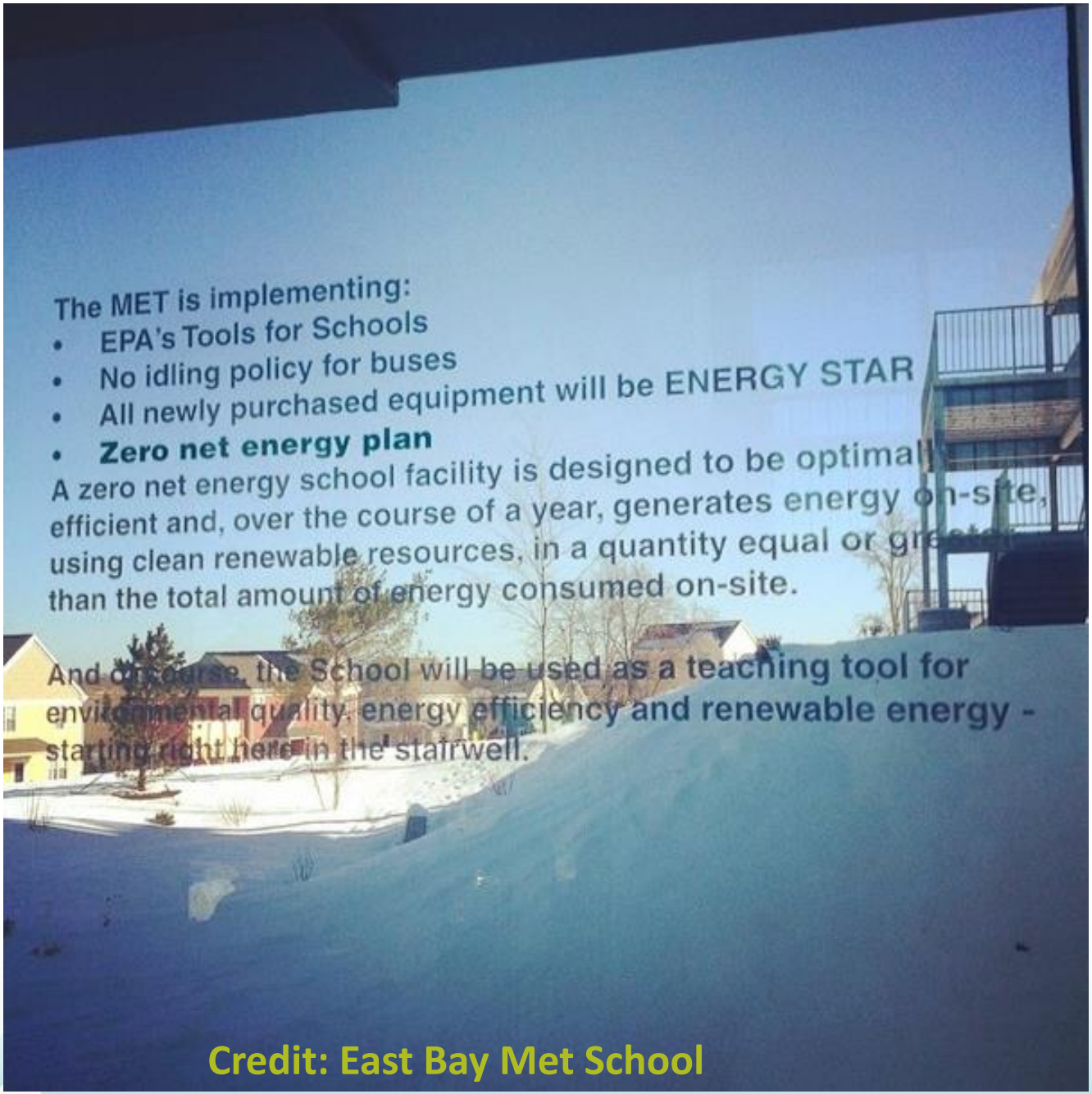
- 16,800 Square Feet - New Construction Project
- LED Lighting / Daylighting exposure maximized
- Water consumption reduced by more than 20%
- Renewable Energy Systems:
  - 150 kW PV solar energy system
  - Geothermal heating system
- School as a teaching tool initiative
- 50% of construction waste was recycled or redirected from landfill

"The greatest aspect of this school is the incredible indoor air quality"

-Taylor Rocc, Teacher


ENERGY EFFICIENCY
Your East Bay MET School incorporates design features and systems that provide superior performance with the minimum possible energy usage in order to offset all energy use with on-site energy generation. Making the school energy efficient reduces operating costs while helping to conserve energy resources and reduce environmental pollution associated with energy production.
STOP

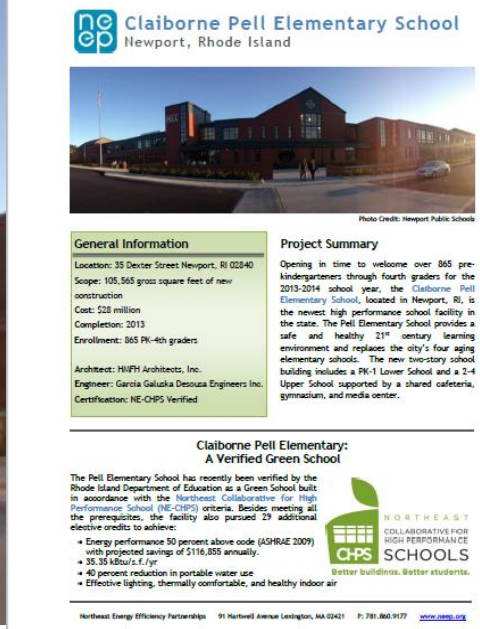
Credit: RGB Architects



Credit: East Bay Met School

Case Study: Pell Elementary School

Newport, RI



Claiborne Pell Elementary School
Newport, Rhode Island

Photo Credit: Newport Public Schools

General Information

Location: 35 Dexter Street Newport, RI 02840
Scope: 105,565 gross square feet of new construction
Cost: $28 million
Completion: 2013
Enrollment: 865 PK-4th graders

Architect: HMFH Architects, Inc.
Engineer: Garcia Galuska Desousa Engineers Inc.
Certification: NE-CHPS Verified

Project Summary

Opening in time to welcome over 865 pre-kindergarteners through fourth graders for the 2013-2014 school year, the Claiborne Pell Elementary School, located in Newport, RI, is the newest high performance school facility in the state. The Pell Elementary School provides a safe and healthy 21st century learning environment and replaces the city's four aging elementary schools. The new two-story school building includes a PK-1 Lower School and a 2-4 Upper School supported by a shared cafeteria, gymnasium, and media center.

Claiborne Pell Elementary: A Verified Green School

The Pell Elementary School has recently been verified by the Rhode Island Department of Education as a Green School built in accordance with the Northeast Collaborative for High Performance School (NE-CHPS) criteria. Besides meeting all the prerequisites, the facility also pursued 29 additional elective credits to achieve:

- Energy performance 50 percent above code (ASHRAE 2009) with projected savings of $116,855 annually.
- 35.35 kBtu/s.f./yr
- 40 percent reduction in portable water use
- Effective lighting, thermally comfortable, and healthy indoor air

NORTHEAST COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS
Better buildings. Better students.

Northeast Energy Efficiency Partnerships 91 Hartwell Avenue Lexington, MA 02421 P: 781.860.9177 www.neep.org

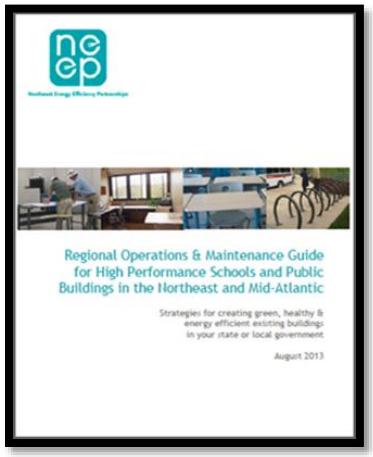
- CHPS Verified
- 40% Water Reduction
- 50% above energy code
- Effective Daylighting features
- 35 EUI (median = 58)

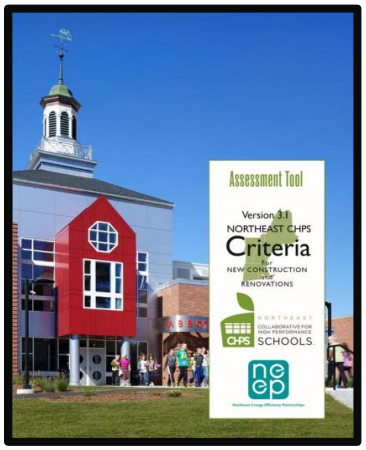
Students exposed to **natural daylight in classrooms** progress as much as **20 percent** faster on math tests and as much as **26 percent** faster on reading tests than students with no daylight exposure *(EPA, K-12 Guide)*

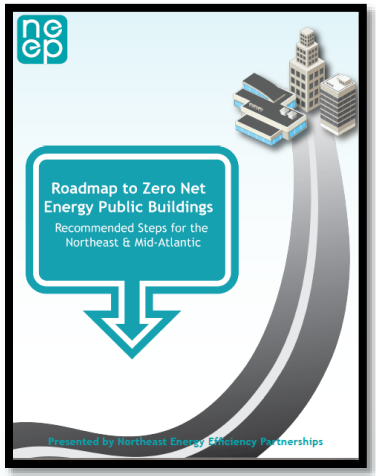
Green building measures in school designs **improves indoor air quality** and can **reduce absenteeism** rates by as much as **15 percent** *(EPA, K-12 Guide)*

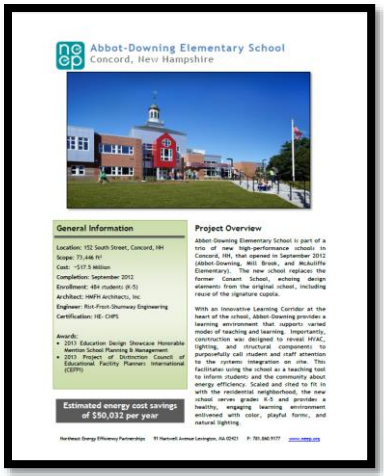
Resources

- **NE-CHPS V3.1**
- **School Exemplars**
- Roadmap to Zero Energy Public Buildings
- Regional Operations & Maintenance Guide
- LED Street Lighting Report









Additional Resources: http://neep.org/resources

High Performance Schools Training

Free Training April 21, 2016

Maynard High School in Massachusetts

Register on the NEEP Website Today!

