Proposition 39 ZNE School Retrofit Pilot Workshop

Delivering the Winning Pitch: Making the Business Case for ZNE Schools

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East Bay AIA

June 26, 2018

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Prop 39 ZNE School Retrofit Pilot Program Workshops

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Learning Objectives

1. Participants understand the fundamental principles and planning processes of getting to ZNE in the built environment.
2. Participants are given the opportunity to build on the real-world experiences of school districts in their efforts to engage stakeholders in their community.
3. Participants can describe best practices and key components of ZNE building success based upon real-world experiences of school districts that are pursuing and achieving zero net energy schools.
4. Participants have access to ZNE school experts and the opportunity to collaborate with other district staff as they brainstorm how to implement and support ZNE policies and programs.

Agenda

9:00 a.m. – 9:15 a.m.	**Welcome: Workshop Goals & Expectations**
9:15 a.m. – 9:30 a.m.	**Introduction: Zero Net Energy & Prop 39** *NBI and Pacific Gas & Electric*
9:30 a.m. – 10:20 a.m.	**The Winning Pitch: K-12 School Strategy** *Nate Kinsey, Energy Manager, San Francisco Unified School District &* *Alan Glass, Energy Supervisor, Pittsburg Unified School District*
10:20 a.m. – 10:35 a.m.	*Break*
10:35 a.m. – 11:00 a.m.	**The Winning Pitch: Community College Strategy** *Joe Fullerton, Facilities, Planning and Operations, San Mateo Community College District*
11:00 a.m. – 11:50 a.m.	**Activity: Developing Your Pitch to ZNE**
11:50 a.m. – 12:00 p.m.	**Closing Discussion & Resources**

School District Presenters

Joe Fullerton
San Mateo Community College District
Facilities Planning and Operations

Nate Kinsey
San Francisco Unified School District
Energy Manager

Alan Glass
Pittsburg Unified School District
Special Projects Accountant/
Energy Supervisor

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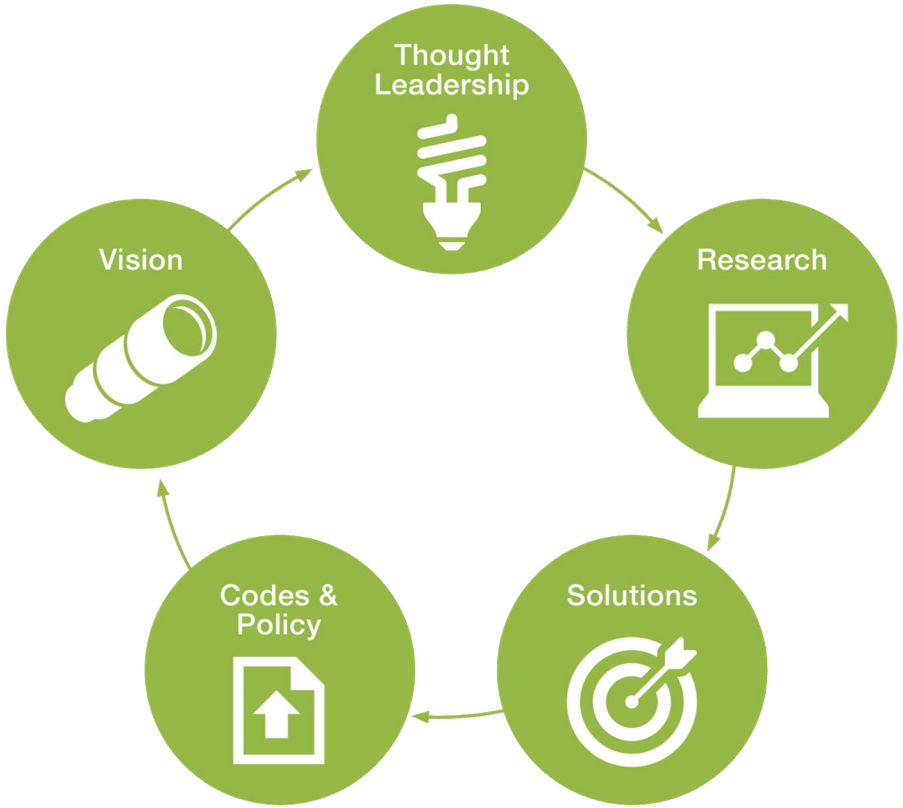
Redefining energy efficiency in the built environment

NBI is a national nonprofit working to improve buildings for people and the environment.

Program Areas:

1. *Best practices in new and existing buildings*
2. *Continuous code and policy innovation*
3. *Zero energy leadership and market development*



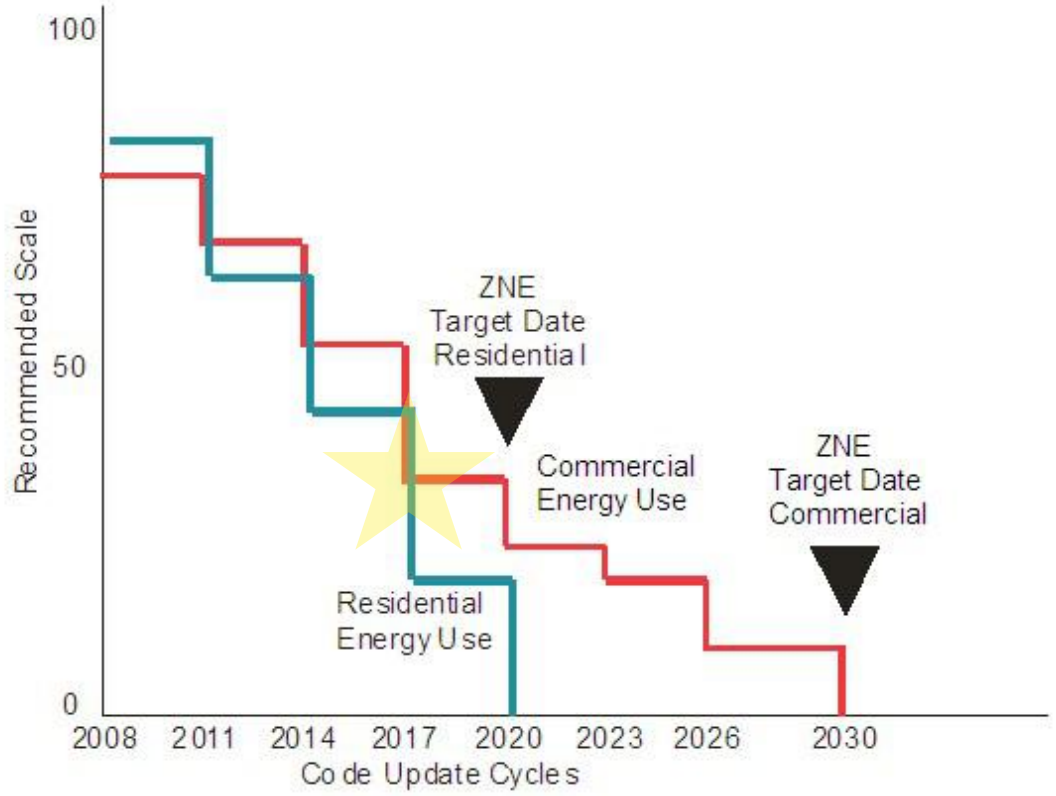
What is a Zero Net Energy Building?

ZNE Source Definition:

A building that produces at least as much energy as it uses in a year when grid-supplied energy (including primary energy for generation, transmission and delivery to the site) is taken into account

Sbrega Health & Science Building | Fall River, MA
Photo Courtesy of Edward Caruso

Code Cycles to Net Zero in California



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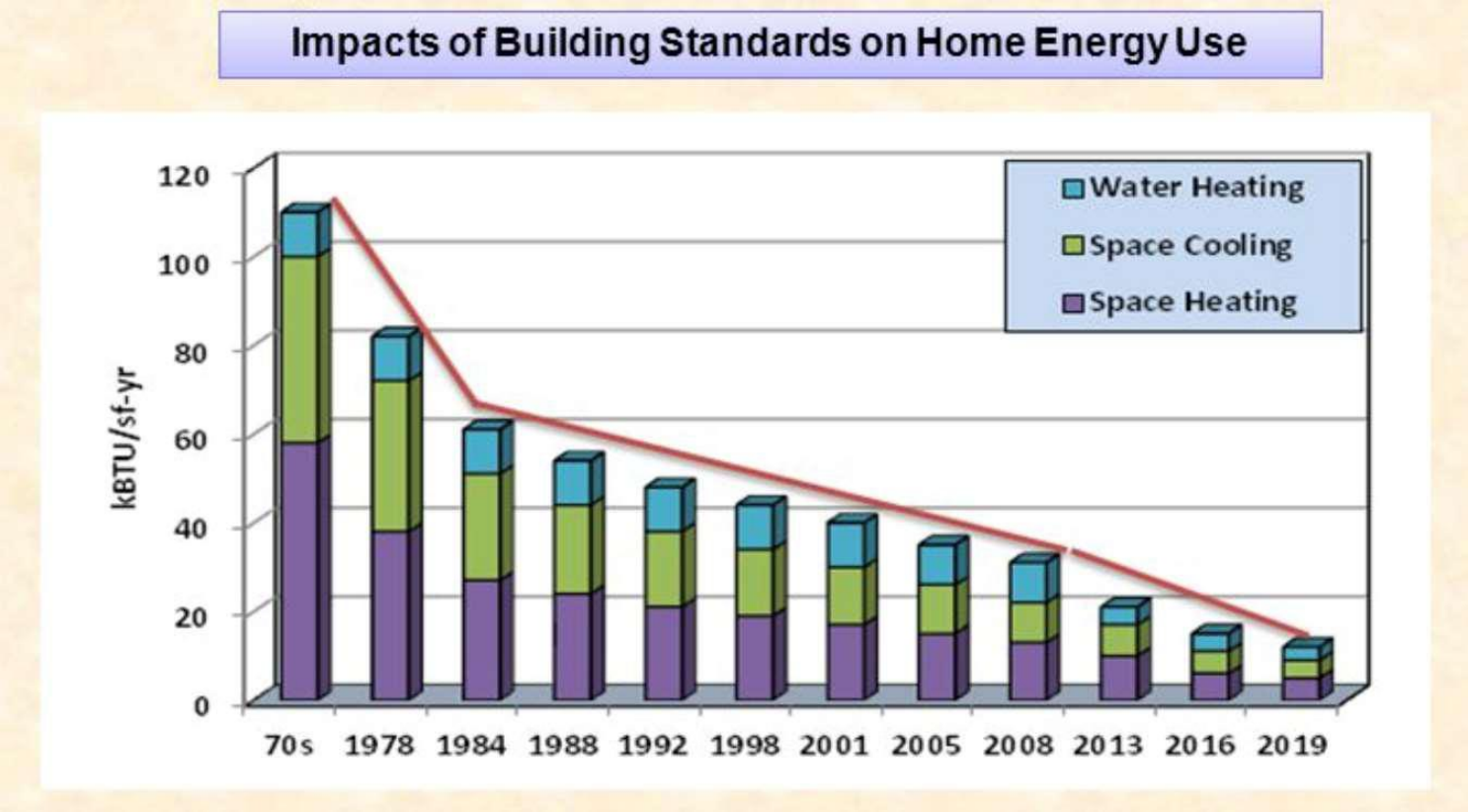
Source: SCE & AEC, 2009

Code Cycles to Net Zero in California



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Source: CEC 2016

Why Zero Net Energy Schools?

- The next evolution in sustainable, high performance buildings
- Cost avoidance from utility bills to classroom
- Create comfortable and productive environment for teachers and students
- Provide hands-on, tangible learning opportunities for 21st century skills
- Make schools and communities stronger, resilient and energy independent

Hood River School District Science Building | Hood River, OR
Photo Courtesy of Opsis Architecture

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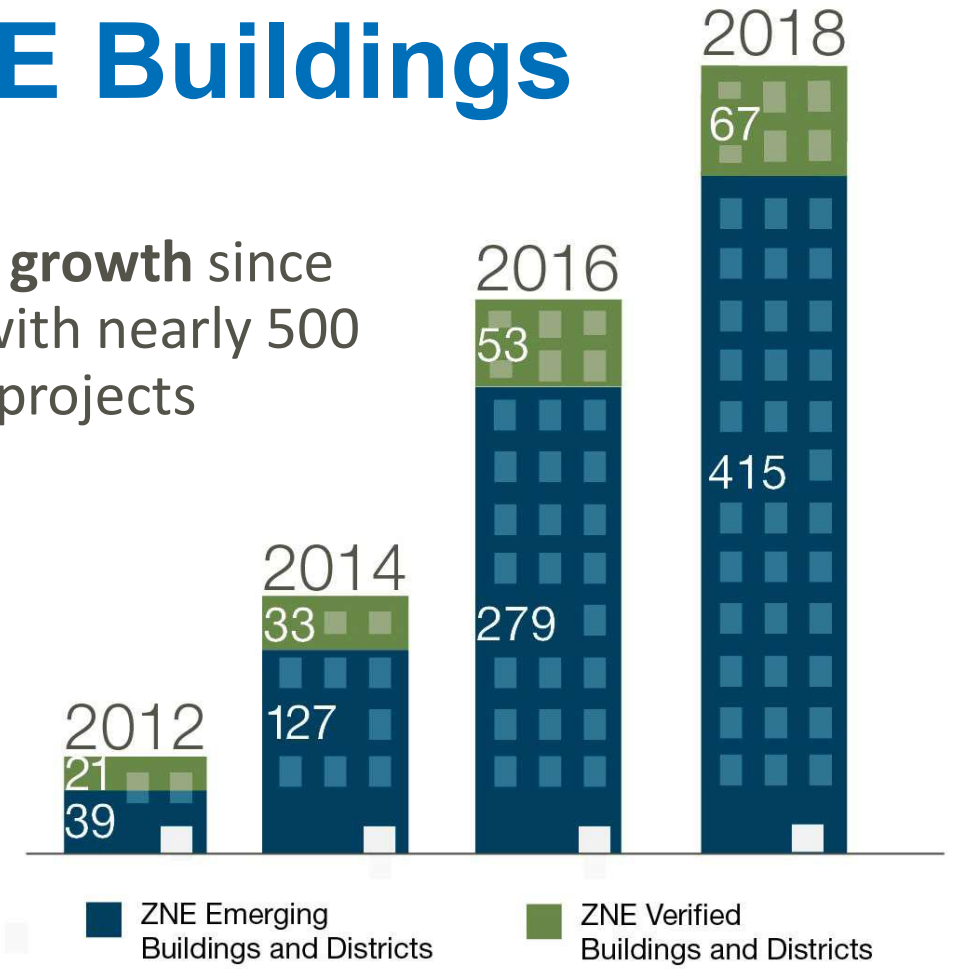
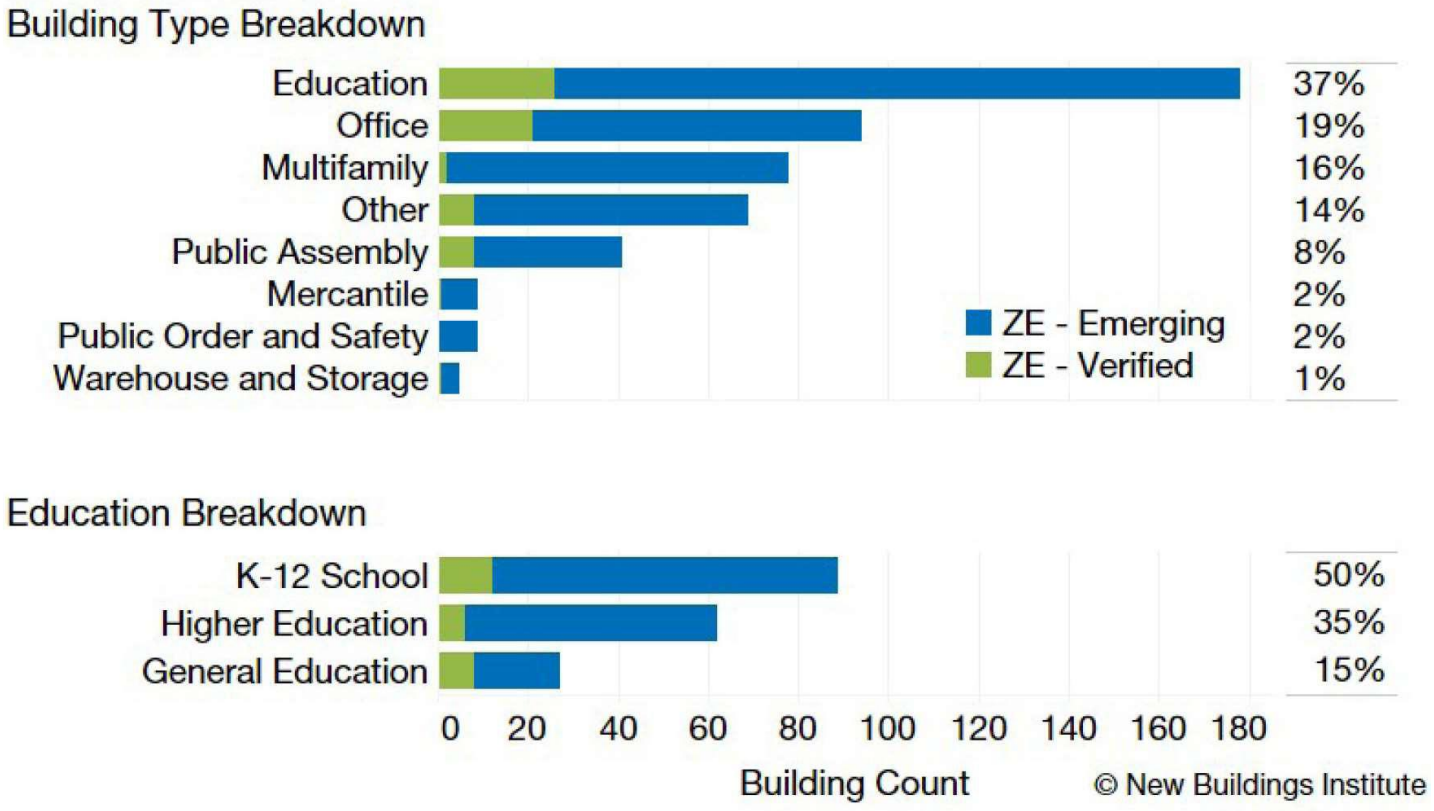
2018 List of ZNE Buildings

700% growth since 2012 with nearly 500 projects



Schools are Leading in ZNE



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ZNE and Ultra-Low Energy in Education

K-12 Schools

Community Colleges

Higher Education

Libraries

Science Centers

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Path to Zero Net Energy Schools:

Redding School for the Arts | Redding, CA
Photo Courtesy: TRILOGY Architecture

While ZNE is a realistic end game, the path to sustainable, zero net energy schools is a process that will take time to accomplish.