TRAINING CO-HOSTS

CHPS COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS

neep

MFAA MASSACHUSETTS FACILITIES ADMINISTRATORS ASSOCIATION

2016 NEEP Summit

Information on registration, sponsorship opportunities, and program: http://neep.org/events/2016-summit or contact Lucie Carriou at lcarriou@neep.org

Thank you!

- Contact information

John Balfe, High Performance Buildings Associate

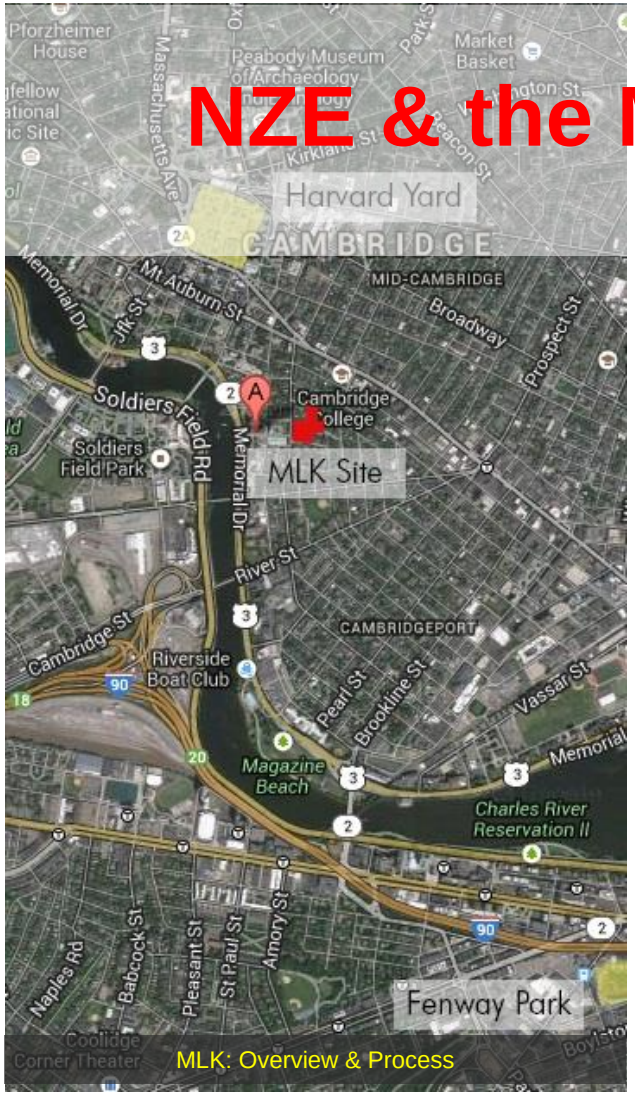
Northeast Energy Efficiency Partnerships (NEEP)

jbalfe@neep.org

781-860-7177 x 109

NZE & the MLK Jr. School

NZE: What is IT?



MLK: Overview & Process

Metrics & Lessons Learned

CAMBRIDGE'S VISION

1. Innovation Agenda

The Innovation Agenda is an ambitious plan that will propel Cambridge Public Schools into the 21st century, and ***prepare all our students for life in a world we cannot fully imagine*** *today. The Innovation Agenda is a design for excellent education rather than adequate education - merging Cambridge Public Schools' twin goals of academic excellence and social justice.*

- Superintendent Young

2. Net Zero Energy

"For Cambridge the process of ***planning and designing a net-zero school has changed the way we think about energy in all our buildings****. It has made us think about what energy we really need to use in our existing city buildings and will surely change some of what we do even in buildings not slated for full scale renovation or rebuilding."*

- Former Mayor Davis

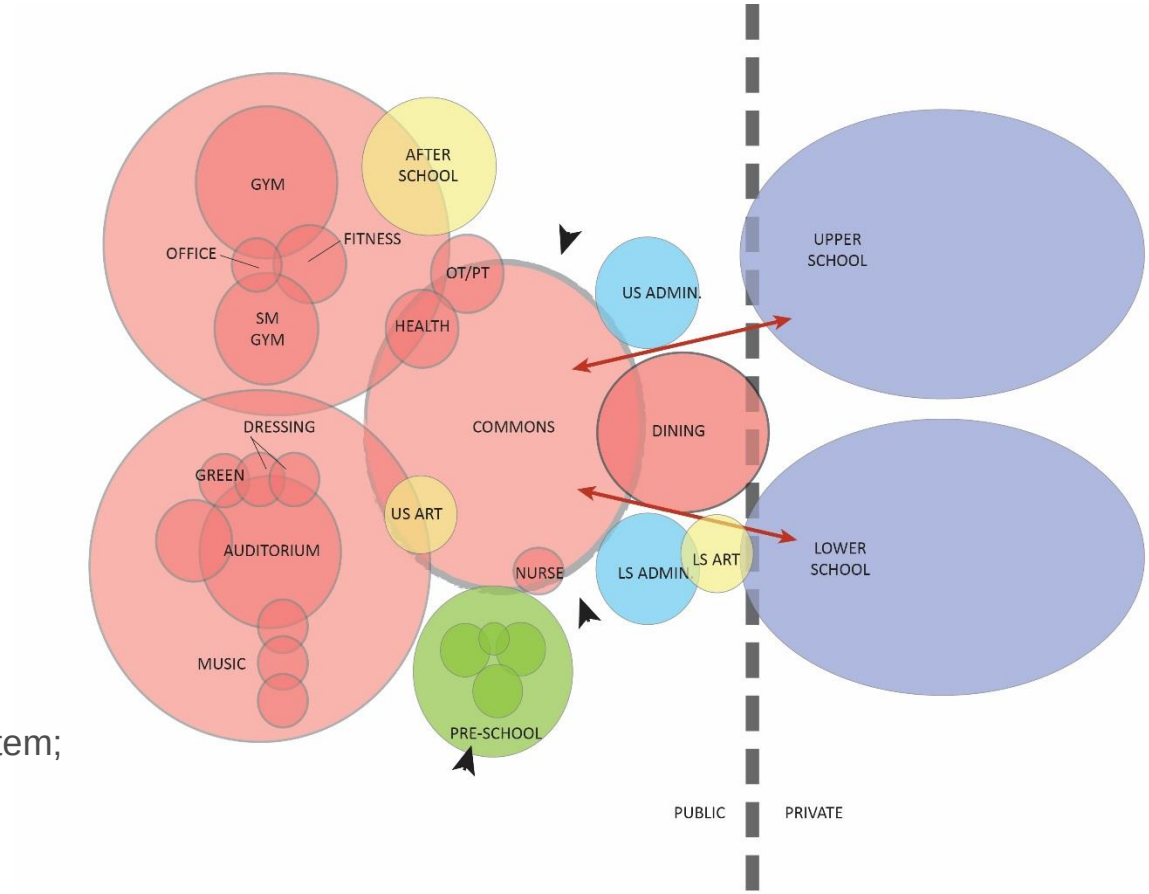
THREE SCHOOLS: ONE CAMPUS

Program: 740 Students

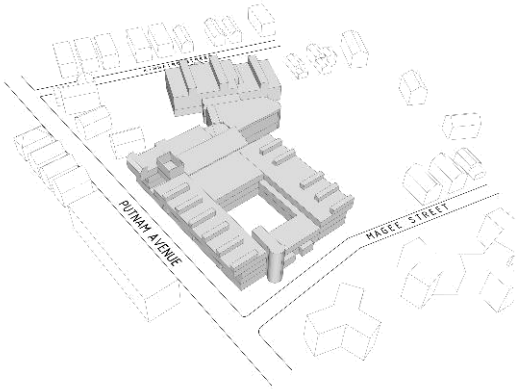
- **Lower School:**
  400 JK-5th Graders
- **Upper School:**
  300 6th – 8th Graders
- **Human Services:**
  40 PreSchool Students, Community School & After School Programs