School districts can start now with benchmarking, energy targets, policies, plans and practices on the path to zero.

Prop 39 ZNE Pilot Program

Overview

June 26, 2018

Anna LaRue
presenting on behalf of Peter Turnbull

Prop 39 Public Schools ZNE Pilot, IOUs

Core Idea: Create an "adjunct" pilot to Prop 39 focused on ZNE

- **Demonstrate the technical feasibility of ZNE retrofits** in public K-14 schools statewide
  - Implement 12-14 total ZNE retrofit projects statewide
  - Use expert technical consultants to develop projects
  - Choose geographically, demographically diverse schools to work with

- **Provide training, recognition and communication**: Disseminate lessons learned regarding the technical design process and the implementation process broadly throughout the state
  - Technical and Institutional Training
  - Recognition Events
  - Publications

Method to Demonstrate Technical Feasibility of ZNE Retrofits

1. **Set a consumption target**

- Conduct “no stone left unturned” energy analysis of the building; develop fully calibrated energy model of the building
- Set an energy consumption target based on the model a kBtu/square foot/year consumption target to get to zero (pre-renewables)

2. **Design to the energy consumption target (no “de”-value engineering)**

- Establish measure package lists (usually with multiple options)
- Provide incremental cost buy-down to implement the measures (Utilities supplement state Prop 39 funds)

3. **Build out and implement the measures at the school**

4. **Provide end use monitoring, post-construction, for validation, diagnosis and correction**

Status Update of IOU Pilot

- **Training:** We have teamed up with the New Buildings Institute to deliver many training sessions statewide, both technical and institutional, with more to come
- **School Projects**: About 12 ZNE retrofit projects are underway throughout the state; these will complete mainly in 2018, some in 2019
- **Energy Performance Targets:** We find that a site energy target of about 20 kBtu/square foot/year is commonly feasible for many schools; savings in the range of 30-40% is a typical savings range
- **Common Measures**: We find many similarities in the measures identified for implementation across many schools
- **Bulk Procurement Opportunity**: There appear to be opportunities for statewide or regional "bulk procurement" of common measures (tubular skylights, heat pumps)

Commonly Identified Features and Measures

Successful districts have a strong project champion—sometimes inside the district, sometimes a consultant to the district

Daylighting features are commonly present but “defeated” in many older schools; usually uncontrolled glare is the reason for the “defeat”

All schools within the program have refreshed daylighting measures in the ZNE retrofit plan

- Replacement or refurbishment of skylights and clerestories and accompanying light shelfs and shades
- Addition of “tubular” skylights
- Addition of daylighting controls (to turn off lights when daylight is adequate)

Replacement of noisy, inefficient “Bard” heat pumps is commonly recommended

Envelope sealing and caulking is commonly recommended

Whole building control systems are commonly recommended

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Process to Achieve Zero Net Energy

Steps to Success in Sustainable Design

Kathleen Grimm School, PS 62 | New York, NY
Photo Courtesy: James Ewing

- Get Stakeholder Support
- Make a Commitment
- Use an Integrated Design Process
- Set Energy Targets
- Design and Construct To The Target
- Optimize Operations
- Measure and Verify

Discovery Elementary School | Arlington, VA
Photo Courtesy of VMDO Architects

Gain Support for the Path to Zero

- Stakeholder mapping:
  - Who are the stakeholders?
  - What are their drivers?
  - What are the key messages?
- Share case studies & fact sheets
- Tour nearby schools or share video case studies with decision makers
  - Patriot Hall - https://energytrust.org/pathtonetzero/
  - Discovery Elementary School - https://www.zeroenergy.org/video-case-study/

Discovery Elementary School | Arlington, VA
Photo Courtesy of VMDO Architects

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Benefits of High Performance Schools

- Occupants in ventilated spaces with low CO2 and low volatile organic compounds (VOCs) had improved scores in crisis response, information usage, and strategy ranging from 100 to 300%.[1]
- Students in daylit environments showed a 20-26% improvement on test scores compared to traditionally lit environments[2].
- Students with operable windows progressed 7-8% faster than those without operable windows[2].
- Students with the most daylighting performed 7-18% better in math and reading than those without[2].
- Students exposed to daylight attended school 3.2 to 3.810 more days per year[3]

Discovery Elementary School | Arlington, VA
Photo Courtesy of VMDO Architects

1. Bakó-Biró, Zs., Kochhar, N., Clements-Croome, D.J., Awbi, H.B. & Williams, M. (2007, January). Ventilation Rates in Schools and Learning Performance. https://www.researchgate.net/publication
2. Heshong Mahone Group. (1999, August 20). Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance. http://h-m-g.com/downloads/Daylighting/schoolc.pdf
3. Healthy Schools Network, Inc. (2012) Daylighting. http://www.healthyschools.org/downloads/Daylighting.pdf

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Six Key Messages for Communicating Zero Net Energy

1. **ZERO NET ENERGY:** Zero net energy (ZNE) schools are low energy buildings coupled with renewables that provide a ready generation resource.

2. **LOWER OPERATING COSTS:** Schools built to ZNE performance avoid utility costs that can be spent on educating students or further improving facilities.

3. **INCREASED STUDENT PERFORMANCE:** Occupants of ZNE schools benefit from heightened student performance, increased attendance, better occupant health and improved teacher satisfaction and retention.

Redding School for the Arts | Redding, CA
Photo Courtesy: TRILOGY Architecture

Six Key Messages for Communicating Zero Net Energy

4. **EDUCATIONAL BENEFITS:** ZNE schools are living laboratories, stimulating learning and innovation.

5. **RESILIENCY:** ZNE schools are also more resilient in severe weather events. They can create safe havens for the community during emergencies since the building energy generation systems can be islanded and remain functional continuing to provide light and space conditioning during an outage

6. **GETTING TO ZERO:** While ZNE is the end game for building sustainably, it is a process and can take time to accomplish. School districts can start now on this path to zero.

Discovery Elementary | Arlington. VA
Photo Courtesy: VMDO Architects

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Make a Commitment

- Start early!
- Benchmark
- Establish goals
- Attend webinars and trainings
- Visit an ultra-low or zero net energy building
- Identify sources to support efforts

Sbrega Health & Science Building | Fall River, MA
Photo Courtesy of Edward Caruso

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Financing and Incentives

Turkey Foot Middle School | Edgewood, KY
Photo Courtesy of JH Photography, Inc.

Zero net energy projects do not need to cost more, but they can…

Funding Opportunities:

- Solar Tax Credit
- Energy Efficiency Incentive Programs
- Bond funding
- Power Purchase Agreements

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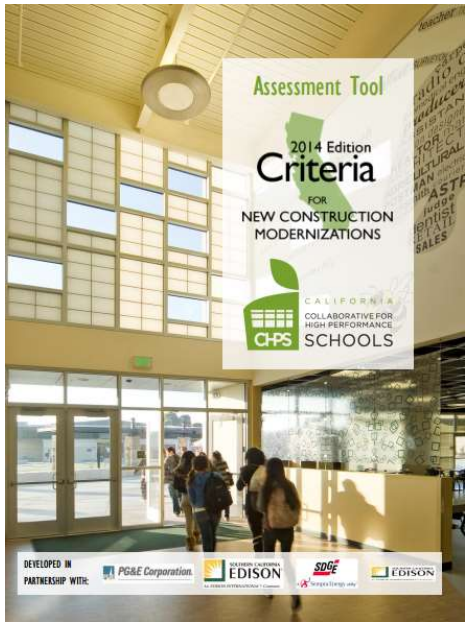
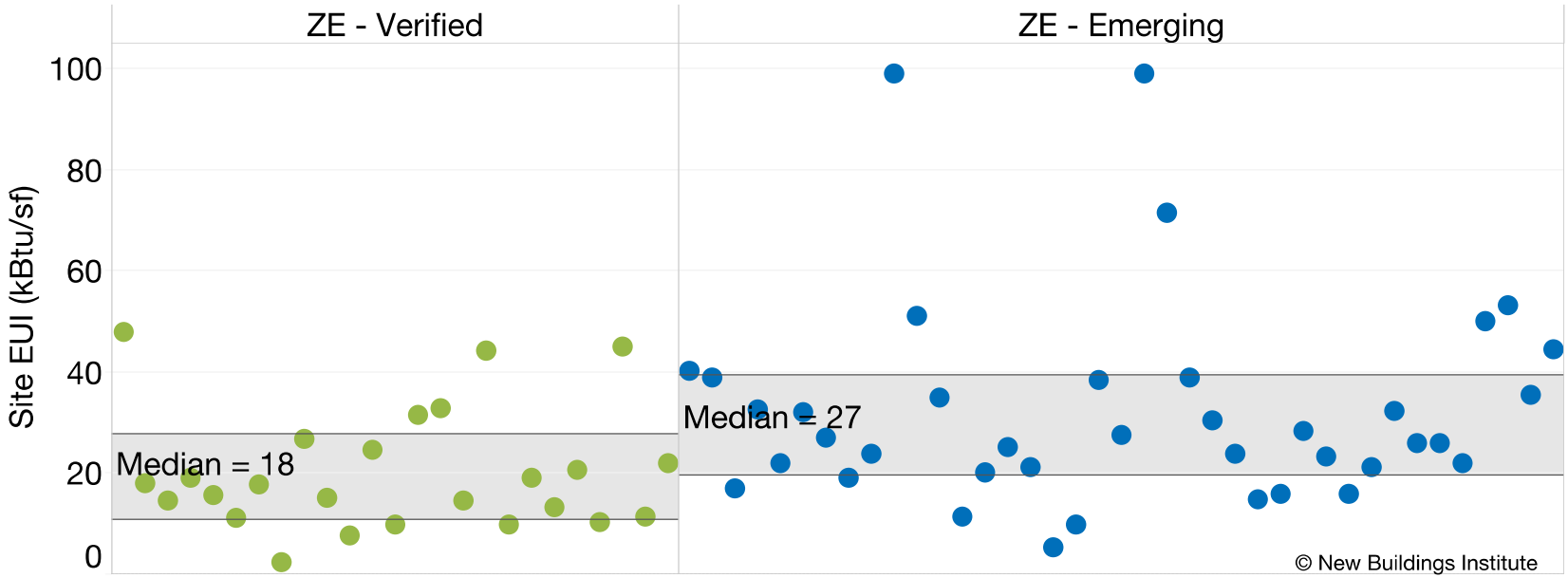
Establish the EUI Target

- Set absolute energy targets instead of simply “% better than code”
- Couple with other sustainability goals and policies (CHPS, LEED, etc.)
- Consider existing facility benchmarking results
- Determine solar capacity on roof and/or campus



Energy Use Intensity (EUI)
Range of Performance in Schools



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Zero Net Energy Targets

Table 29. Energy Intensity Values for Zero Energy Schools

Climate Zone	Representative City	Primary School		Secondary School	
		Site Energy (kBtu/ft²·yr)	Source Energy (kBtu/ft²·yr)	Site Energy (kBtu/ft²·yr)	Source Energy (kBtu/ft²·yr)
1A	Miami, FL	25.9	76.4	23.1	68.5
2A	Houston, TX	24.3	71.1	21.7	63.5
2B	Phoenix, AZ	24.7	72.5	21.9	64.3
3A	Memphis, TN	23.8	69.0	21.2	61.6
3B	El Paso, TX	23.4	67.8	20.7	60.2
3C	San Francisco, CA	21.6	61.9	19.0	54.3
4A	Baltimore, MD	23.5	67.6	20.9	60.1
4B	Albuquerque, NM	23.1	66.6	20.4	58.8
4C	Salem, OR	22.4	64.2	19.7	56.4
5A	Chicago, IL	24.3	69.9	21.6	62.2
5B	Boise, ID	23.2	66.7	20.4	58.4
6A	Burlington, VT	24.5	70.1	21.6	61.9
6B	Helena, MT	23.5	66.9	20.5	58.4
7	Duluth, MN	25.9	74.1	22.8	65.1
8	Fairbanks, AL	28.7	82.5	25.0	71.5

NREL Technical Feasibility Study for Zero Energy K-12 Schools: http://www.nrel.gov/docs/fy17osti/67233.pdf

Integrating Zero Net Energy Into the Process

- Integrate energy targets and solar considerations into RFP, OPR and contract language
- Host integrated design charrette early in design
- Use energy modeling to inform decisions
- Consider controls that allow for centralized management
- Include “net zero” building commissioning
- Keep team involved *after* substantial completion

Example OPR's

SFUSD PROJECT REQUIREMENTS

May 1, 2017

SUSTAINABLE SFUSD

ZERO NET ENERGY

All buildings will use less than 20 kBTU/sf/yr by 2040

STRATEGY

The District has many opportunities to improve the carbon footprint of its buildings:

BOND PROJECTS: voter-approved funding for new construction & major renovations provides the best opportunity for deep energy retrofits

MONITORING: post-occupancy commissioning and energy monitoring can identify opportunities to adjust operation to meet design intent

OPERATIONS & SHARED SAVINGS: preventative maintenance, energy and water monitoring, and engagement of users prevent rising energy and water usage as buildings age

FACILITIES PROJECTS: major repairs and deferred maintenance projects provide an opportunity to improve energy and water efficiency

These *SFUSD Owner's Project Requirements* were created to assist design teams in supporting the District's ambitious zero carbon goals. The following pages describe the process for incorporating ZNE-ready design into new buildings, bond modernizations, and facilities projects. In summary:

New Buildings will be designed to achieve an Energy Use Intensity (EUI) < 20 kBTU/sf/yr. SFUSD's preferred strategies for achieving such exemplary energy efficiency are outlined in the *ZNE Guidelines* at the end of this document. While the addition of renewable energy is generally outside the scope of new projects, solar readiness should be built into the building.

Bond Modernizations will focus on improvements to the lighting systems and building envelope as outlined in *ZNE Assessments* commissioned by the District for every project prior to the design phase. These assessments will also look for opportunities to improve heating and ventilation systems, but these items will generally be tackled in future bonds unless broken equipment necessitates earlier action.

Facilities Projects generally have limited scope and will support ZNE goals by upgrading building elements as they wear out. In each case, the *ZNE Guidelines* below and *District Design Standards + Guidelines* (DDSG) will inform the design and selection of materials and/or equipment for these projects.

PROCESS

New Buildings

Ensuring that the District's energy targets are faithfully met in new construction projects requires a rigorous design process, stellar construction techniques, and attention to quality control. To ensure the best possible outcome on each and every project, SFUSD requires architects to incorporate the following elements into the process of creating new buildings:

CHARRETTE: All projects will commence with an architect-led design charrette specifically focused on identifying the strategies and systems necessary for meeting the EUI performance goal. At a minimum, the Project Manager, Sustainability Office, Buildings & Grounds, Design Team, Commissioning Agent, and Electrical/Mechanical/Civil consultants will attend.

ENERGY MODELING: Building form, massing, orientation, and roof layout (among other design parameters) have a significant impact on energy usage and solar energy production. Therefore, design decisions shall be evaluated against a constantly refined energy model from the earliest stages of a project. In this way, project architects will have many opportunities for course correction should site conditions or non-energy parameters make achievement of ZNE goals difficult.

COMMISSIONING: Commissioning agents hired by the District will be brought into the design process early on and follow each project through design, construction, and post-occupancy to ensure that design intent is achieved as outlined in this document and reflected in the Basis of Design (BOD). The *Commissioning Plan* will include design reviews, construction inspections, functional testing, development of a maintenance manual, and systems training (see Commissioning Procedures in the 2016 Bond Program *Procedures + Standards Binder*).

First ZNE Projects

SFUSD is in the process of designing its first new ZNE building at Claire Lilienthal School on Divisadero St. The building will house the middle school program of this K-8 school and replaced eight existing bungalows. The second ZNE project is a PG&E-supported modernization of Garfield Elementary on Telegraph Hill. The utility is particularly interested in identifying design solutions in the constrained urban environment.