Other Criteria

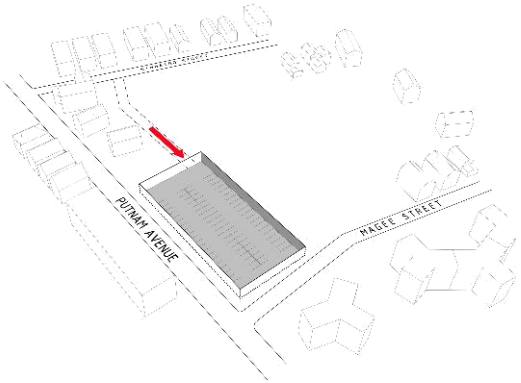
- **Hours of Operation**:
  6:00 am to 11:00 pm
- **Able to be Maintained:**
  Defines “sustainable”
- **Site Water:**
  High Water table; Poor Storm System; Charles River Watershed
- **Responsive to Neighbors:**
  Tight urban site



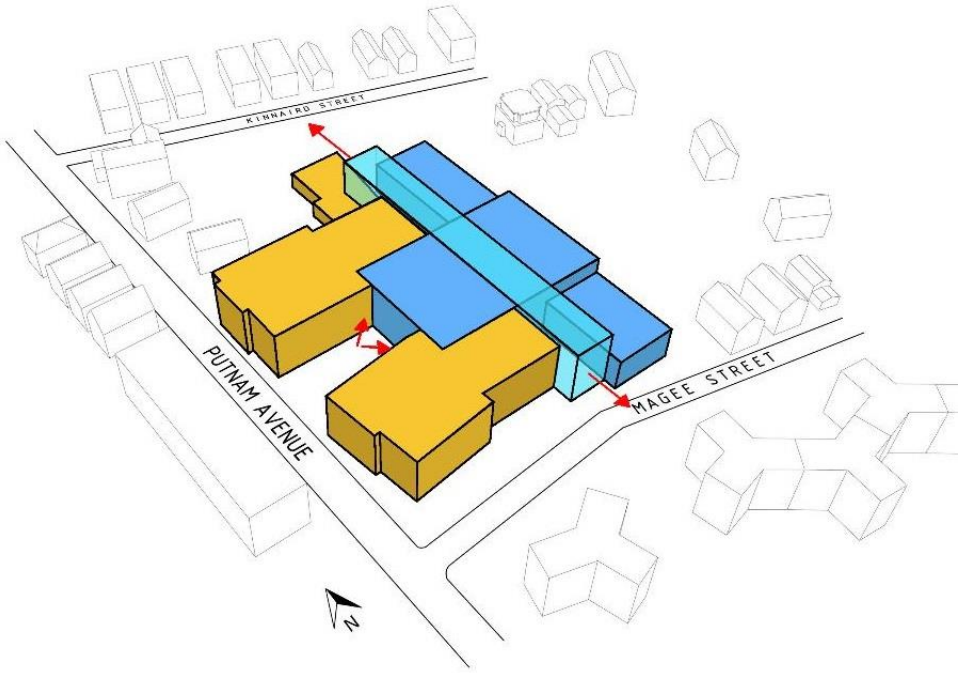
THREE SCHOOLS: ONE CAMPUS



EXISTING BUILDING



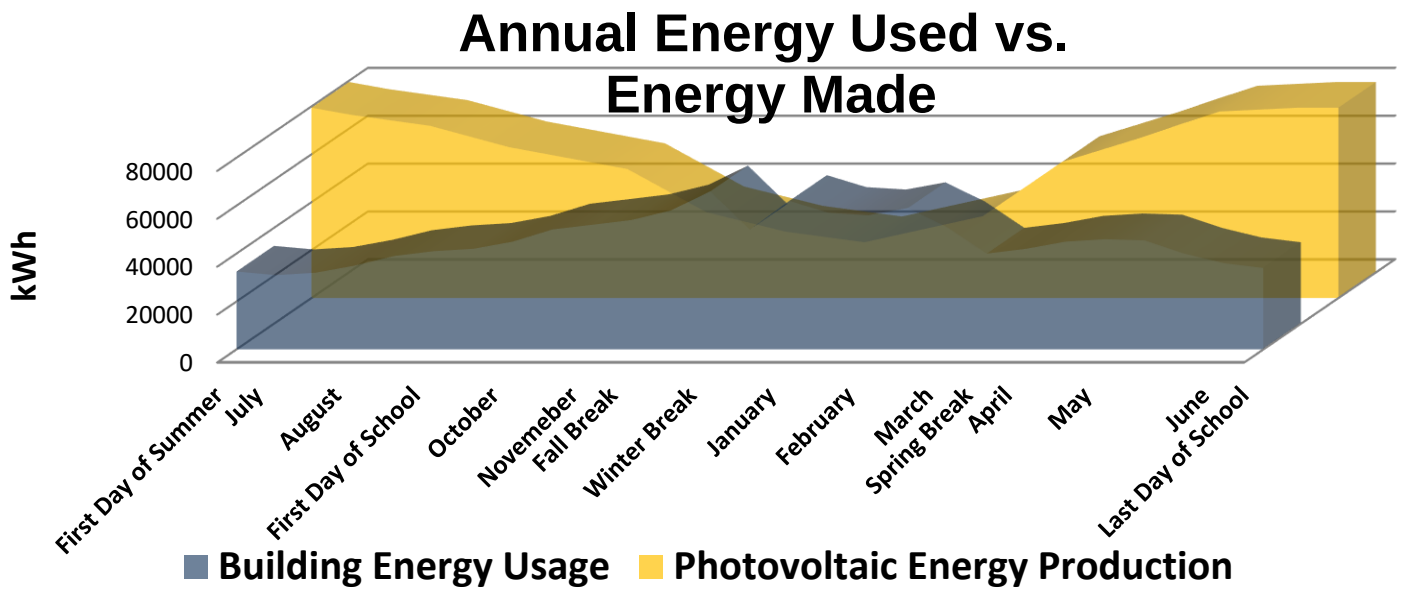
BUILDING REUSE
UNDERGROUND PARKING



PARTI

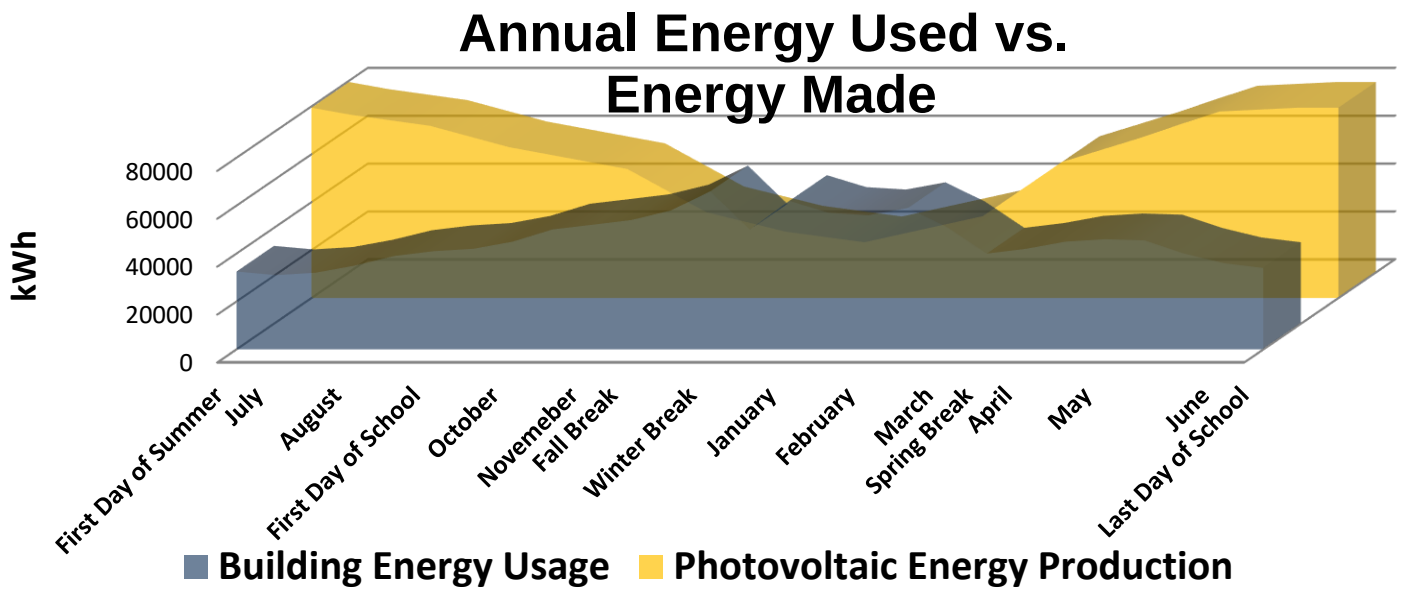
PRIVATE / PUBLIC / KING STREET

REAL PERFORMANCE



REAL PERFORMANCE

NOT THEORETICAL PERFORMANCE



DEFINING IT

ACCOUNTING FOR ENERGY

- Net-Zero Site Energy
- Net-Zero Source Energy
- Net-Zero Energy Cost
- Net-Zero Energy Emissions

Net-Zero Energy Buildings: A Critical Look at the Definition, NREL, June 2006

WHERE IS ENERGY HARVESTED

NZEB:A	Within building footprint
NZEB:B	within building footprint + the site
NZEB:C	Within building footprint, on site + imported renewables
NZEB:D	Within building footprint and/or on site + REC's

Net-Zero Energy Buildings: A Classification System Based on Renewable Energy Supply Options, NREL, June 2010

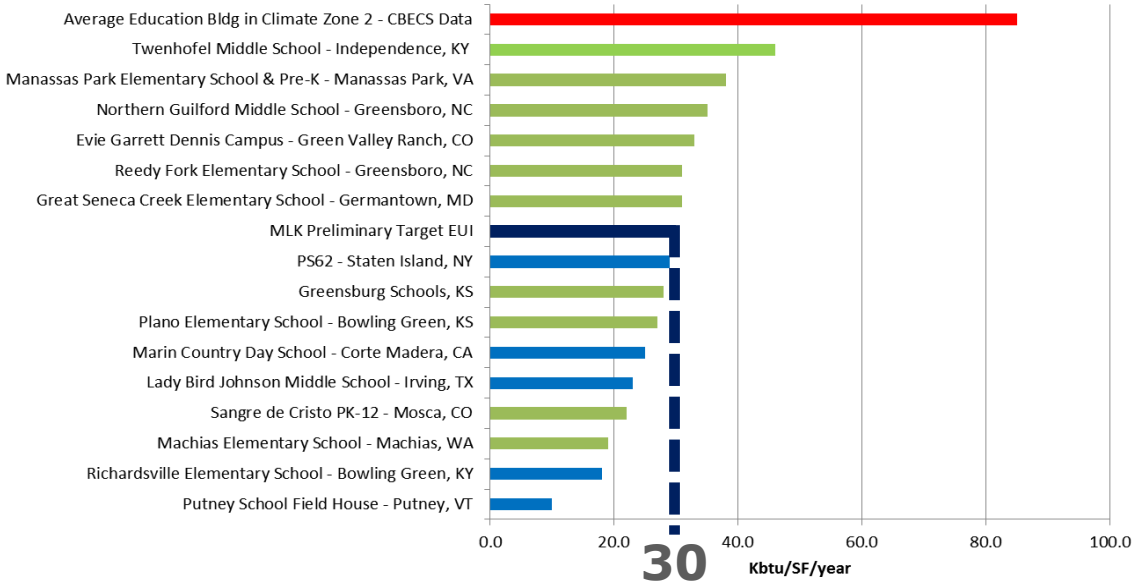
STEPS TO NZE – ESTABLISH ENERGY BUDGET

MAXIMUM POSSIBLE

- 2,700,000 kWh/year with **site fully covered** (140,000 sf)
- 57.6 kbtu/sf/year

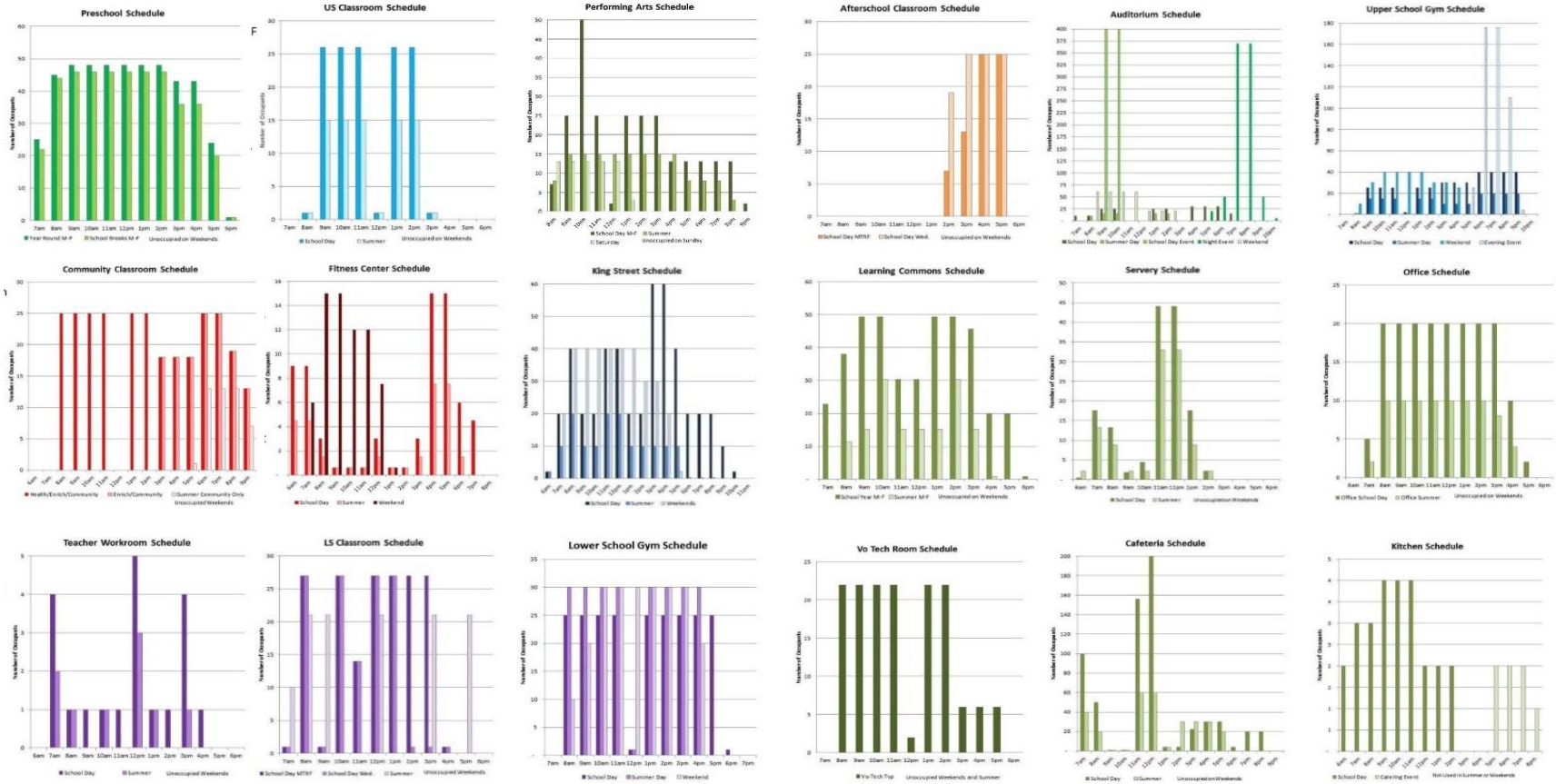
LIKELY REQUIRED

- 1,410,000 kWh/year with approximately 73,500 sf of PV with **over half of site covered**
- **30 kbtu/sf/year**

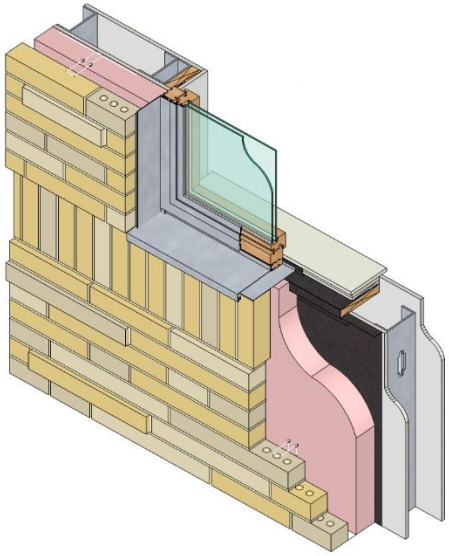


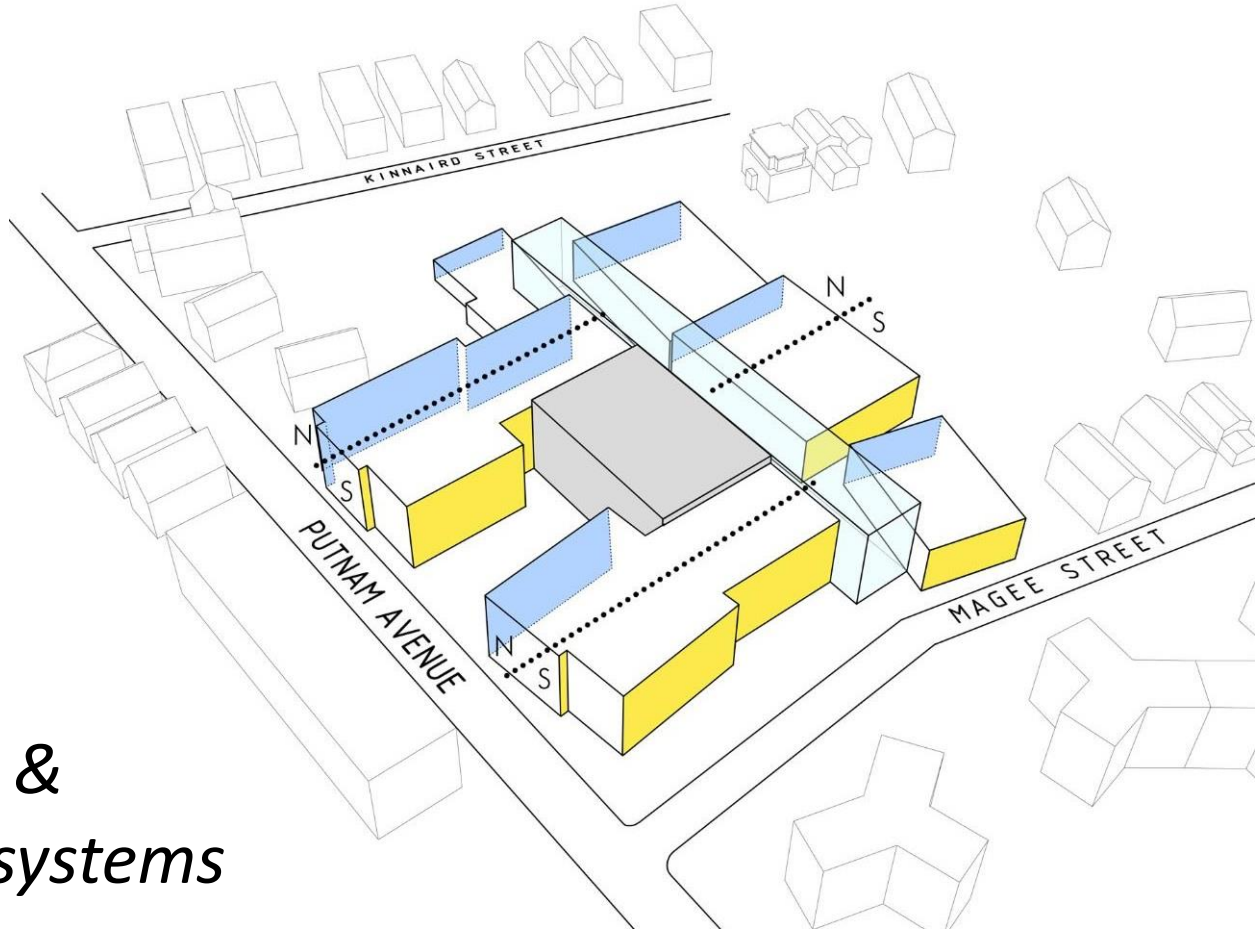
Energy Benchmarking (EUI)