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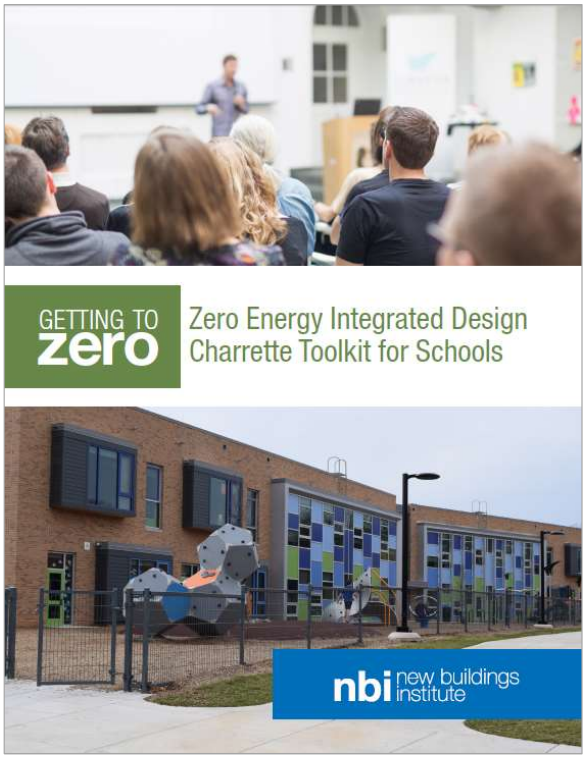
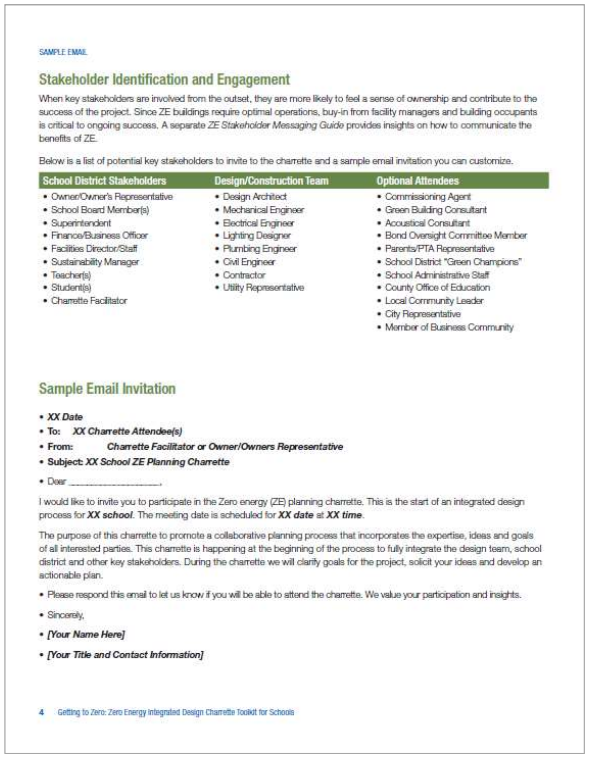
Integrated Design Charrette Toolkit for Schools





SAMPLE EMAIL

Stakeholder Identification and Engagement

When key stakeholders are involved from the outset, they are more likely to feel a sense of ownership and contribute to the success of the project. Since ZE buildings require optimal operations, buy-in from facility managers and building occupants is critical to ongoing success. A separate *ZE Stakeholder Messaging Guide* provides insights on how to communicate the benefits of ZE.

Below is a list of potential key stakeholders to invite to the charrette and a sample email invitation you can customize.

School District Stakeholders	Design/Construction Team	Optional Attendees
• Owner/Owner's Representative • School Board Member(s) • Superintendent • Finance/Business Officer • Facilities Director/Staff • Sustainability Manager • Teacher(s) • Student(s) • Charrette Facilitator	• Design Architect • Mechanical Engineer • Electrical Engineer • Lighting Designer • Plumbing Engineer • Civil Engineer • Contractor • Utility Representative	• Commissioning Agent • Green Building Consultant • Acoustical Consultant • Bond Oversight Committee Member • Parents/PTA Representative • School District "Green Champions" • School Administrative Staff • County Office of Education • Local Community Leader • City Representative • Member of Business Community

Sample Email Invitation

- ***XX Date***
- **To:** ***XX Charrette Attendee(s)***
- **From:** ***Charrette Facilitator or Owner/Owners Representative***
- **Subject:** ***XX School ZE Planning Charrette***
- Dear _____,

I would like to invite you to participate in the Zero energy (ZE) planning charrette. This is the start of an integrated design process for ***XX school***. The meeting date is scheduled for ***XX date*** at ***XX time***.

The purpose of this charrette to promote a collaborative planning process that incorporates the expertise, ideas and goals of all interested parties. This charrette is happening at the beginning of the process to fully integrate the design team, school district and other key stakeholders. During the charrette we will clarify goals for the project, solicit your ideas and develop an actionable plan.

- Please respond this email to let us know if you will be able to attend the charrette. We value your participation and insights.
- Sincerely,
- ***[Your Name Here]***
- ***[Your Title and Contact Information]***

SAMPLE CHARRETTE AGENDA

Sample Charrette Agenda

Below is a sample agenda for an Integrated Design Charrette. A more detailed, Facilitator's Version of the Agenda is located at the end of this document.

Event Title

Day of the Week, Date, Year
Time (Hour AM – Hour PM)
Address: Street
City, State Zip
XX Room Number

Map

Time	Content	Who
8:30-9:00 am	GATHER AND SETTLE IN	All
9:00-9:10 am	Welcome & Introductions	All
9:10-9:15 am	Purpose and Introductions	Facilitator Owner
9:15-9:20 am	Agenda and Expectations	Facilitator
9:20-9:30 am	Overview of Sustainable, ZE Schools	Facilitator
9:30-9:50 am	Activity: What is Your Vision of a Sustainable, ZE School?	All
9:50-10:05 am	Project Overview and Goals	Architect
10:05-10:45 am	Site, Stormwater, and Water Strategies	Civil & Plumbing Engineers
10:45-11:00 am	BREAK	All
11:00-11:40 am	Energy Strategies to Achieve ZE	Architect, Mechanical
11:40 am-noon	Strategies to Support Superior Indoor Environmental Quality	Architect
12:00-12:20 pm	Designing & Operating to ZE	Facilitator, All
12:20-12:40 pm	Review Sustainability & Energy Targets and Identify Action Items	Facilitator, All
12:40-12:45 pm	Wrap Up and Conclusion	Facilitator

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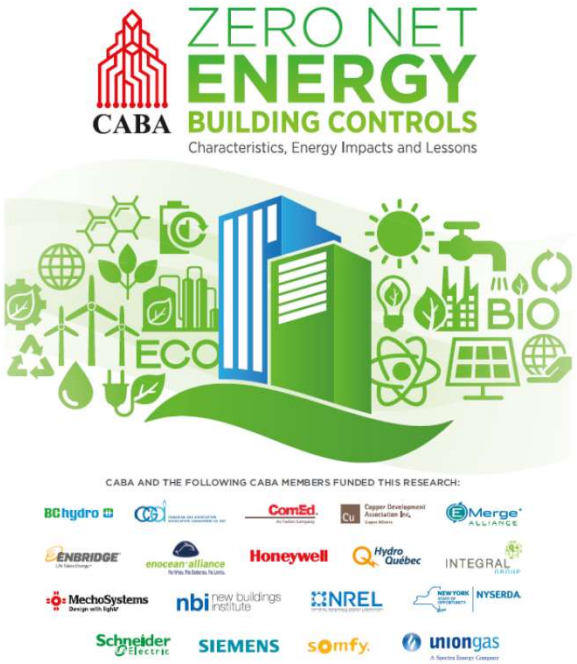
Design to the Target

Building automation and controls integration

Making It All Work Together: Key Points

- Use the Owners Project Requirements (OPR's) to guide the ZNE process
- Plan for measurement and verification
- Beware of value engineering!
- Controls considered from design through operation
- Keep the operators and occupants in mind



Common Technologies for ZNE

- Building Orientation, Window to Wall Ratio, and Glazing Location/Optimization
- Highly Efficient Thermal Envelope
- Ventilation Options: Natural, Dedicated Outdoor Air Systems (DOAS), Demand Control Ventilation (DCV)
- Conditioning: Ground Source, Radiant, Chilled Beams
- Controls Integration
- Daylighting Access and Controls
- Solar and Glare Control - shading
- Energy Recovery Systems
- Plug Load Reductions
- Energy Management Systems
- Building Dashboards

Redding School for the Arts | Redding, CA
Photo Courtesy: TRILOGY Architecture

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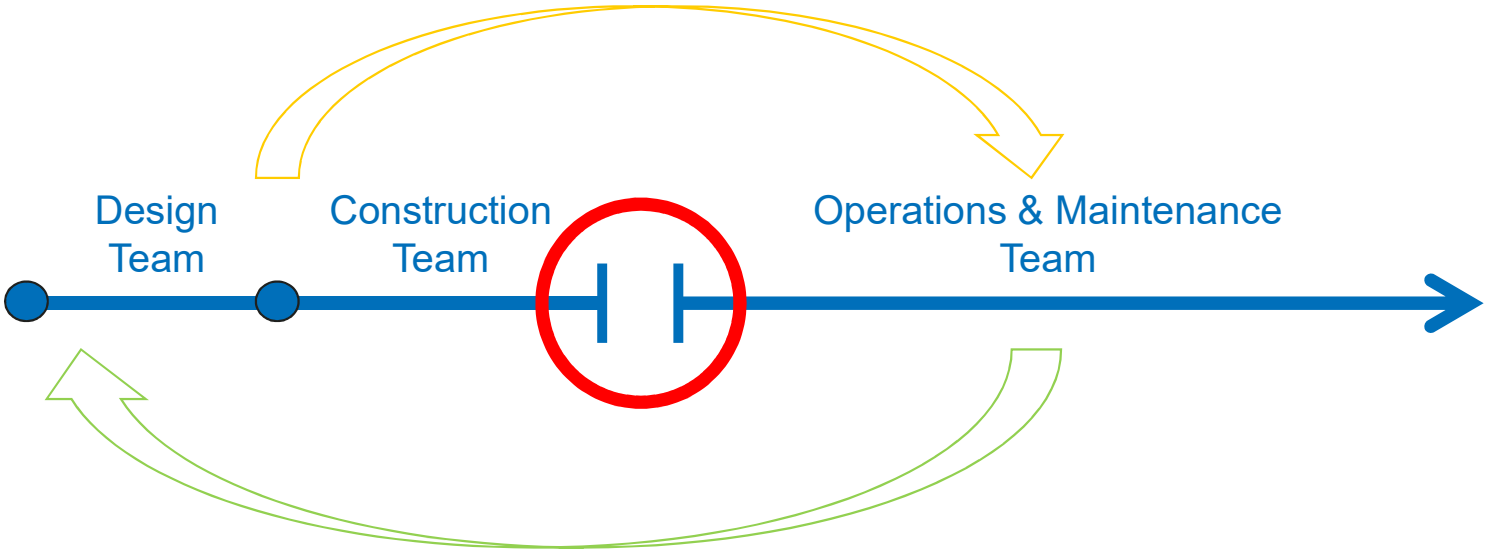
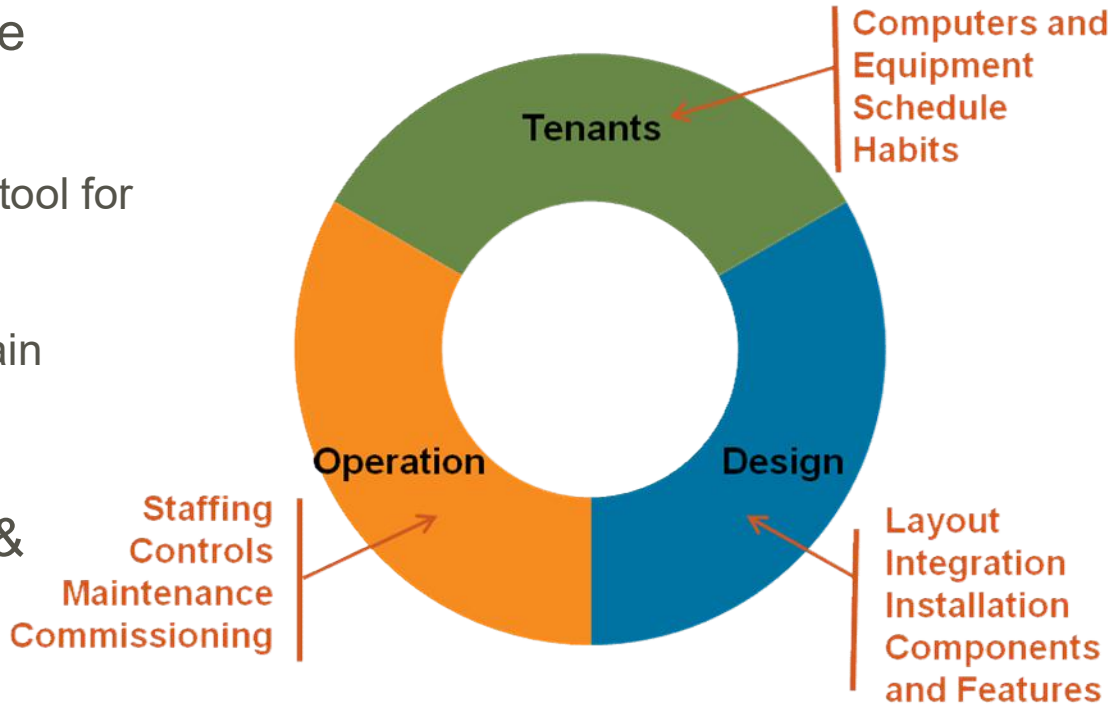
Contract to Achieve the Target

Integrating operations team into the design process



Operate to the Target

- **Operator training & guides** (on-going)
- **Monitor** & **benchmark** energy use
- **Engage occupants**
  - Use your building as an educational tool for 21st Century Skills & STEAM
  - Create awareness of environmental stewardship & the energy supply chain
- **Plug load management**
- Seek **continuous improvement** & performance data review
- **Use** operator, occupant & public **feedback**



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Measure and Verify Performance

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Case Studies

Garden Grove School District Retrofit

Location: Garden Grove, CA

Construction Type: Retrofit

Schools: Ralston Intermediate & Santiago High School

Building Size: Ralston: 6,200 SF
Santiago HS: 8,069 SF

Building Completed: 2018

Energy Target: Zero Net Energy

Predicted EUI: 24.7 kBtu/sf/yr

GGUSD is a large, low income school district in California. It ranks among the lowest 20% of districts in terms of household income and top 20% test scores. Their culture of frugality means they have consistently invested in students over facilities.

Photo Courtesy of Garden Grove School District.

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Garden Grove School District Retrofit

Technologies:

- LED Lighting Upgrade
- Lighting & HVAC Controls
- Tubular skylights and daylighting
- High Efficiency HVAC
- Energy Star Appliances
- Energy Dashboard
- 38 kW Photovoltaic Array (proposed)

Retrofits will focus on classrooms and kitchens. The Santiago project will serve as a hub for the school's environmental student groups where students use energy data as a hands-on STEM learning opportunity.

Lighting Replacements Before and After. Photo Courtesy of Garden Grove School District.

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San Francisco City College Multi-Use Building

Location: San Francisco, CA

Construction Type: New Construction, Ultra-Low

School Type: Community College

Building Size: 102,000 ft^2

Building Completed: 2010

Energy Target: 40% better than Title 24 energy code

EUI: 28 (Building total EUI) – 0 (RPI) = **28** (Net EUI)

Photo Courtesy of Bruce Damonte

San Francisco City College Multi-Use Building

The Multi-Use Building (MUB) is a pioneering project for large, low-energy facilities. The building is one of the largest in the U.S. to rely nearly entirely on natural ventilation to meet fresh air and cooling requirements.

The SFCC MUB houses classrooms, laboratories, a childcare center, café, meeting rooms, administrative offices, and other miscellaneous spaces.

Photo Courtesy of Bruce Damonte

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San Francisco City College Multi-Use Building

Technologies:

- Daylighting
- Lighting Controls
- Natural Ventilation
- Radiant Heating System
- Temperature Controls
- Demonstration PV Array & the plan for more panels in the future

Lessons Learned:

- Natural ventilation (wind) poses challenges with occupants/operators.
- Staff turnover causes major gaps in operational efficiency.

Photo Courtesy of Bruce Damonte

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SFUSD Carbon Neutrality

Pitching for Zero, Again…

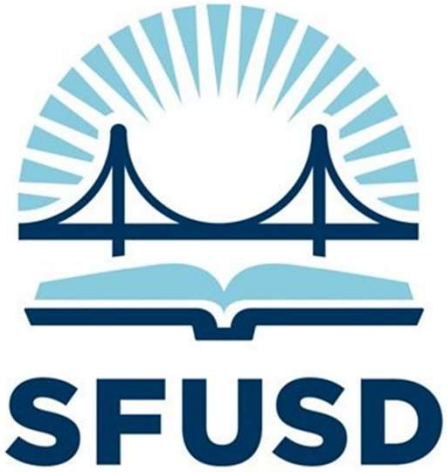
FAST FACILITY FACTS

Dense/Urban

7th Largest

57K Students

Diverse



Poor

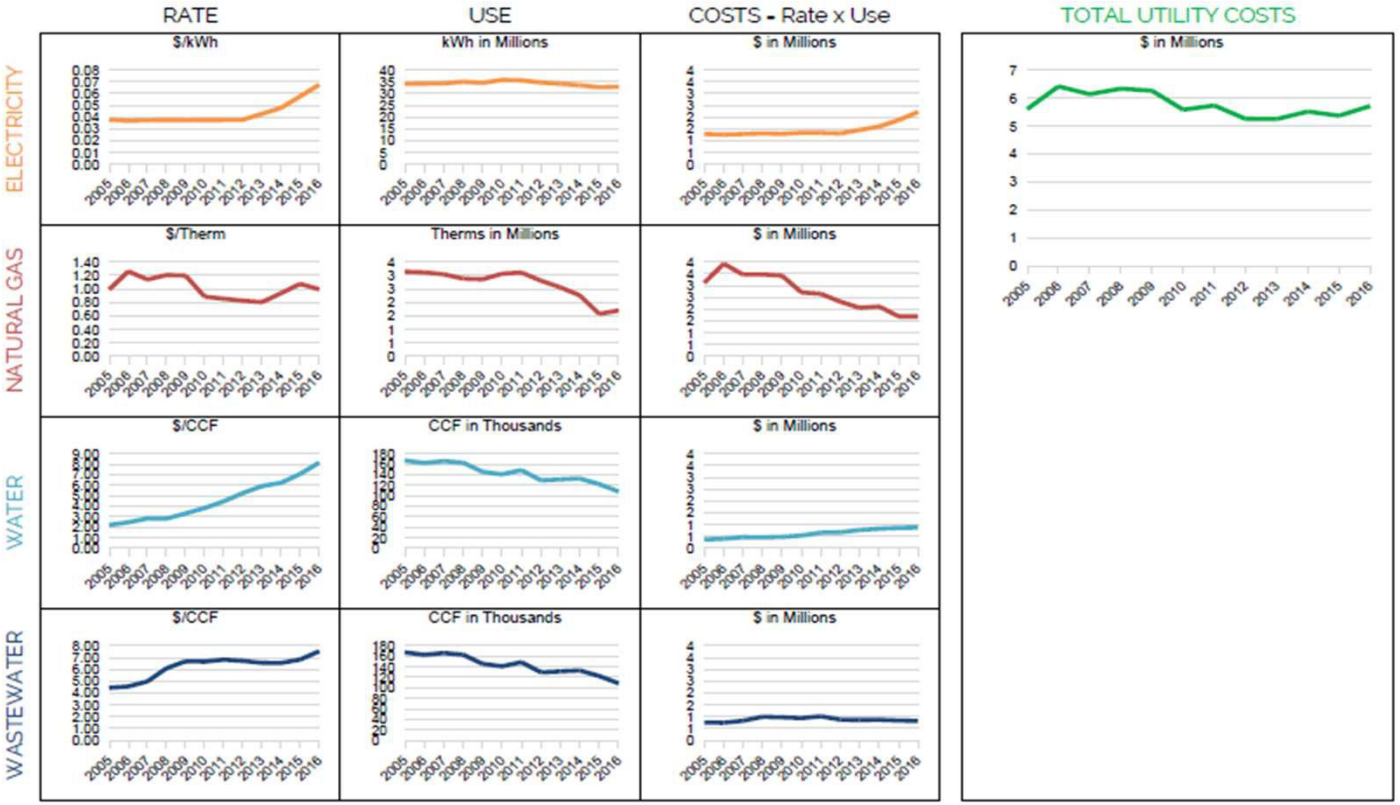
Old Buildings

Supportive Voters

SUSTAINABILITY BACKGROUND

SUSTAINABILITY
OFFICE SFUSD

UTILITY RATES… THEY BE RISING!

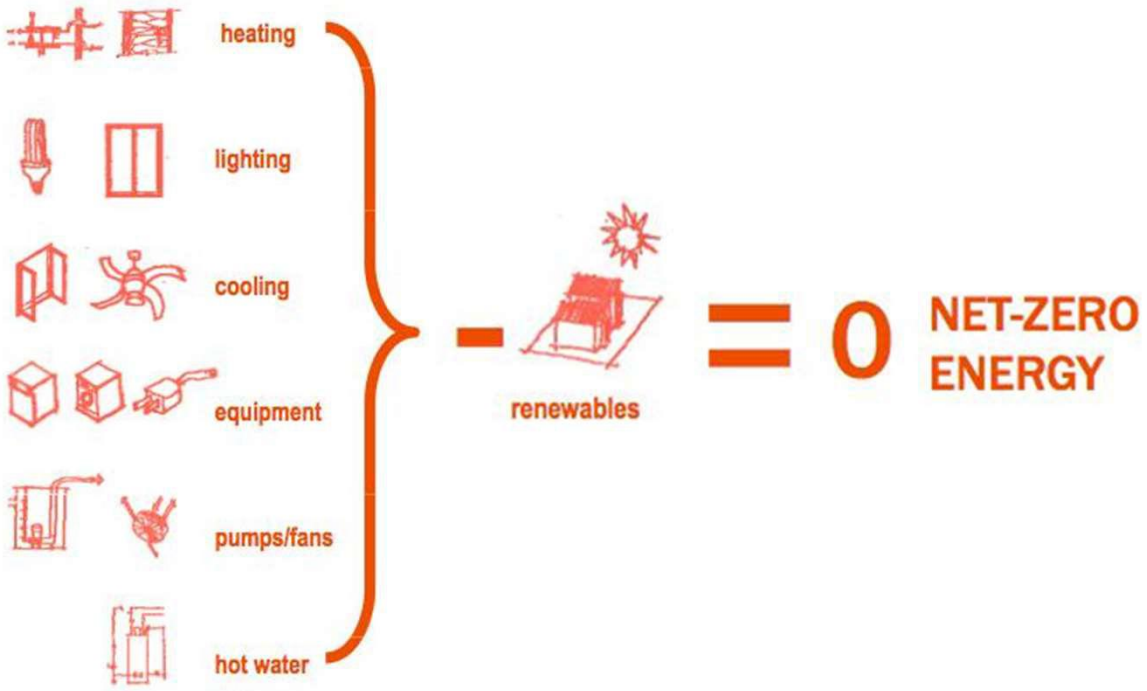


2011 Bond “Sustainability Lite”

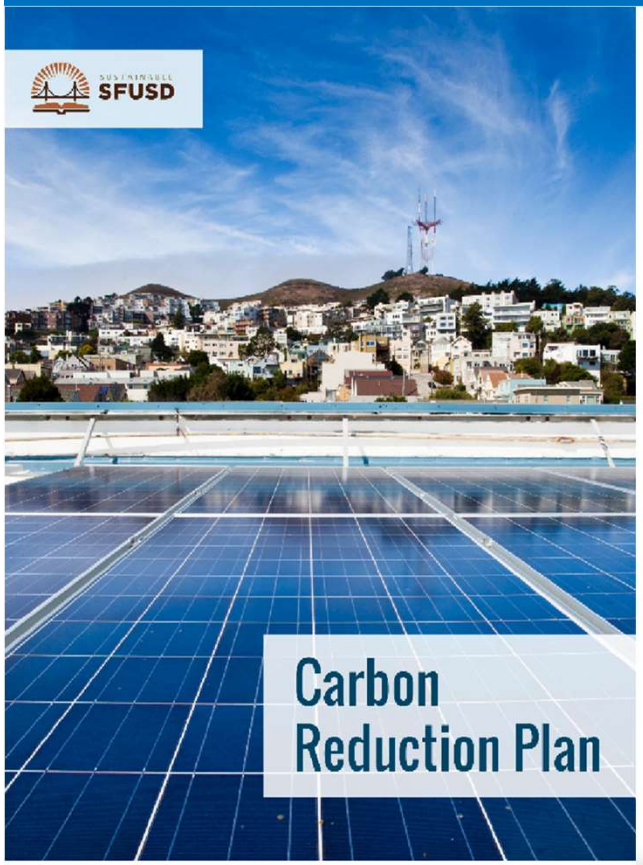
Initial Strategies for Increasing CHPS 2009 Compatibility

ZERO NET ENERGY MANDATED

ZERO NET ENERGY



CARBON NEUTRAL SCHOOLS



NEWS FIX

San Francisco Schools Aim for a Zero Carbon Footprint by 2040

THE DETAILS

SFUSD PROJECT REQUIREMENTS

July 1, 2017

SUSTAINABLE SFUSD

STRATEGY

The District has many opportunities to improve the carbon footprint of its buildings:

BOND PROJECTS: voter-approved funding for new construction & major renovations provides the best opportunity for deep energy retrofits

MONITORING: post-occupancy commissioning and energy monitoring can identify opportunities to adjust operation to meet design intent

OPERATIONS & SHARED SAVINGS: preventative maintenance, energy and water monitoring, and engagement of users prevent rising energy and water usage as buildings age

FACILITIES PROJECTS: major repairs and deferred maintenance projects provide an opportunity to improve energy and water efficiency

These *SFUSD Owner's Project Requirements* were created to assist design teams in supporting the District's ambitious zero carbon goals. The following pages describe the process for incorporating ZNE-ready design into new buildings, bond modernizations, and facilities projects. In summary:

New Buildings will be designed to achieve an Energy Use Intensity (EUI) < 20 kBTU/sf/yr. SFUSD's preferred strategies for achieving such exemplary energy efficiency are outlined in the *ZNE Guidelines* at the end of this document. While the addition of renewable energy is generally outside the scope of new projects, solar readiness should be built into the building.

Bond Modernizations will focus on improvements to the lighting systems and building envelope as outlined in *ZNE Assessments* commissioned by the District for every project prior to the design phase. These assessments will also look for opportunities to improve heating and ventilation systems, but these items will generally be tackled in future bonds unless broken equipment necessitates earlier action.

Facilities Projects generally have limited scope and will support ZNE goals by upgrading building elements as they wear out. In each case, the *ZNE Guidelines* below and *District Design Standards + Guidelines* (DDSG) will inform the design and selection of materials and/or equipment for these projects.

THE RULES

ZNE GUIDELINES

Design teams working with SFUSD are asked to design buildings that are:

HEALTHY... maximizing daylight and air quality and minimizing harmful pollutants.

BEAUTIFUL... encouraging pride and engagement among families and the community.

EFFICIENT... reducing energy use to a minimum to facilitate achievement of ZNE.

VALUABLE... minimizing lifecycle costs and reducing maintenance as much as possible.

In order to achieve adequate levels of efficiency in San Francisco, design teams should consult the Department of Energy's (DOE) Technical Feasibility Study for Zero Energy K-12 Schools and follow the *ZNE Guidelines* below. While these guidelines are most easily implemented in new construction, they should also be utilized where applicable in bond modernization and facilities projects.

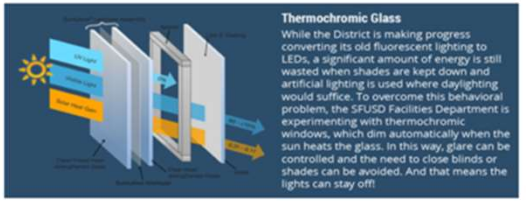
ENERGY: New buildings should be designed to achieve a modeled **Energy Use Intensity (EUI) of 15-20 kBTU/sf/yr**, a value that allows rooftop solar to offset yearly energy usage for a typical 2-3 story San Francisco school. Building systems should be **"designed for off"**, meaning that they will shut down without user intervention. **Solar analysis** during **Schematic Design (SD)** should confirm that rooftop solar potential will be adequate to cover modeled energy usage.

FORM: Buildings should be simple and compact, oriented to the sun, with a depth & layout that allows **daylight harvesting**, **natural ventilation**, **outside views**, and use of **thermal mass**.

MAINTENANCE: Every effort should be made to **facilitate maintenance access** to building systems (without ladders/lifts and without disturbing classes), materials should be chosen that are **easy to clean** and **inexpensive to maintain**, and design teams are encouraged to **expose** the **functional elements** of the building for students to see.

ENVELOPE: In order to minimize the heating load, wall, window, and door **insulation** levels should be **optimized** via building modeling to comply with the EUI target above. **Exterior insulation** should be specified **over cavity insulation** where possible. **Fiberglass batts** are **never allowed** due to poor thermal performance in the field. Moisture and air **control layers** should reside on the **warm side of exterior insulation** and architects should specify **airtight construction** practices. **Rain screens** are encouraged to enhance durability.

WINDOWS: Windows size and specifications should be tuned based on building **orientation**, with north and shaded, south-facing glass being larger and/or having higher **Solar Heat Gain Coefficients** (SHGC) than east or west-facing glass. **U-values** should be **less than 0.30** on all sides (including roof). Where budget allows, glare and heat control should be provided via **heat-responsive glass** and/or **exterior shading**. In addition, **interior shades** should always be provided.



Thermochromic Glass

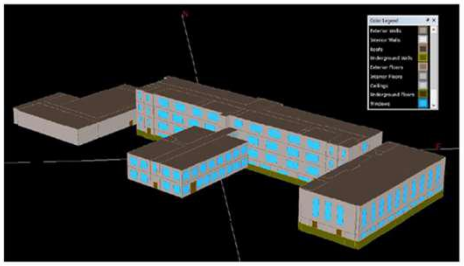
While the District is making progress converting its old fluorescent lighting to LEDs, a significant amount of energy is still wasted when shades are kept down and artificial lighting is used where daylighting would suffice. To overcome this behavioral problem, the SFUSD Facilities Department is experimenting with thermochromic windows, which dim automatically when the sun heats the glass. In this way, glare can be controlled and the need to close blinds or shades can be avoided. And that means the lights can stay off!

LIGHTING: Whenever possible, buildings should utilize **natural light** to meet lighting needs. **Interior** lighting shall be **100% LED**, with **vacancy sensors** (not occupancy) and **daylighting controls per Title 24** (see the DDSG for guidance on shut-off delays). Classroom light levels of **35 foot-candles** are sufficient. **Skylights**, **sun tubes**, or **light wells** should be included in sufficient quantity to allow zero artificial lighting in **common areas** during daytime hours. **Exterior** lighting should incorporate **bi-level control** and astronomical **time clocks**.

HEATING: Space conditioning should be limited to **permanently occupied areas**; no conditioning is needed in foyers, hallways, restrooms, or closets. Heating shall be provided by **Variable Refrigerant Flow** (VRF) systems or high-efficiency **heat pumps**; NO FOSSIL FUEL-BASED HEATING (natural gas) IS ALLOWED. Space heating should be controlled **separately for each zone**, with set points of **66-72 °F** in **occupied** spaces. Occupied hours should be aggressive (**M-F: 7am-6pm**); the system should be off after hours and on weekends (w/the possibility of limited duration and zone-specific overrides).

COOLING/VENTILATION: Occupied spaces should rely on **natural ventilation** unless schools are located in close proximity to a major pollutant source (e.g. freeway, major arterial). If mechanical ventilation is required, schools should incorporate **dedicated outside air systems (DOAS)** designed to **ASHRAE 62.1** or **CEC T24** requirements in permanently occupied spaces, **demand-based (CO2)** controls in auditoriums, gyms, and cafeterias, and **MERV 13** final filters throughout. The **fresh air** should be delivered **low in the room** and originate from a shaded

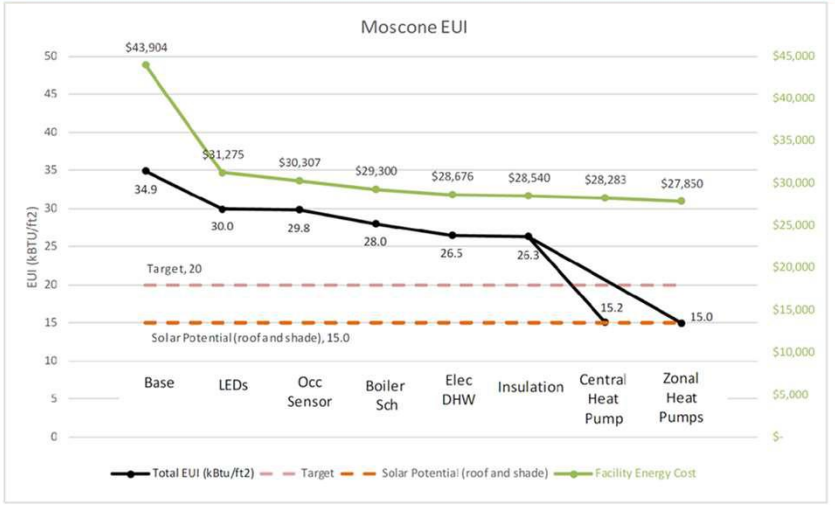
ZNE MODELS



Zero Net Energy Study for James Denman Middle School

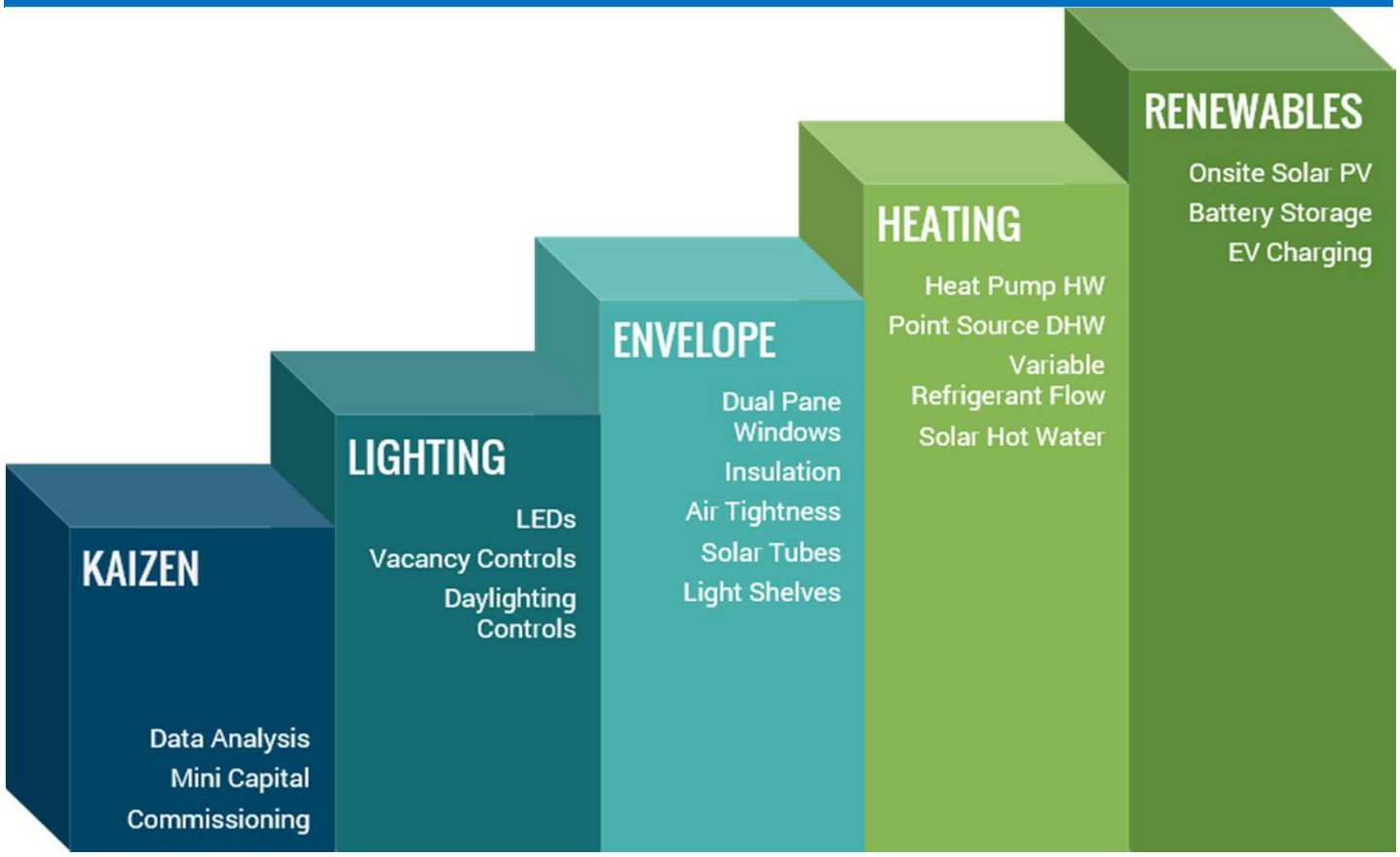
September 7, 2016

Prepared By:
Ecology Action | 877 Cedar Street, Suite 240 | Santa Cruz, CA 95062
T: 831.426.5925 | F: 831.427.1368 | www.ecoact.org