STEPS TO NZE – UNDERSTAND EXPECTED ENERGY USE



STEPS TO NZE – OPTIMIZE THE DESIGN

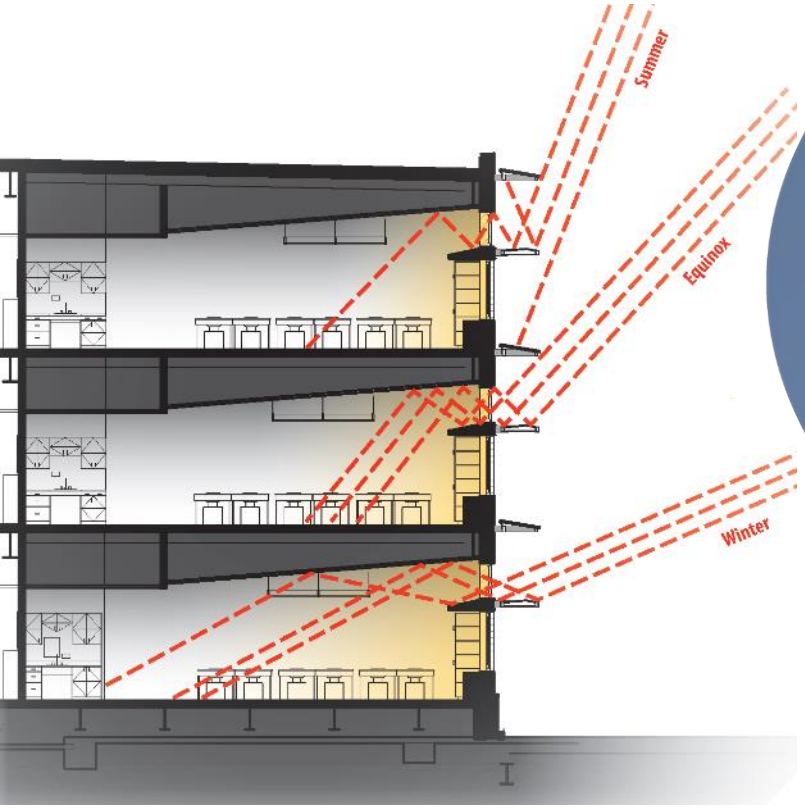


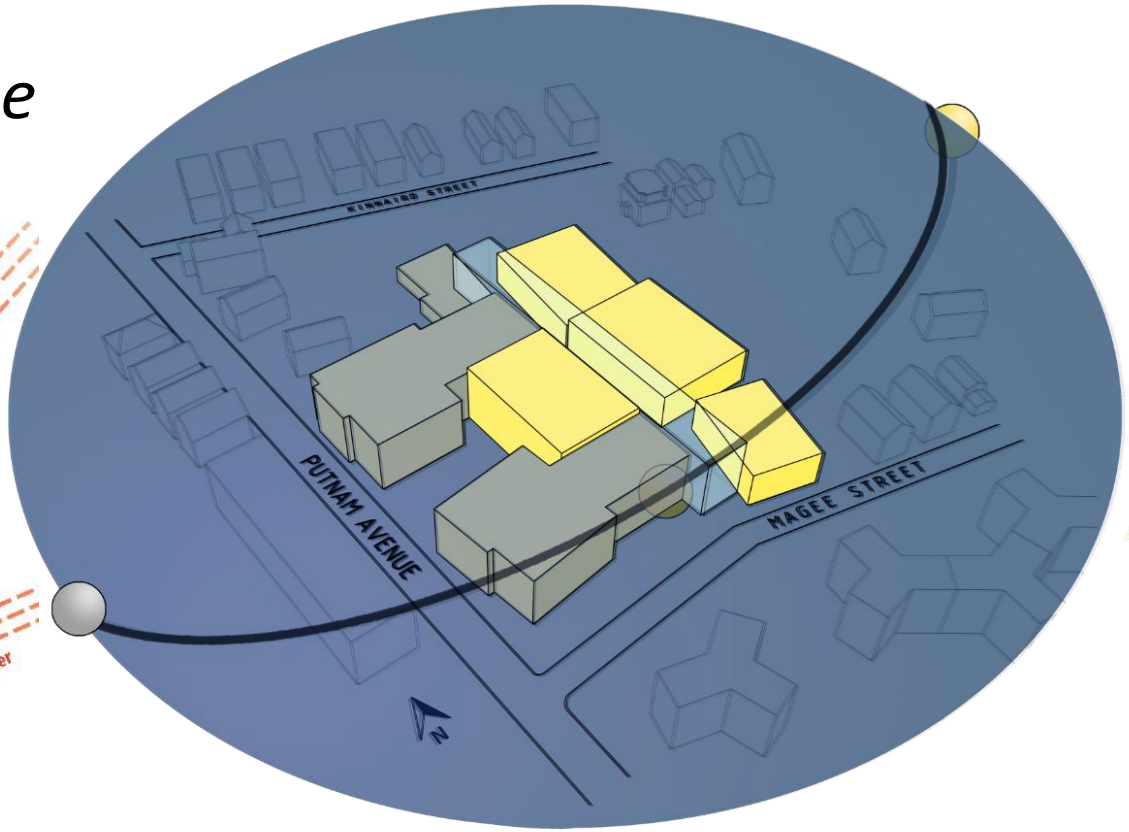


- Optimize the building
  - *Reduce loads & demands on systems*

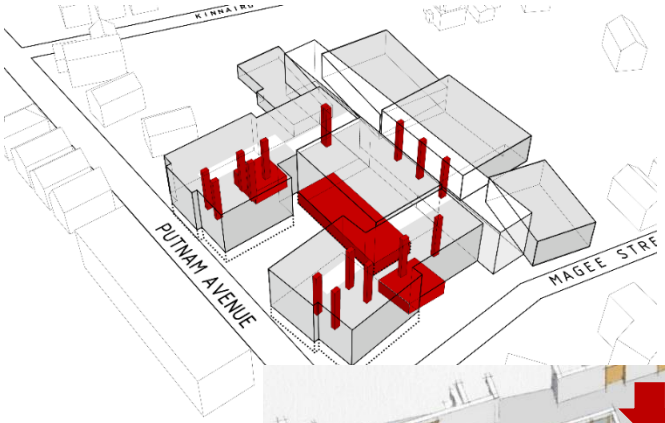
STEPS TO NZE – OPTIMIZE THE DESIGN

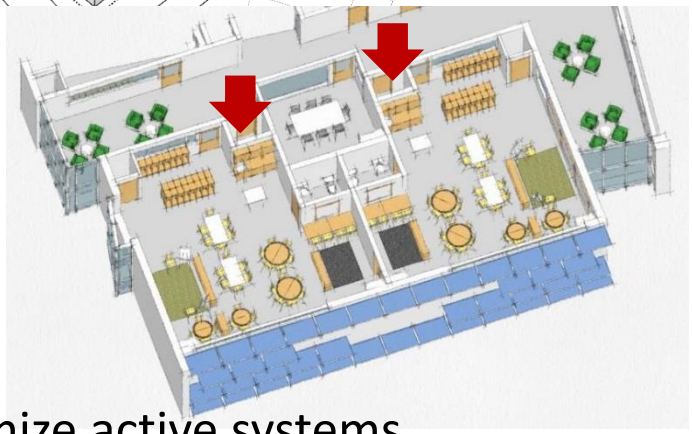
- Optimize passive systems
  - *– Reduce energy use*