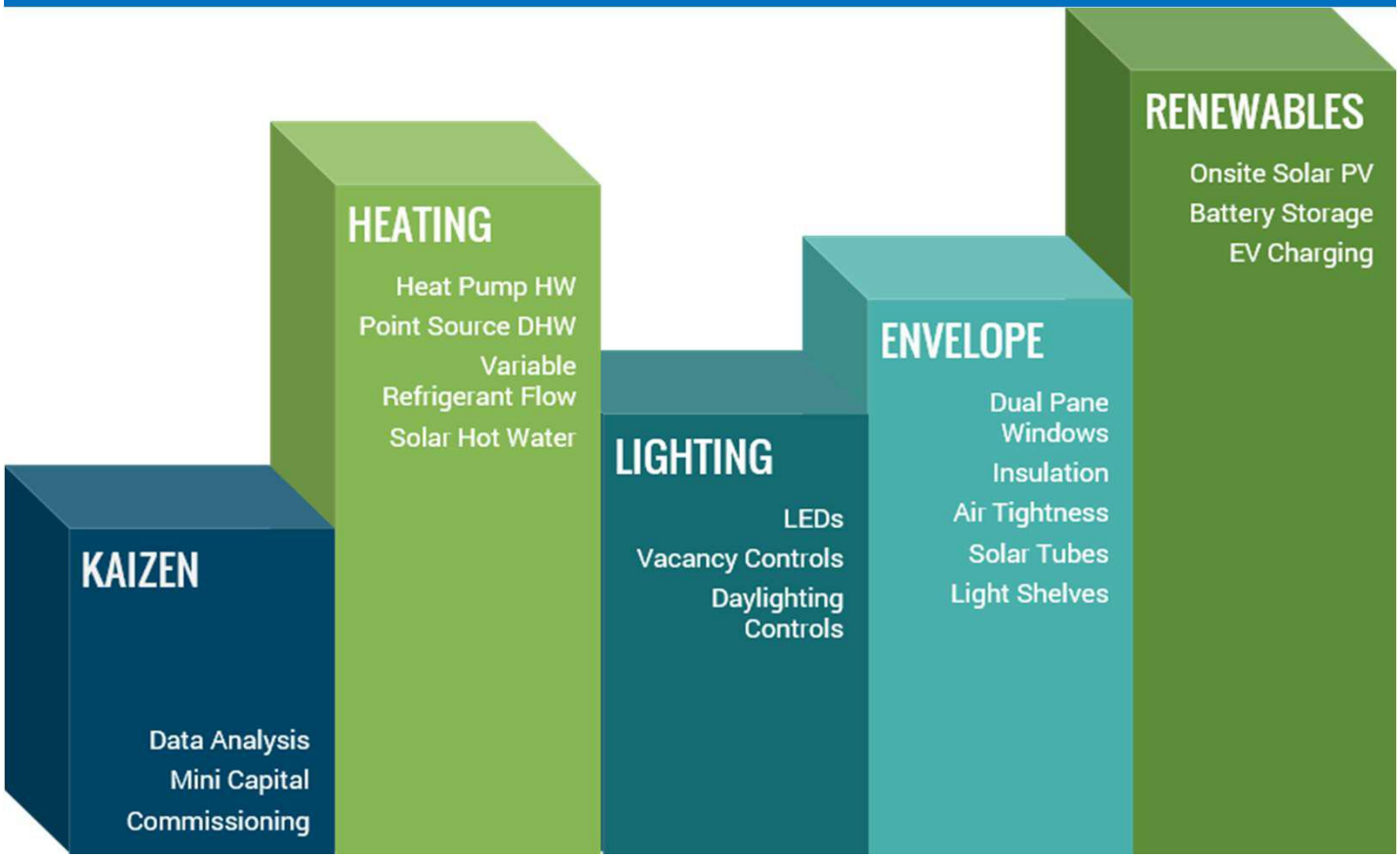


Source: Ecology Action

ZNE STAIRCASE



ZNE ADVENTURE



1st ZNE BUILDING

Source: Lionakis

ZNE RETROFITS

Source: Google Maps

EXECUTION IS EVERYTHING

Source: Pinterest

CAN WE MOVE QUICK ENOUGH?

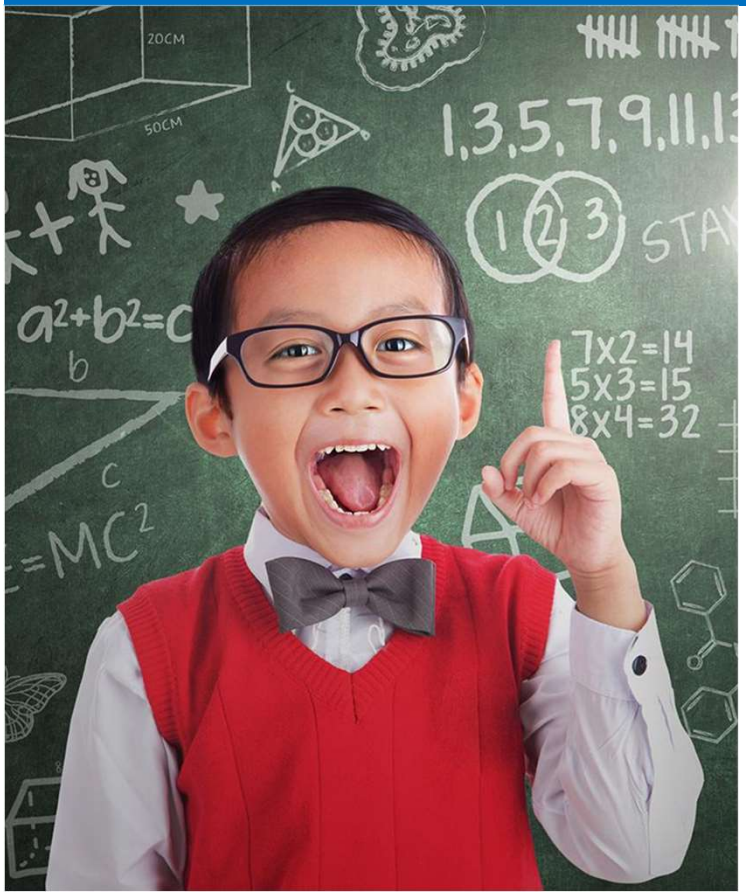
Capital Weather Gang

San Francisco smashes all-time record high temperature, hits 106 degrees

By Jason Samenow September 1, 2017 Email the author

A seaplane flies over the Golden Gate Bridge on Friday in this view from the Marin Headlands near Sausalito, Calif. (Eric Risberg/AP)

SPARKING CHANGE



Identify the "Why"

Educate yourself & stakeholders

Listen and build Consensus

Provide an Ambitious but Pragmatic Path Forward

Source: FCPA

THANK YOU

PRIORITIES

TRAINING: In addition to the thorough training of Buildings & Grounds staff, it is critical that building occupants are properly engaged in order to operate a building efficiently and obtain feedback about building operation. Thus, the Sustainability Office will work with the Commissioning Agent to conduct rigorous maintenance and occupant training as well as post-occupancy commissioning.

VERIFICATION: The Sustainability Office will monitor building and end-use utility data before and after a project to see if performance specifications were truly met. Given the constrained nature of many school sites in San Francisco, attaining low energy usage is of paramount importance if future solar installations are to cover the entire energy demands of a site.

Bond Modernizations

While new buildings can be designed and built to meet ZNE-ready status relatively easily and with minimal additional cost, renovating existing buildings to reach similar levels of efficiency presents a much bigger hurdle. This is because many parts of the building cannot be cost-effectively upgraded. For example, improving envelope insulation levels cannot readily be done without removing an entire building façade. In addition to the enormous expense, upgrades of this kind do not lead to dramatic energy savings in the mild San Francisco climate zone.

For this reason, SFUSD has decided to hire energy modeling firms to conduct *ZNE Assessments* of all sites named in the 2016 bond in order to identify the importance of various energy efficiency measures in achieving an EUI of less than 20 kBTU/sf/yr. These firms will also calculate the area of solar generation required to offset predicted site energy usage. Thus, design teams will be able to combine this information with project cost estimates to select a package of efficiency improvements that most cost-effectively achieves the District's EUI targets.

In deciding which recommendations from *ZNE Assessments* to include in the project scope, design teams will be guided by an implementation hierarchy that calls for lighting retrofits and envelope improvements to be adopted first, followed by heating upgrades, and finally renewable generation. In other words, the goal is to minimize heating load before implementing system upgrades, thereby avoiding possible oversizing of equipment.

This strategy also allows the work to achieve ZNE

to be spread out over multiple bond cycles, recognizing that there generally are not enough funds assigned to each site to do all necessary work in one round of modernization. In cases where unique opportunities arise to replace an entire heating system, bond sustainability funds, Prop 39 funding, and/or support from the SF Public Utilities Commission (SFPUC) may allow a quicker approach.

The chart below summarizes which elements will be incorporated into each 2016 bond project and which will only be included on a case-by-case basis. Design teams will consider recommendations from the ZNE audit, synergies with other scope, available funding, and site-specific design parameters to determine which of the latter to include.

	MODERNIZATION		FUNDING			
SCOPE	Mandatory	Case-by-case	Bond	Sustainability	Prop 39	Utility
Air sealing weather-stripping around all doors/windows	✓		✓			
Window replacements if windows deteriorating		✓	✓			
Insulation cost-effective (reroofing, attics, open walls)	✓		✓			
LED lighting with daylighting and vacancy controls	✓		✓			
Solar tubes/skylights common areas		✓		✓		
Light shelves/shading classrooms and offices		✓	✓	✓		
EMS upgrades latest standard; connect all spaces	✓		✓			
Building dashboard site usage & solar (if applicable)	✓			✓		
Fuel switch/transformer when replacing end-of-life heating/DHW systems		✓	✓	✓	✓	✓
Heating optimization boiler, VFD, ECM pumps, pipe insulation, steam traps, radiator bypass	✓		✓	✓	✓	✓
Solar readiness roofing, conduit, space		✓	✓	✓		✓
Piping leak repairs and pipe insulation	✓		✓			
DHW reconfiguration close to use, eliminate recirc		✓	✓	✓	✓	
Water fixture upgrades high-flow fixtures	✓		✓			
Shut-off valves at all upgraded bathrooms	✓		✓			
RWH pre-plumbing where wall cavity accessible		✓		✓		
Irrigation as identified in SFPUC Landscape Technical Assistance Program (LTAP)		✓		✓		
Turf replacement where existing lawn sports field		✓		✓		✓
Stormwater control where > 5000sf disturbance		✓	✓	✓		
Bottle fillers cafeteria & one per floor	✓		✓			
Washing machines stub out and appliance; no dryer	✓		✓			
Hand dryers upon approval of spec	✓		✓			
Trash sorting outdoor/indoor sorting areas where space		✓	✓			
Walking & biking infrastructure striping, bike racks	✓			✓		

BUILDING STRATEGY

NEW SCHOOLS

→ ZNE Ready

MODERNIZATION

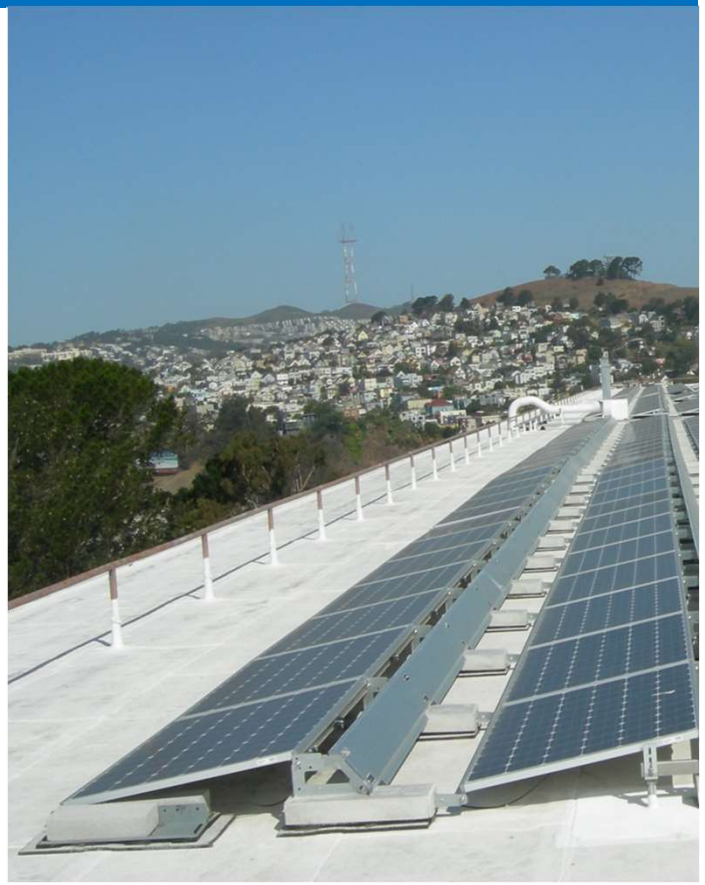
→ ZNE Two-Step

SMALL PROJECTS

→ Guidelines

RENEWABLES

→ In Due Time



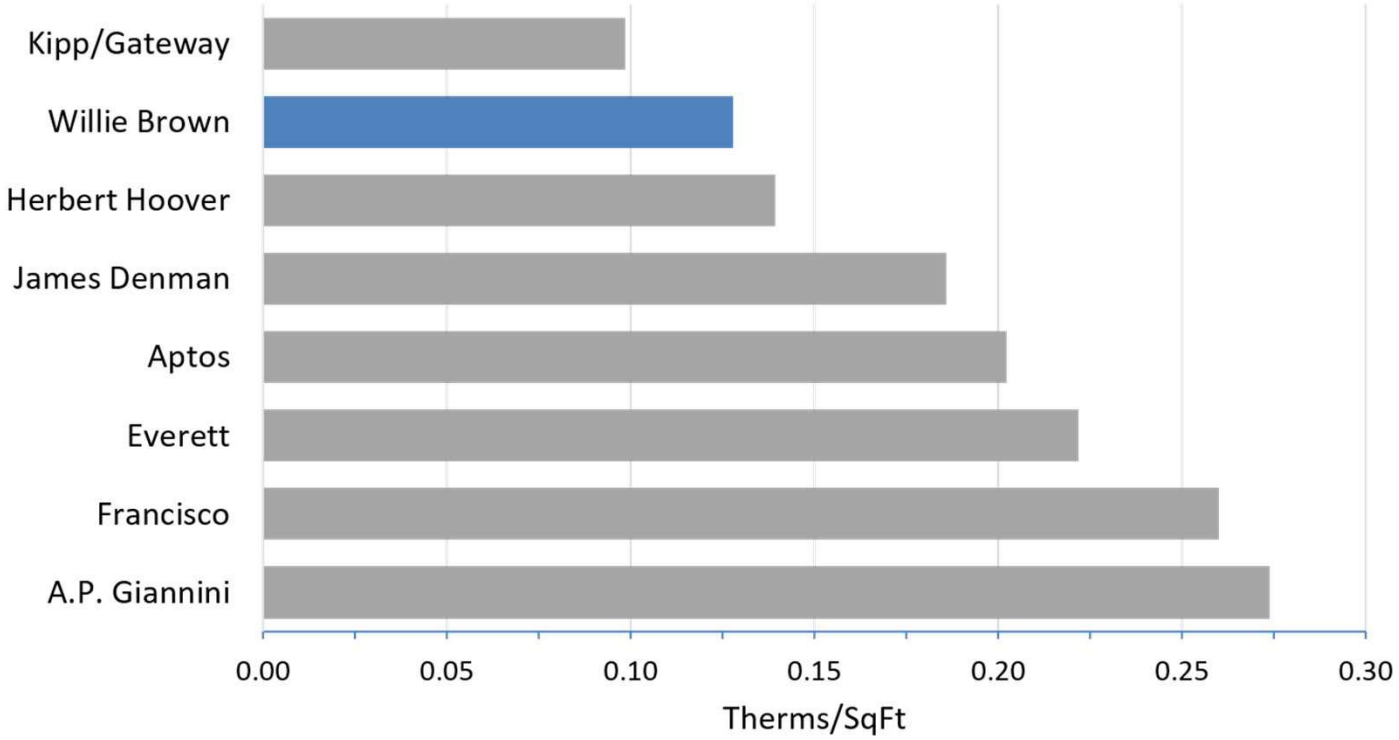
FUNDING OPTIONS

- ➔ Bonds
- ➔ Deferred Maintenance
- ➔ Developer Fees
- ➔ Prop 39
- ➔ Utility Company
- ➔ ECAA Loans
- ➔ PPAs

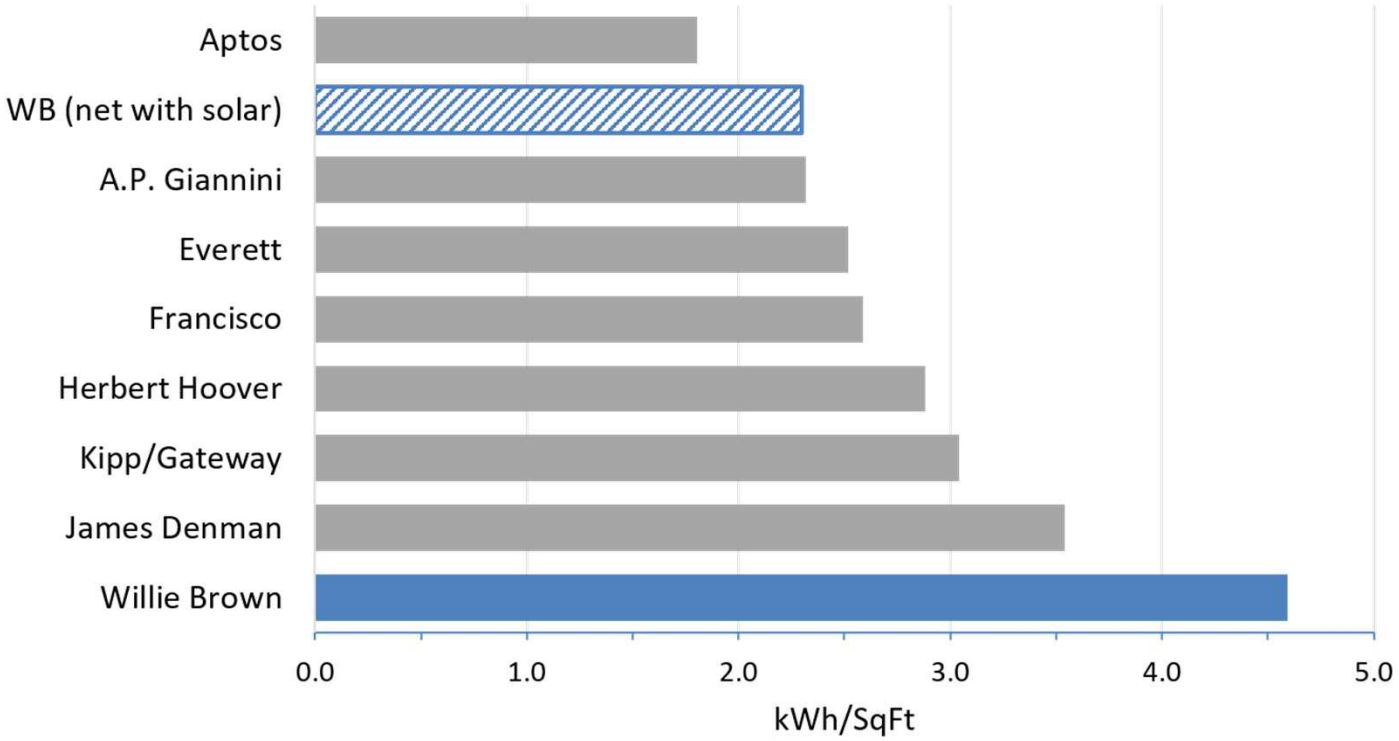
Source: UC Berkeley

WILLIE BROWN MIDDLE SCHOOL

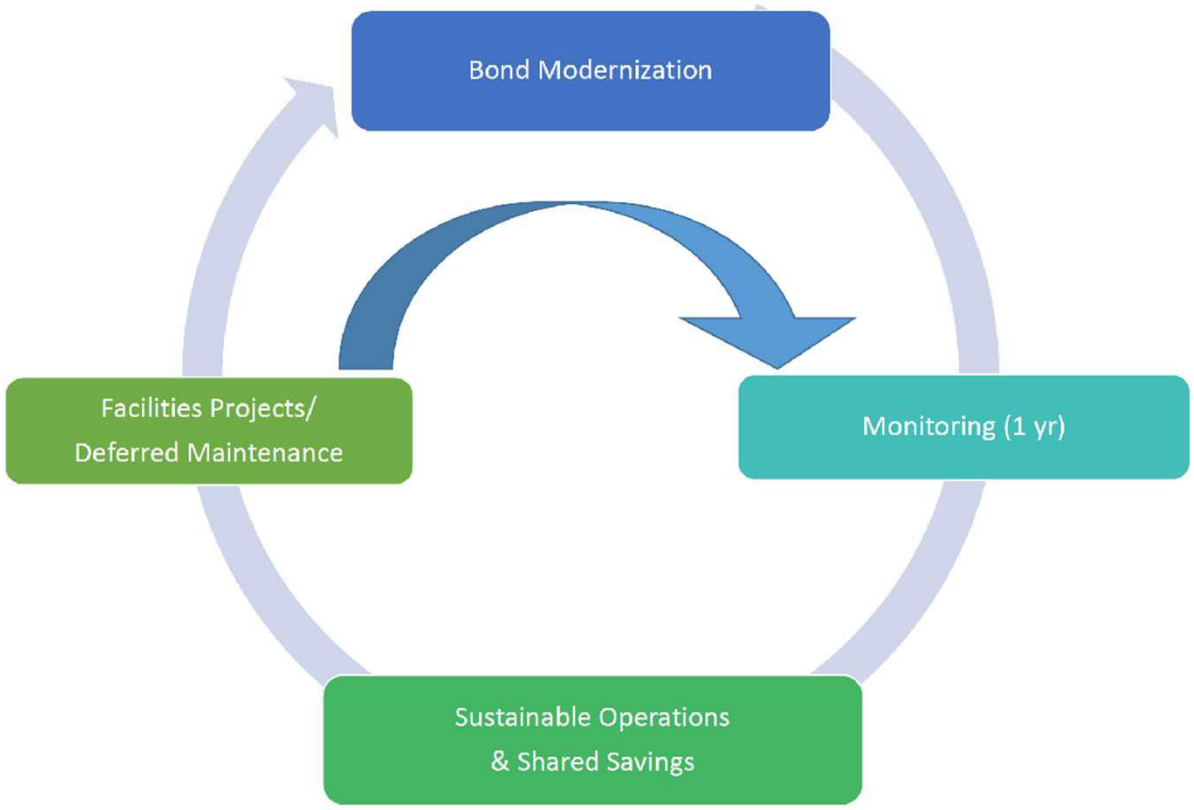
Therms Per Square Foot
NATURAL GAS



kWh Per Square Foot
ELECTRICITY



OPPORTUNITIES



SMALLER PROJECTS

- ➔ LED Lighting
- ➔ Windows
- ➔ DHW Replacement
- ➔ Heating Controls/EMS
- ➔ Ventilation/VFD
- ➔ Pipe Insulation/Capping
- ➔ NO: New Gas Boilers

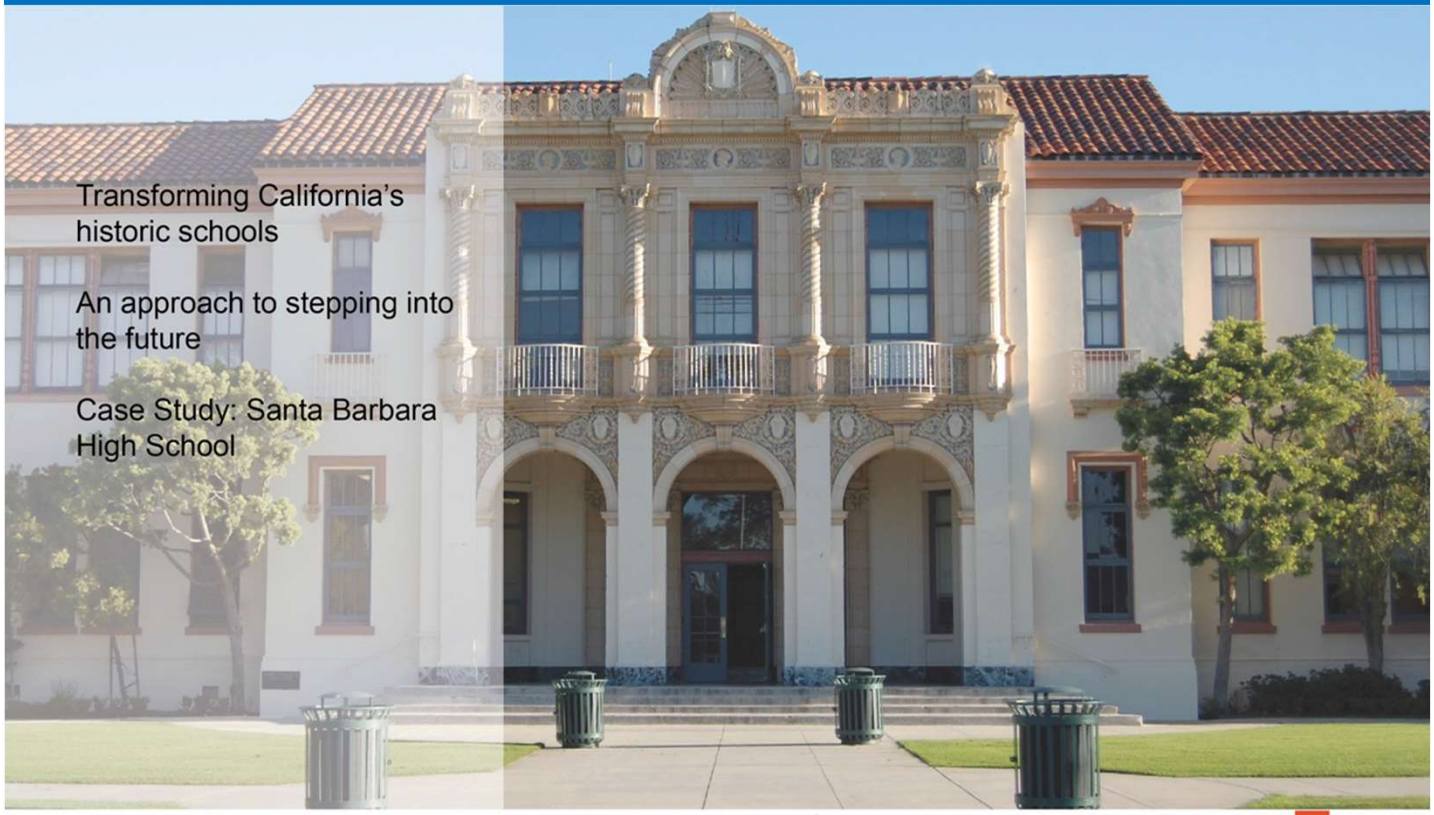
Source: Alta Planning

ZNE NEW CONSTRUCTION

Source: Harley Ellis Devereaux

SUSTAINBILITY LITE & BEATING CODE ARE NOT ENOUGH

7 x 7 x 7 CHALLENGE



Transforming California's historic schools

An approach to stepping into the future

Case Study: Santa Barbara High School

7x7x7 | DESIGN ENERGY WATER
7 ARCHITECTS 7 SCHOOLS 7 INNOVATIONS

CAPITAL ENGINEERING CONSULTANTS, INC.

HAMILTON+AITKEN Architects

ZNE EDUCATION

Source: WRNS Architects

KICK-OFF

Source: WRNS Architects

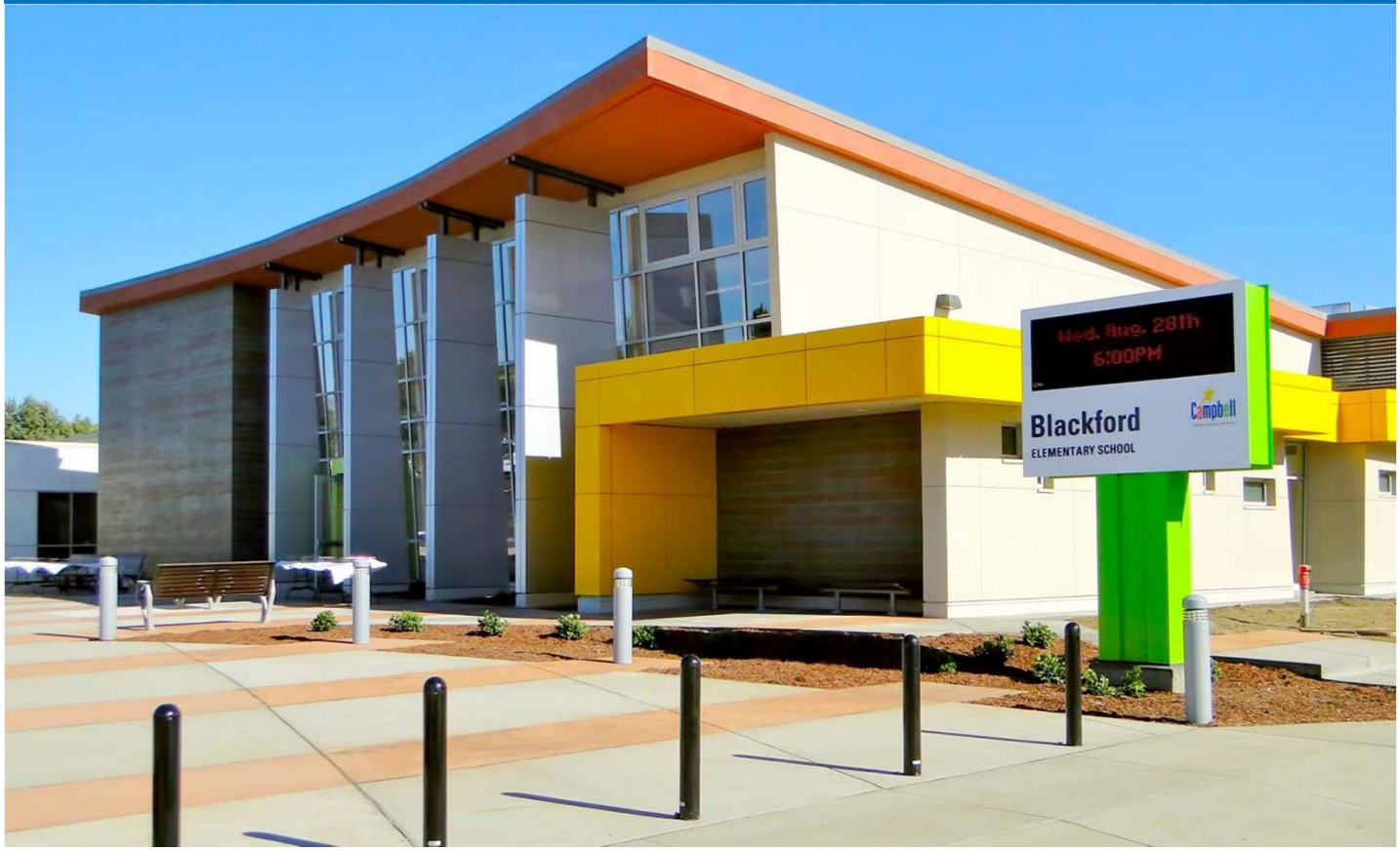
WORKING GROUP

Source: Tarus Expert

SITE VISITS

Source: ZNE Training Center

SITE VISITS



EUI GOAL

Table 29. Energy Intensity Values for Zero Energy Schools

Climate Zone	Representative City	Primary School		Secondary School	
		Site Energy (kBtu/ft²·yr)	Source Energy (kBtu/ft²·yr)	Site Energy (kBtu/ft²·yr)	Source Energy (kBtu/ft²·yr)
1A	Miami, FL	25.9	76.4	23.1	68.5
2A	Houston, TX	24.3	71.1	21.7	63.5
2B	Phoenix, AZ	24.7	72.5	21.9	64.3
3A	Memphis, TN	23.8	69.0	21.2	61.6
3B	El Paso, TX	23.4	67.8	20.7	60.2
3C	San Francisco, CA	21.6	61.9	19.0	54.3
4A	Baltimore, MD	23.5	67.6	20.9	60.1
4B	Albuquerque, NM	23.1	66.6	20.4	58.8
4C	Salem, OR	22.4	64.2	19.7	56.4
5A	Chicago, IL	24.3	69.9	21.6	62.2
5B	Boise, ID	23.2	66.7	20.4	58.4
6A	Burlington, VT	24.5	70.1	21.6	61.9
6B	Helena, MT	23.5	66.9	20.5	58.4
7	Duluth, MN	25.9	74.1	22.8	65.1
8	Fairbanks, AL	28.7	82.5	25.0	71.5

Source: DOE

ROLE MODELS

Boulder Valley School District
Excellence and Equity

Español Deutsch Русский 日本語 Français Italiano 中国 | Sign In

Students Parents Community Employees

Home | About Us | New to BVSD? | Jobs @ BVSD | Schools | Contact Us | BVSD A-Z | Quick Links | Search...

- Greening BVSD
- Awards and Grants
- BVSD Green Policy
- Energy Challenge
- Green Buildings in BVSD
- Green Resources
- **Sustainability Management System**
- Teaching Sustainability
- Zero Waste and Green Star Schools
- Alternative Transportation (leaves greenBVSD)
- greenBVSD News
- 2014 Eco Champions

Sustainability Management System

The Boulder Valley School District is building on 20 plus years of environmental stewardship and further embracing environmental sustainability. The district hired a Sustainability Coordinator in the summer of 2008 and launched its first version of the Sustainability Management System in 2009. The SMS is a comprehensive approach for identifying and coordinating existing efforts, establishing baselines, defining sustainability for BVSD, and creating plans to integrate sustainability into our operations and curriculum. The SMS is used as a roadmap for future years and is reviewed annually. The SMS also has an annual public reporting measure which leads to accountable actions and future goal setting.

In 2015, BVSD released the updated Sustainability Management System to reflect new 5-year goals and updated visions.

2015 Sustainability Management System - Updated

2012 Sustainability Management System Progress Report

2009 Sustainability Management System

BVSD is striving toward net zero energy* buildings with 100 percent reuse of indoor water and no potable water used for irrigation.