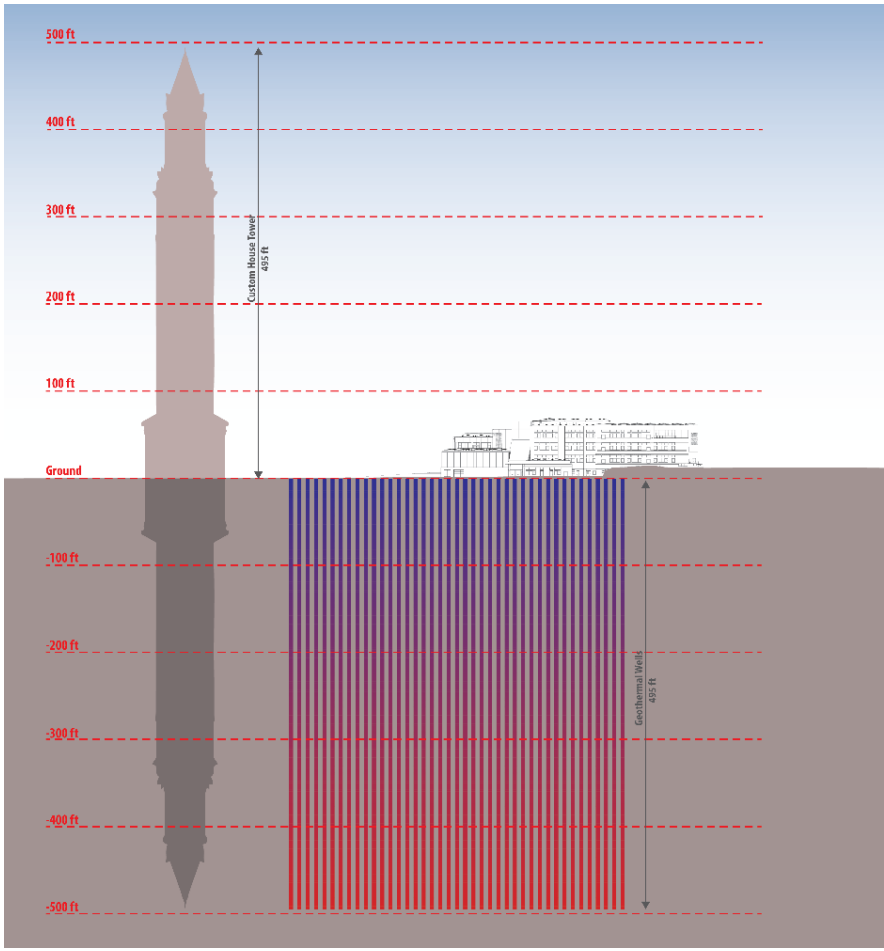




STEPS TO NZE – OPTIMIZE THE DESIGN

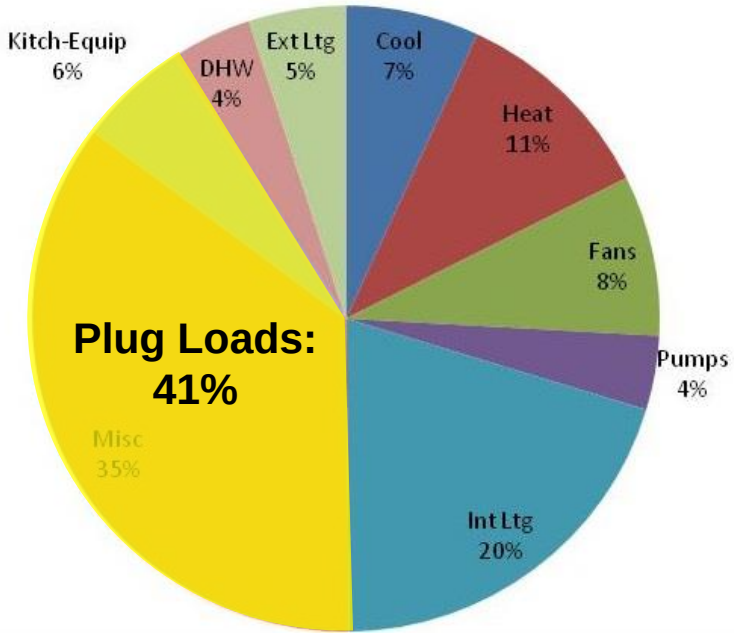


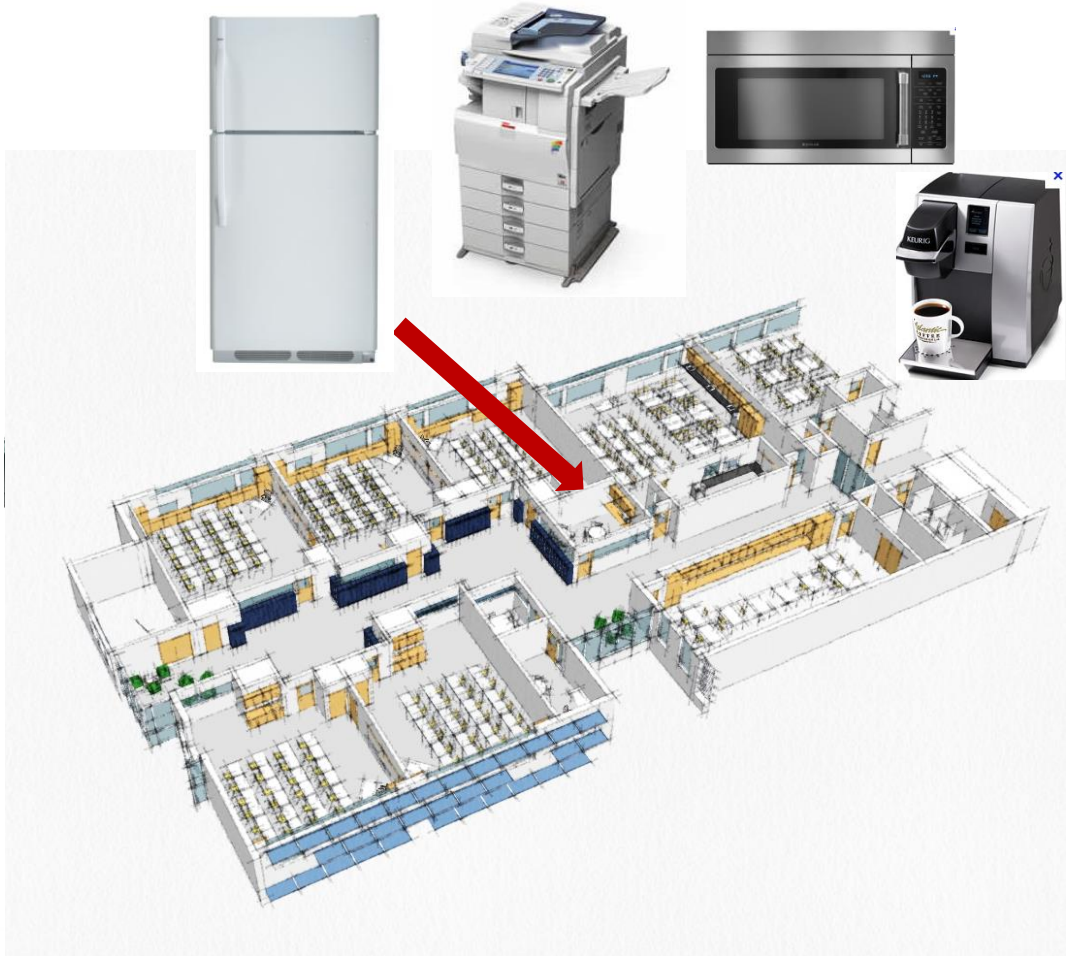




- Optimize active systems
  - *Use energy efficiently*

STEPS TO NZE – USERS TAKE OWNERSHIP



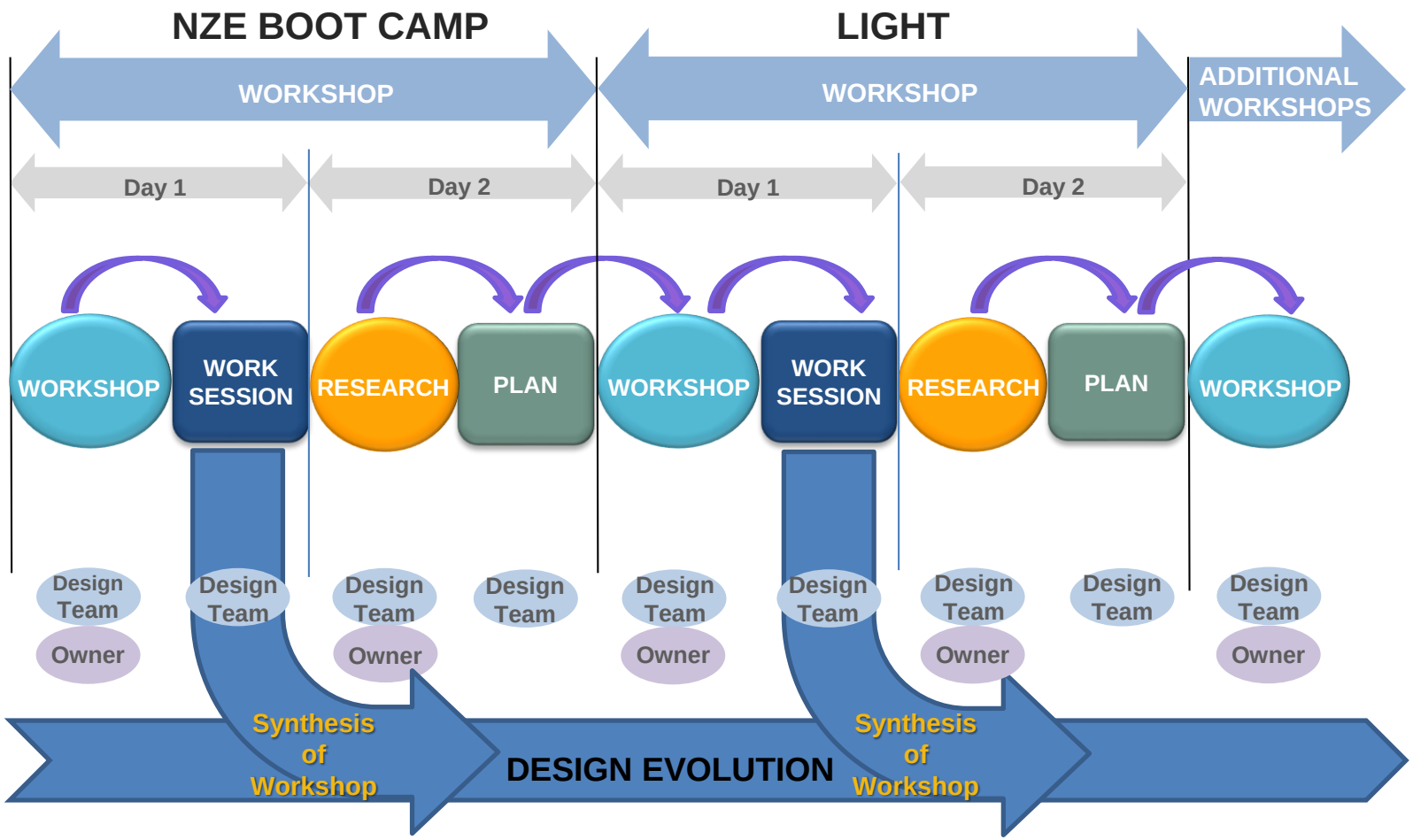


STEPS TO NZE – OCCUPANT ENGAGEMENT

- Owner/Client
  - *Understanding motivation*
- Teachers/Staff
  - *Understanding needs*
- Facilities/Maintenance
  - *Understanding resources*

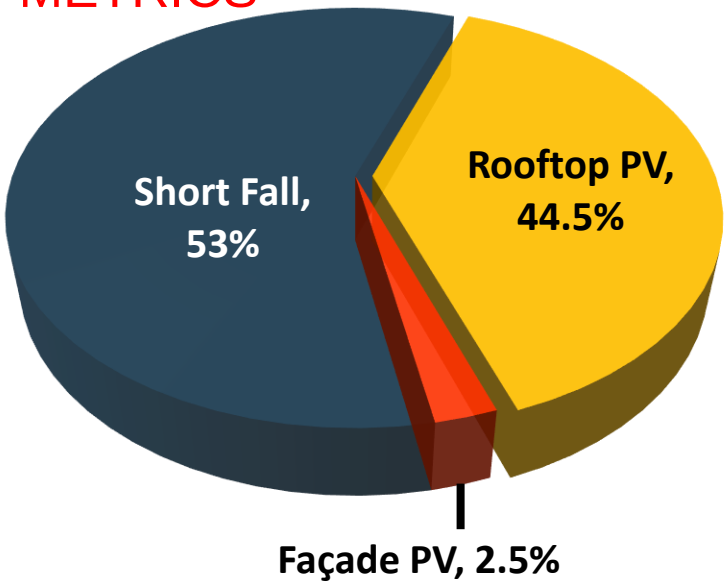
CONTINUED FEEDBACK & EDUCATION

PROCESS: SD WORKSHOPS



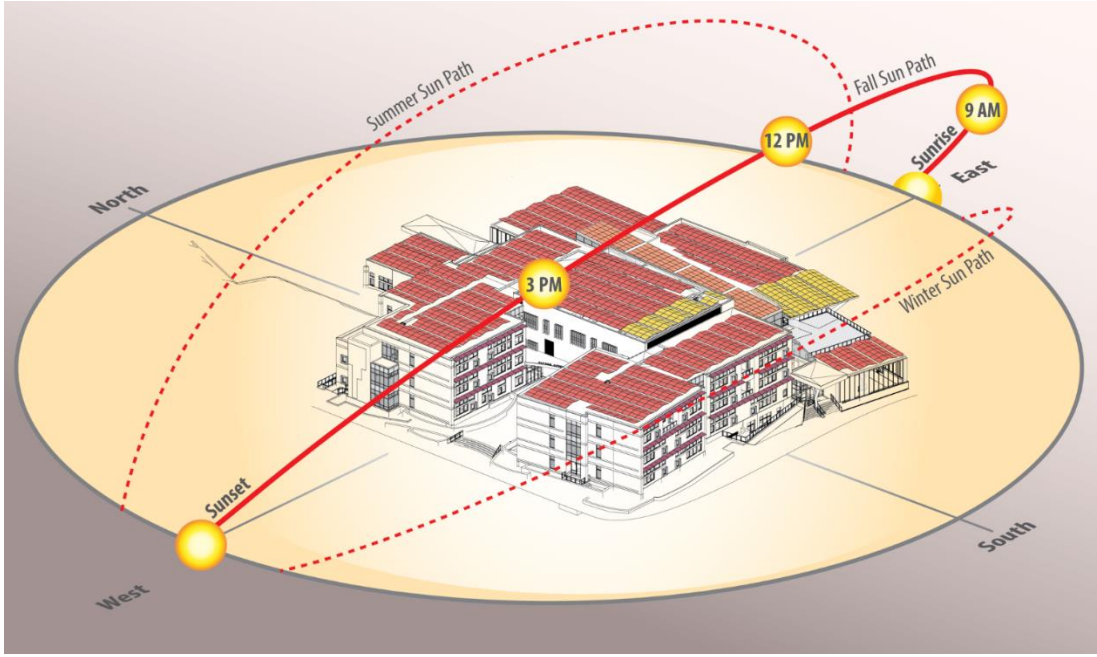
- HVAC
- EQUIP.
- FOOD SERVICE
- WATER

METRICS



- Proposed EUI: 33.4 kBtu/sf/yr