- New Sustainable Energy Plan
- 2012 SMS Report on 5-year goals related to buildings (page 3)
- Green building in BVSD
- Check out the green features and live data for LEED Platinum Casey Middle School!

Source: BVSD

BUILD A CONSENSUS

Source: NY Times

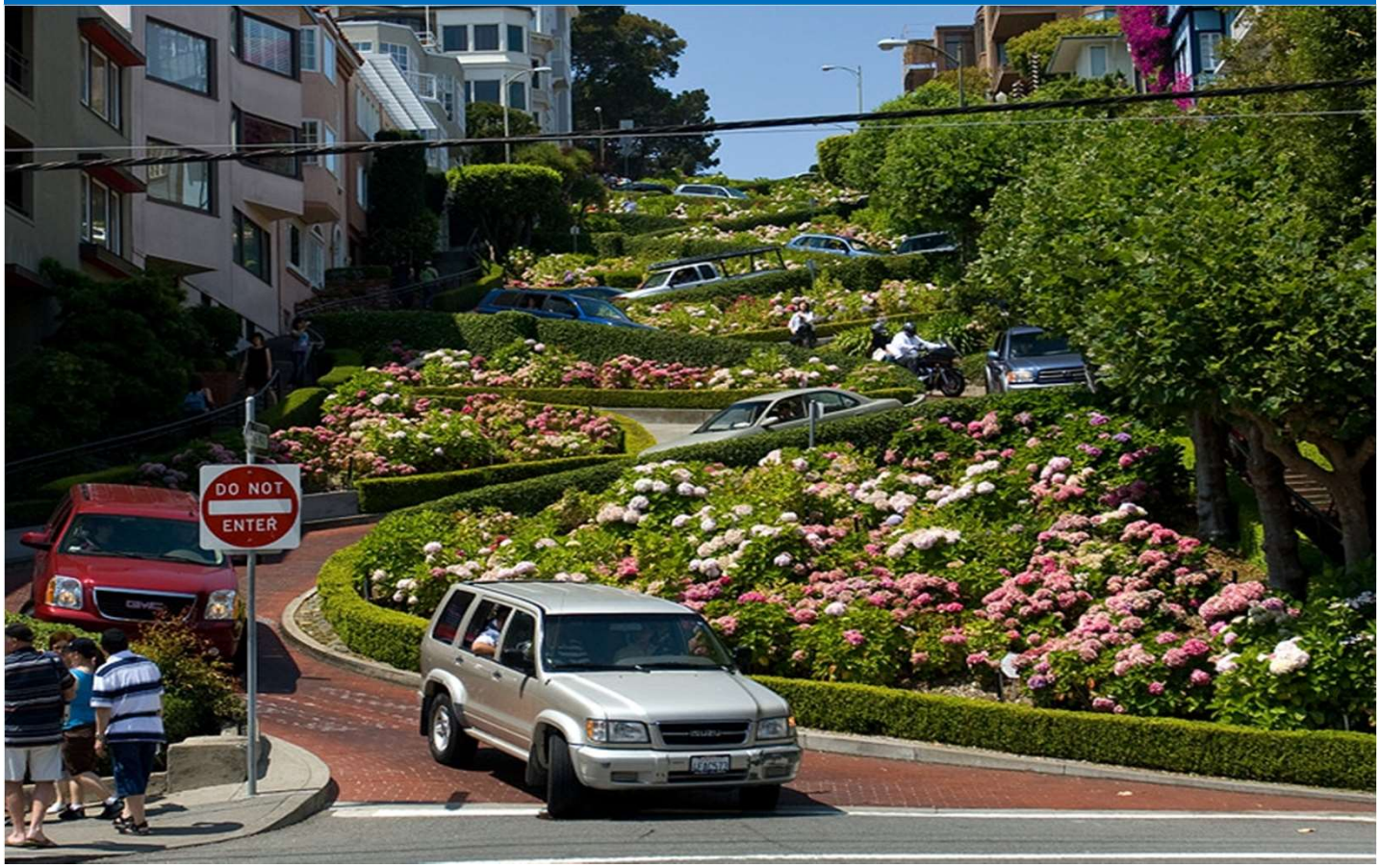
FINDING THE MAINTENANCE LOVE

INDUSTRY NORM

Source: Lochinvar

NO POT LYING AROUND

PRAGMATIC PATH FORWARD

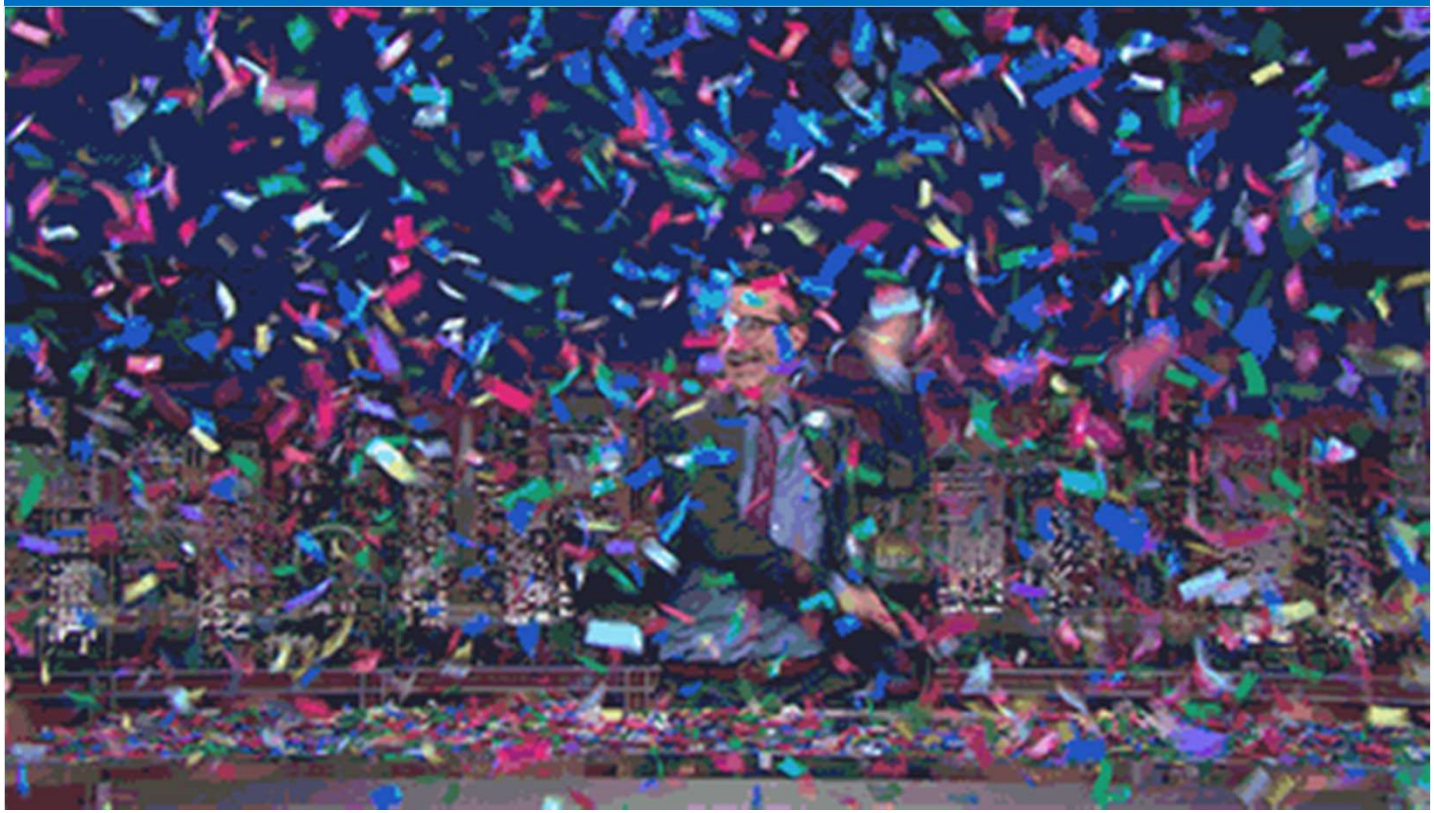


DIVING INTO THE DEEP END

BUT YOUR SAN FRANCISCO

PAINTING A PICTURE OF CHANGE

WE DID IT!



WHY ZNE? WHY NOW?

PITTSBURG UNIFIED SCHOOL DISTRICT

PARKSIDE ELEMENTARY SCHOOL:

A ZERO NET ENERGY NEW CONSTRUCTION PROJECT

Presented by: Alan E. Glass
Energy Supervisor
Pittsburg Unified School District

WHO ARE WE?
PITTSBURG UNIFIED SCHOOL DISTRICT

- K-12 School District located in East Contra Costa County
- Thirteen school sites, all located in the City of Pittsburg, including:
  - Eight (8) Elementary Schools
  - Three (3) Junior High Schools
  - One (1) Comprehensive High School
  - One (1) Continuation High School
  - One (1) Adult Education Center
- Current ADA is 11,300
- Position: Special Projects Accountant and Energy Supervisor

SUSTAINABILITY AND ZERO NET ENERGY

How did we get to this point?

- **PV solar arrays at fifteen (15) of the District's locations**
- **In calendar year 2017, we generated 4,888,589 kWh in energy from our solar arrays, producing close to 50% of the total electrical need of the District.**
- **For the last 5 ½ years, we have generated over 33GWh of electricity**

SUSTAINABILITY AND ZERO NET ENERGY

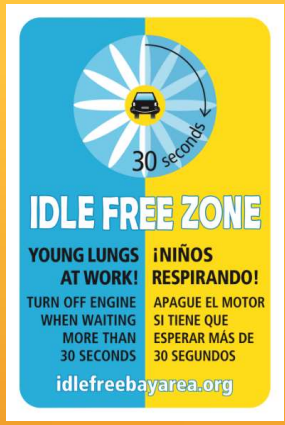
- Recycling and composting at all school sites
  - Foothill Elementary was awarded first place in a nation-wide recycling vs. waste contest
  - Students and staff work together to sort landfill waste from recycling and compostable materials
  - District –wide program for recycling of e-waste; donations to Oakland Technology West, which provides low-cost computers to low-income families instead of e-waste
- Active gardens at all school sites
  - Willow Cove Elementary 4th graders were invited and went to the White House to work in the garden with Michelle Obama
  - Produce from gardens served in cafeterias
  - Farm-to-school fresh produce served in salad bars district-wide

SUSTAINABILITY AND ZERO NET ENERGY

- Our transportation fleet has changed over the last year
  - Two new all-electric buses
  - Fourteen (14) new low-emission propane powered buses
  - Six (6) Kia Soul EV for white fleet
  - Twenty-four (24) electric vehicle chargers district wide. Staff can use chargers for free, to promote the use of EVs by staff.
  - Working with PG&E to install seven new EV charging units for our yellow fleet.
  - Looking to purchase five (5) more all-electric buses

SUSTAINABILITY AND ZERO NET ENERGY

- Idle-free program for vehicles waiting at school sites
- Recycled water currently used for irrigation at two schools where it is available pipe in, with one more site scheduled to be done, our ZNE site.
- Waterless urinals at all school and District sites, each saving close to 40,000 gallons of water per year
- Awarded the California Green Ribbon Schools award with Gold Distinction from the California Department of Education
- Awarded the Golden Bell Award by the California School Board Association (CSBA)
- Site Support Services Center is getting new beta solar panels over a one-acre bioswale and four (4) wind generated turbines, totaling 200kW of energy production




Michelle Obama


CALIFORNIA
GREEN RIBBON
SCHOOLS
EXCELLENCE IN WHOLE SCHOOL SUSTAINABILITY
2016 GOLD LEVEL
Pittsburg Unified School District


Recycled Water
is used at this site for
Landscape Irrigation
DO NOT
DRINK


csba
CALIFORNIA SCHOOL BOARDS ASSOCIATION
38th ANNUAL GOLDEN BELL AWARDS - 2017
Pittsburg USD

SUSTAINABILITY AND ZERO NET ENERGY
SO WHAT'S NEXT?

- Pittsburg Unified has had tremendous support from the community for school bonds
  - Since 1996, the District has passed four (4) school bonds and a parcel tax for school facility improvements, new schools, and educational programs. Bonds total over $300M since 2008
  - The District has built/re-built two new elementary schools, two new junior high schools, and both our comprehensive and continuation high schools
  - We have also fully modernized two other elementary school sites
  - We are currently in the planning stages of building a new Parkside Elementary School. The current campus was built in 1958.

SUSTAINABILITY AND ZERO NET ENERGY
SO WHAT'S NEXT?

- Who are the stakeholders and decision-makers for the District?
  - Board of Trustees
  - Superintendent
  - Cabinet – Deputy Superintendent (CBO), Assistant Superintendent of HR, Executive Director and Director of Educational Services
  - School Principal
  - Staff at site
  - Parents, community members, and students

With all the components of Sustainability and Energy Conservation that the District practices, what did that mean for the new Parkside Elementary School?

PARKSIDE ELEMENTARY AND ZERO NET ENERGY

It seemed like the next logical step for Pittsburg Unified was to build Parkside Elementary School as a Zero Net Energy School.

- First, the Deputy Superintendent, who oversees the business side of the District, was approached with the concept.
- The time is right for PUSD to make Parkside a ZNE school, to make it as efficient as we could for energy conservation and sustainability, given all of our "green efforts" leading to this time
- Use the site as a learning tool for students and staff.
- Continue to be a leader in the community for energy conservation and sustainability
- Cost-effective, with a good return on investment

PARKSIDE ELEMENTARY AND ZERO NET ENERGY

- We took to concept of a Zero Net Energy school to the Facilities Sub-Committee
  - Consists of two of the five Board members
  - Deputy Superintendent
  - Members of the Facilities Department team
- We explained exactly what it would take to make Parkside Elementary School a ZNE school and what that would mean to the District and the community
- The Committee was all in favor and the two members of the Board from the Committee shared with the rest of the Board what we were doing

Gardens and Sustainability
at PUSD schools!

PARKSIDE ELEMENTARY AND ZERO NET ENERGY

- As we were in the early development stages of the plans, the architect added a fee to their proposal to do the work needed to make Parkside a ZNE school
- Plans went to the Division of State Architects a couple of months ago.
- We are finalizing the energy calculations now to determine how much alternative energy we will need for the school
- Project funded from community-supported Bond issue and will be eligible for matching state funds.
- Community, families for school, and District staff have been very supportive of this being another example of how PUSD is leading the way in energy conservation and sustainability.

PARKSIDE ELEMENTARY AND ZERO NET ENERGY

PARKSIDE ELEMENTARY AND ZERO NET ENERGY

North exterior view of new Parkside Elementary, note windows for daylighting

Classrooms with large windows to provide daylighting in all rooms, view from northwest perspective

PARKSIDE ELEMENTARY AND ZERO NET ENERGY

Teachers can utilize hallways for learning spaces for small or larger groups

Learning spaces in the wider hallways, with natural lighting a priority.

PARKSIDE ELEMENTARY AND ZERO NET ENERGY

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Pittsburg Unified School District
aglass@pittsburg.k12.ca.us
925-473-2368