- Energy Savings: 69% (42% w/o PV's)
- Energy Generation: 705,110 kWh (47%)
- No. PV Panels: 1615 panels

MLK PV Design Estimate		
Location	Panel Quantity	Energy Generated (kWh)
Flat Roof	1830	58267
Canopy	184	56669.5
King Street	168	56569.1
Roof Total	2182	698505.6504
Façade Total	126	43676.9
Total for Project	2308	742182.5

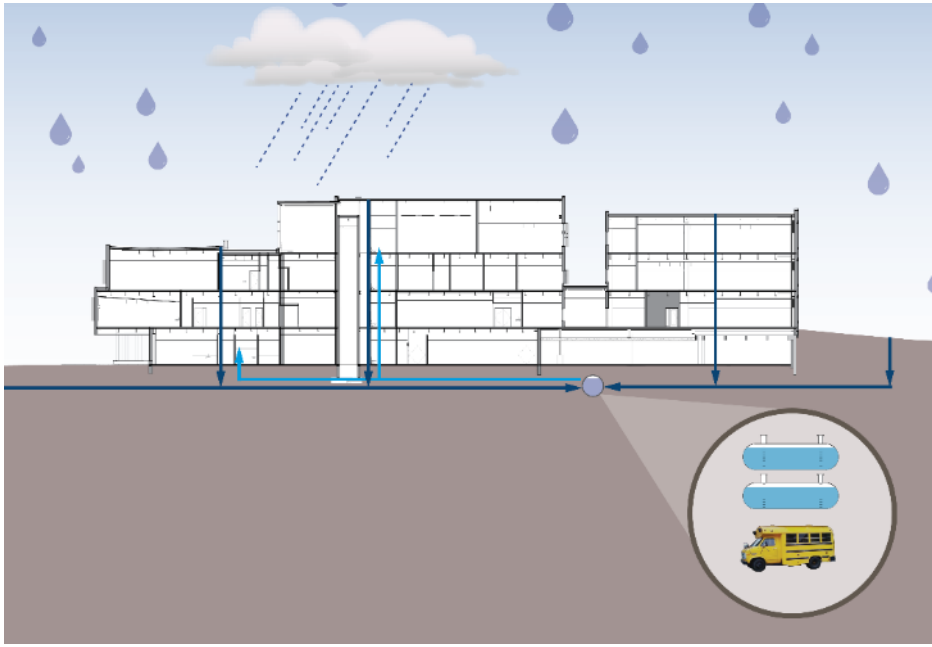


METRICS

LEED 2009 FOR SCHOOLS

- LEED PLATINUM 89 Y/4 M

1. Sustainable Sites (SS)	20 Y/1 M
2. Water Efficiency (WE)	8 Y/1 M
3. Energy & Atmosphere (EA)	33 Y/0 M
4. Materials & Resources (MR)	5 Y/2 M
5. Indoor Environ. Quality (IEQ)	13Y/1 M
6. Innovation & Design (ID)	6 Y/0 M
7. Regional Priority (RP)	4 Y/0 M



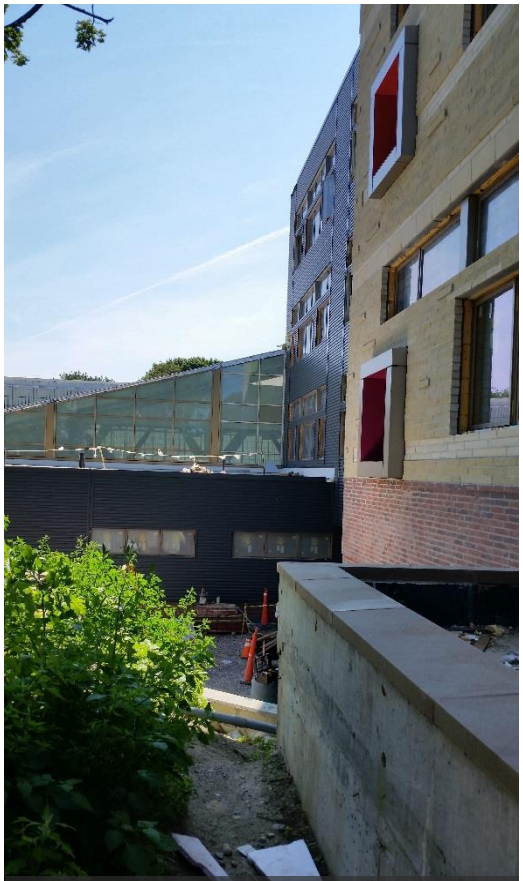
- 85% Reduction in Potable Water Use
- Two 10,000 gal. rainwater collection tanks: flush toilets & phosphorous removal
- 65 Geothermal well (7 miles of piping)

Lessons Learned….

- Process must be flexible, responsive & adaptable
- Program for mechanical space
- Set design criteria and stick to it - Keep track of the team
- Find your story: inspire action
- Engage the users, engage the users, engage the users!

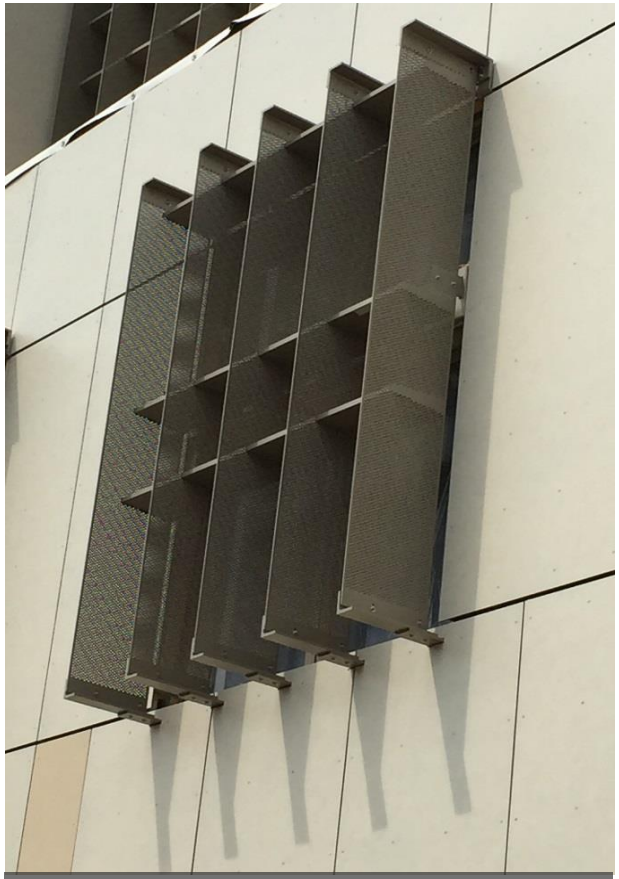
LOWER & UPPER SCHOOL ENTRY COURTYARD

ENTRANCE COURTYARD



NORTH FACE @ UPPER SCHOOL

FACADES DESIGNED FOR THEIR ORIENTATION

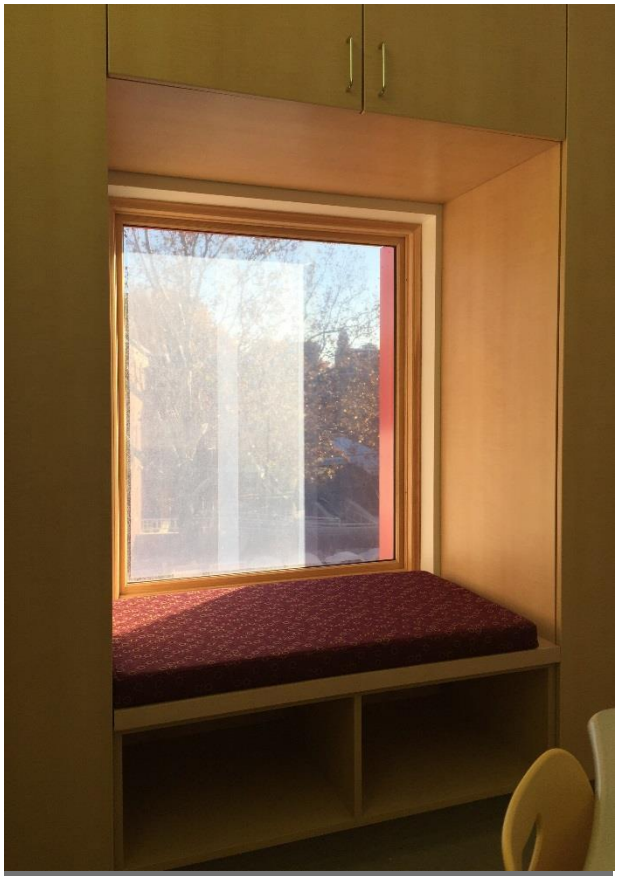


EAST/WEST SUNSHADES

LOWER SCHOOL

SOUTH FACING FAÇADE & COMMUNITY ENTRANCE

DAYLIT CLASSROOMS



WINDOW SEATS

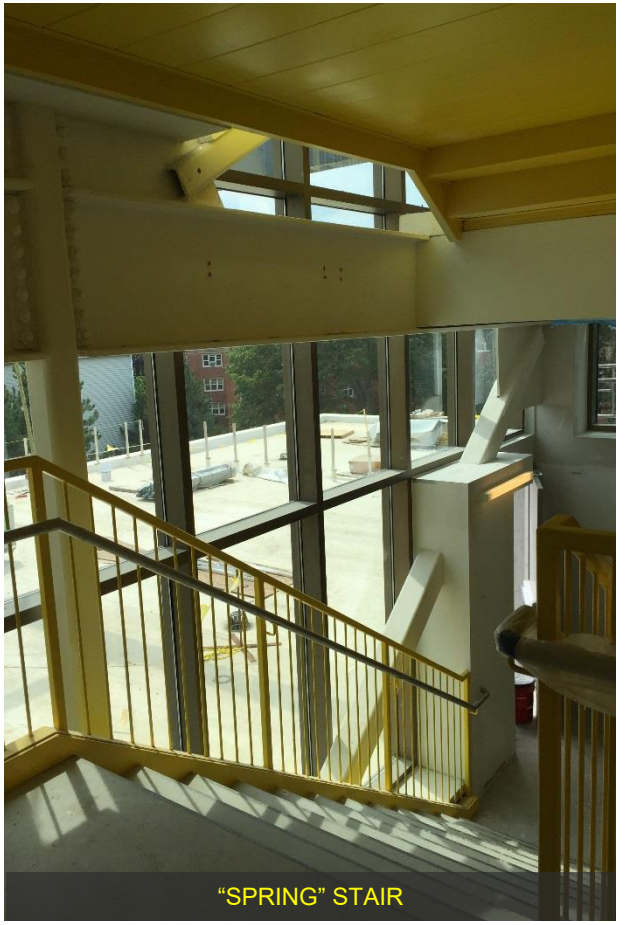
CLASSROOM W/ LIGHT SHELF

DAYLIT CLASSROOM

LIGHT SHELF IN THE CLASSROOM

DAYLIGHT THROUGHOUT

KING STREET



“SPRING” STAIR

BUILDING AS A TEACHING TOOL

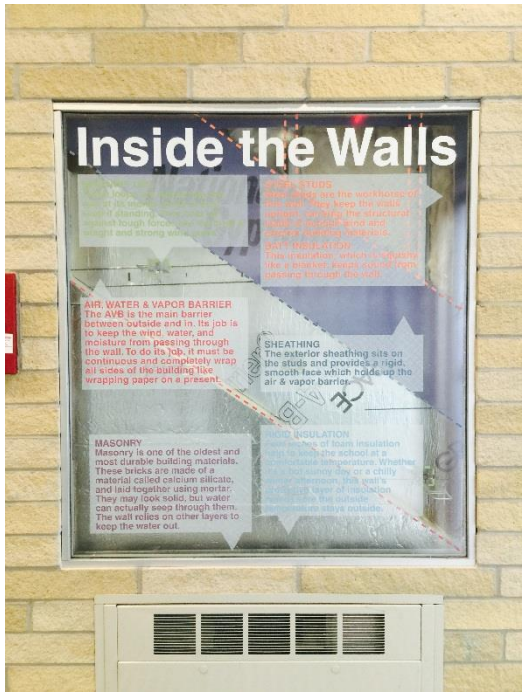



PHOTO-VOLTAICS ON TRELLIS OVER ROOF GARDEN & LOWER SCHOOL GYM

THE NEXT GENERATION