SAN MATEO COUNTY COMMUNITY COLLEGE DISTRICT

Planning for Zero

June 26, 2018

Oakland, California

In Partnership with New Buildings Institute

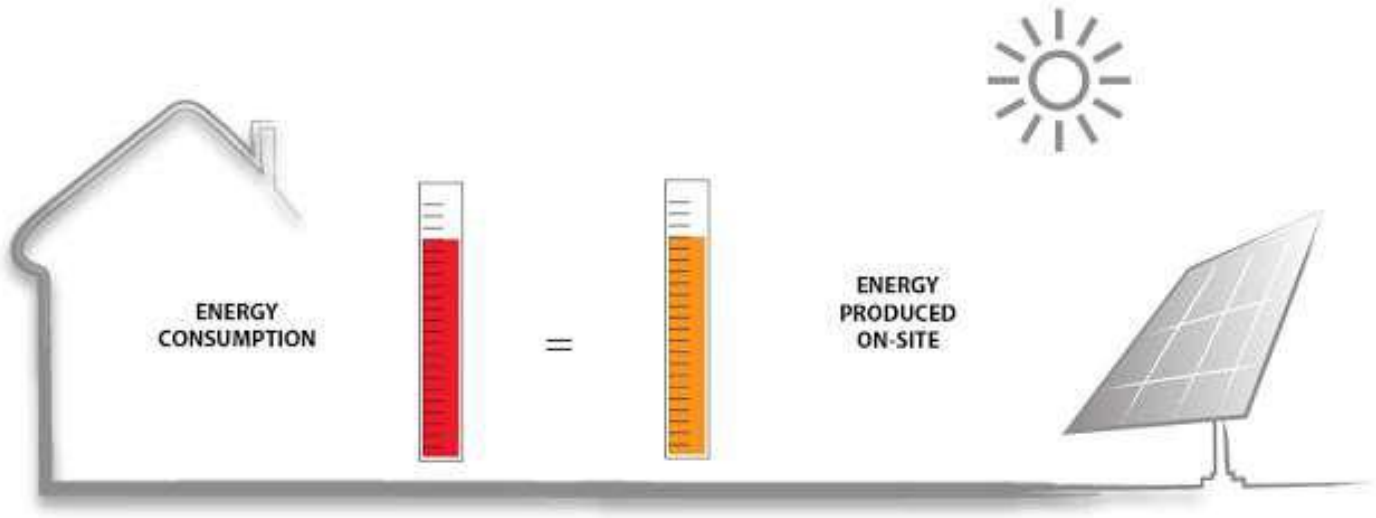
Presented by Joe Fullerton


SMCCD
Sustainability
Initiative

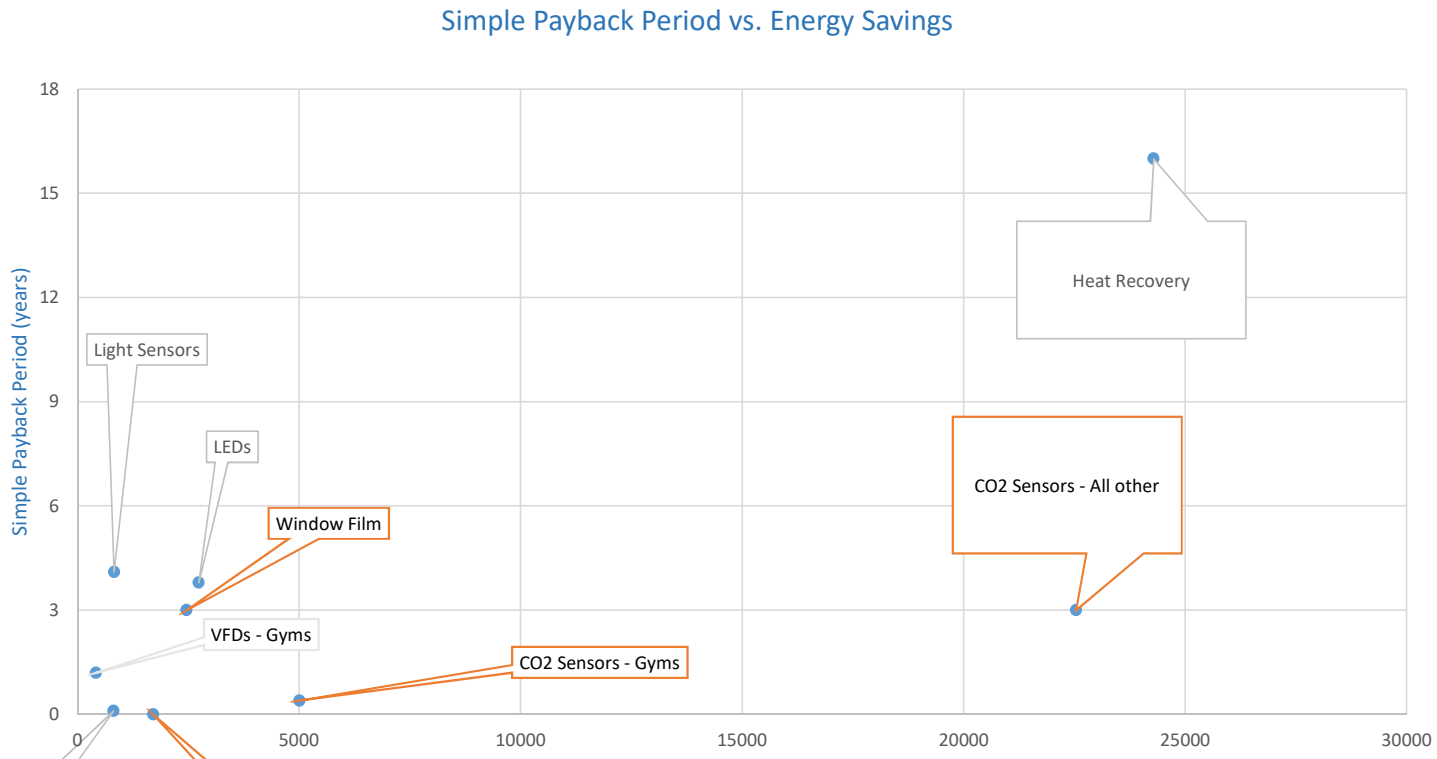
Zero Net Energy Strategy

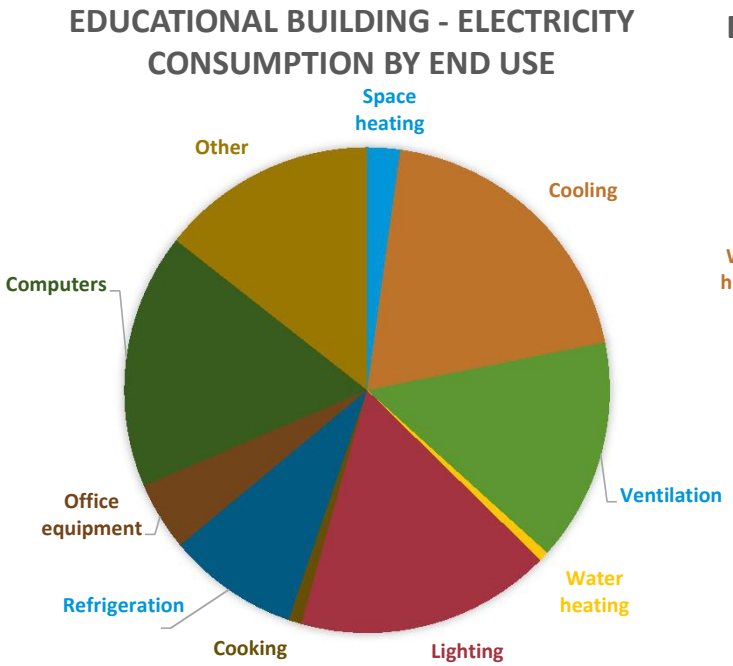
A Road Map to Energy Security

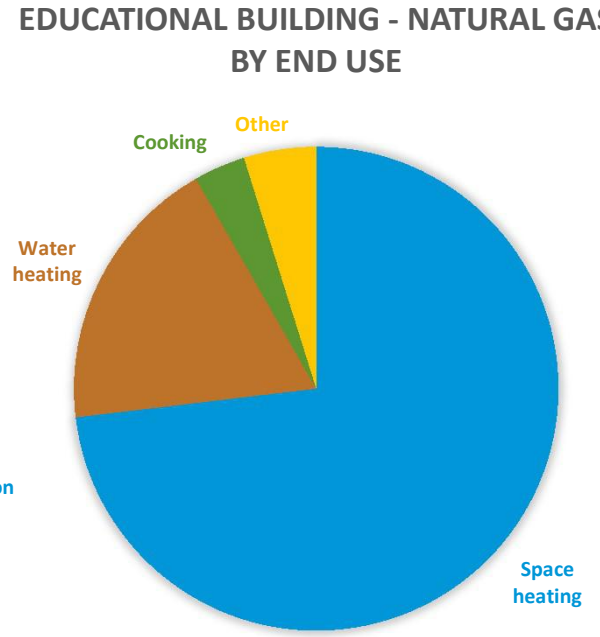
ZNE Strategy



Identified Measures

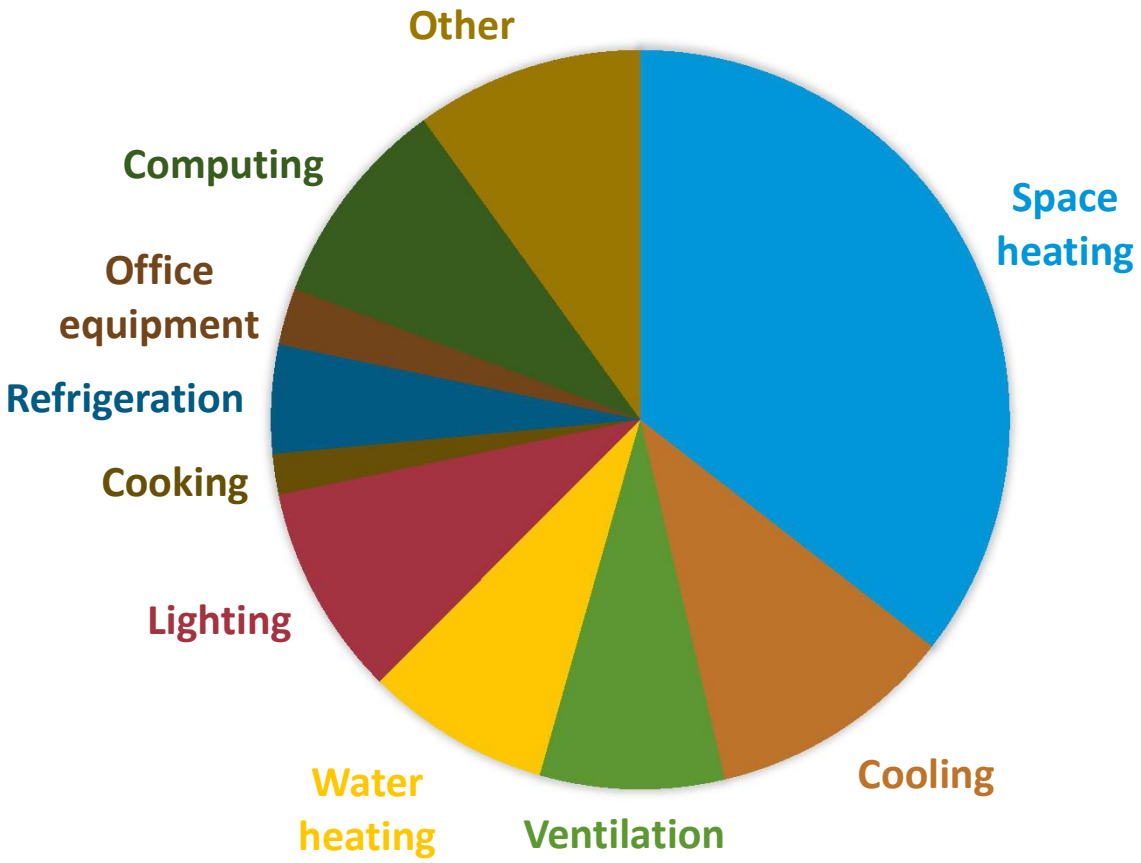






National averages of end uses of electricity and natural gas consumption in educational buildings (U.S. Energy Information Administration, 2012)

EDUCATIONAL BUILDING - FUEL CONSUMPTION BY END USE



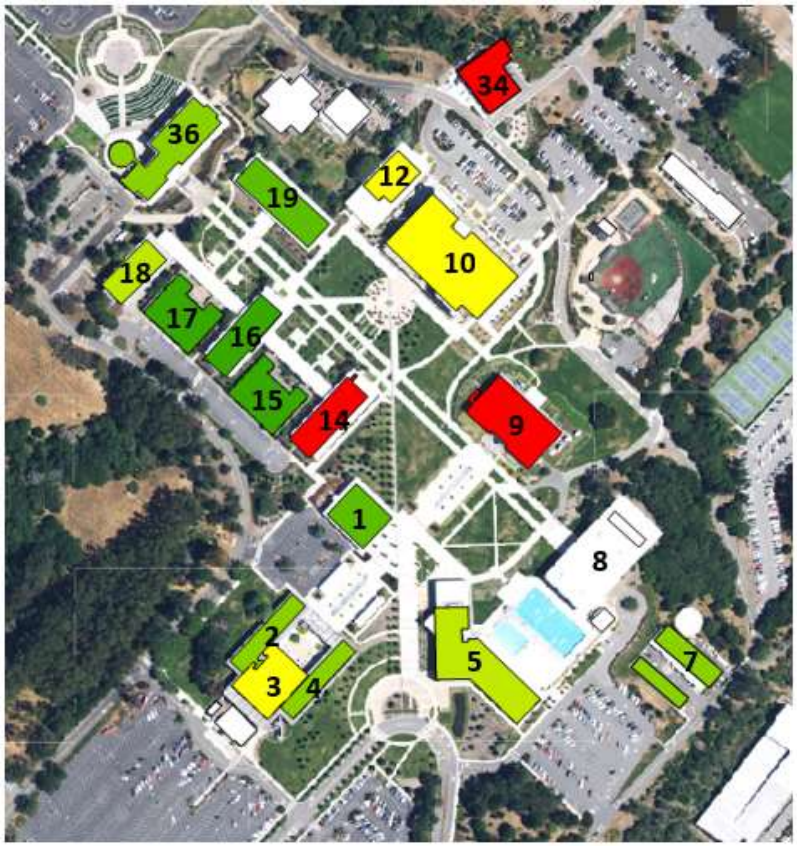
Site Energy Use Intensity (EUI)

	Cañada College	College of San Mateo	Skyline College	Total
# of Buildings	14	20	11	45
Square Footage	370,000	743,000	544,000	1.7 million
Generated Electricity (kWh/yr)	2.2 million	--	--	2.2 million
Consumed Electricity (kWh)	4.3 million	8.7 million	5.2 million	18.2 million
Consumed Natural Gas (therms)	140,000	560,000	310,000	1 million
Site EUI ($kBtu/ft^2/year$)	57	115	89	91

Cañada College Building EUI

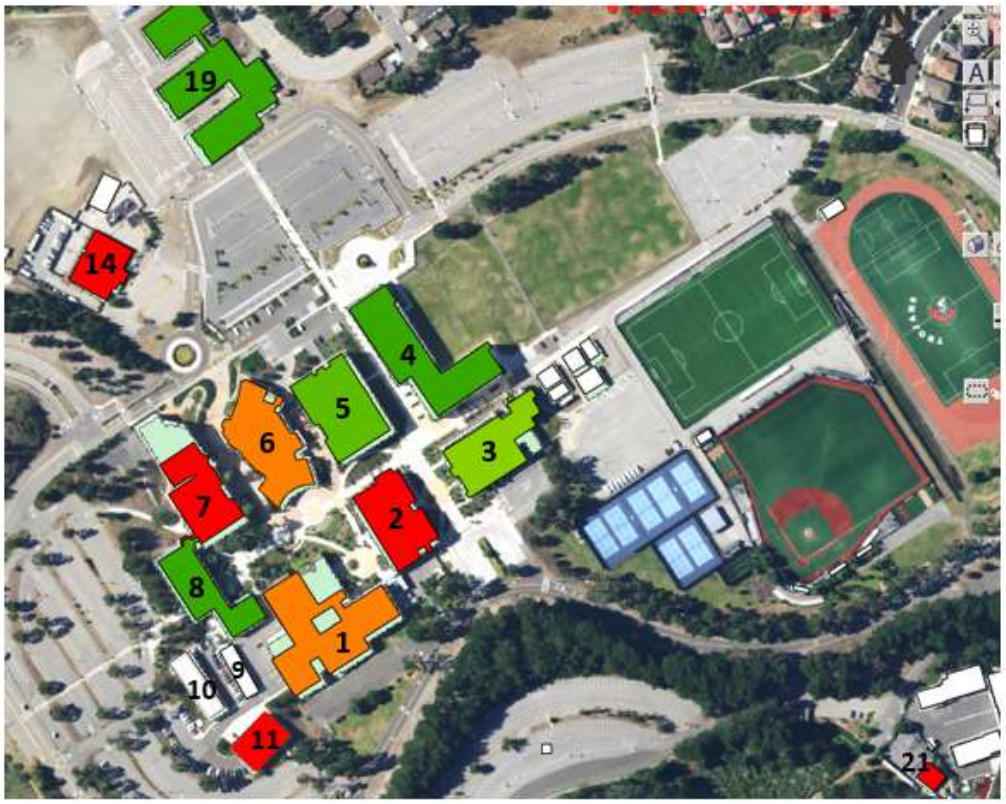
EUI (kBtu/ft2/year)		
EUI	Color	Bldg #s
31-40		6
41-50		--
51-60		7,9,16
61-70		1
71-80		3,17
81-90		13
91-100		18
101-125		8
126-150		5

College of San Mateo Building EUI



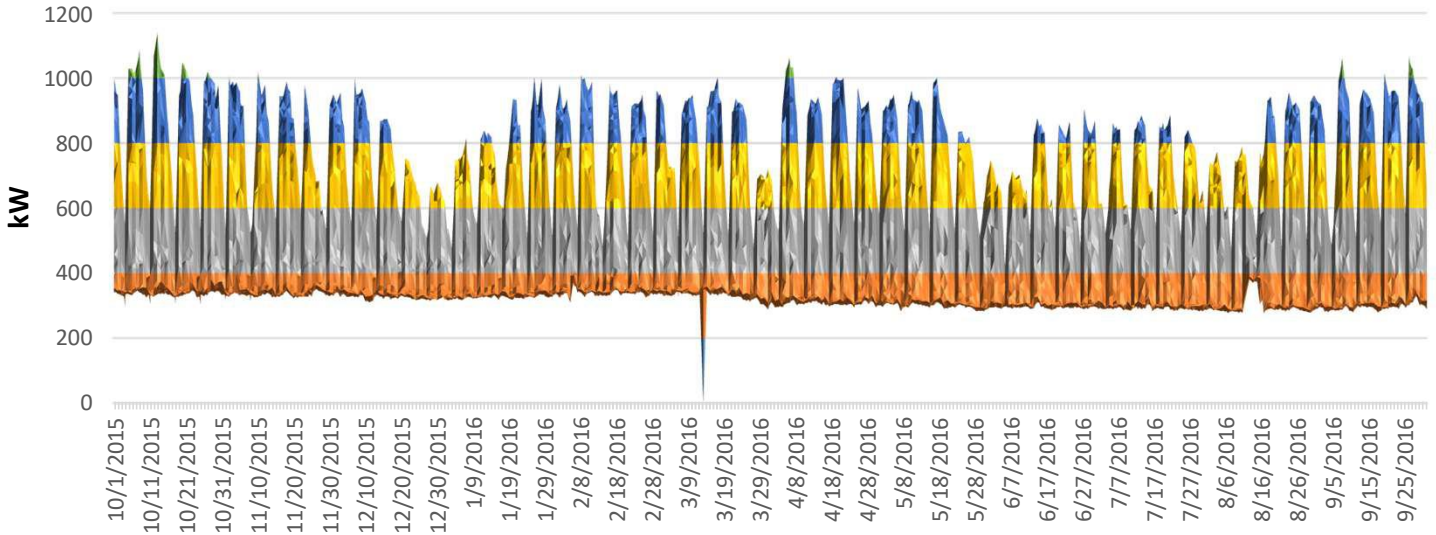
EUI (kBtu/ft2/year)		
EUI	Color	Bldg #s
31-40		15,16,17
41-50		19
51-60		1,2,4,7,36
61-70		5,18
71-80		3,10,12
81-90		--
91-100		--
101-125		DO
126-150		9,14,34

Skyline College Building EUI

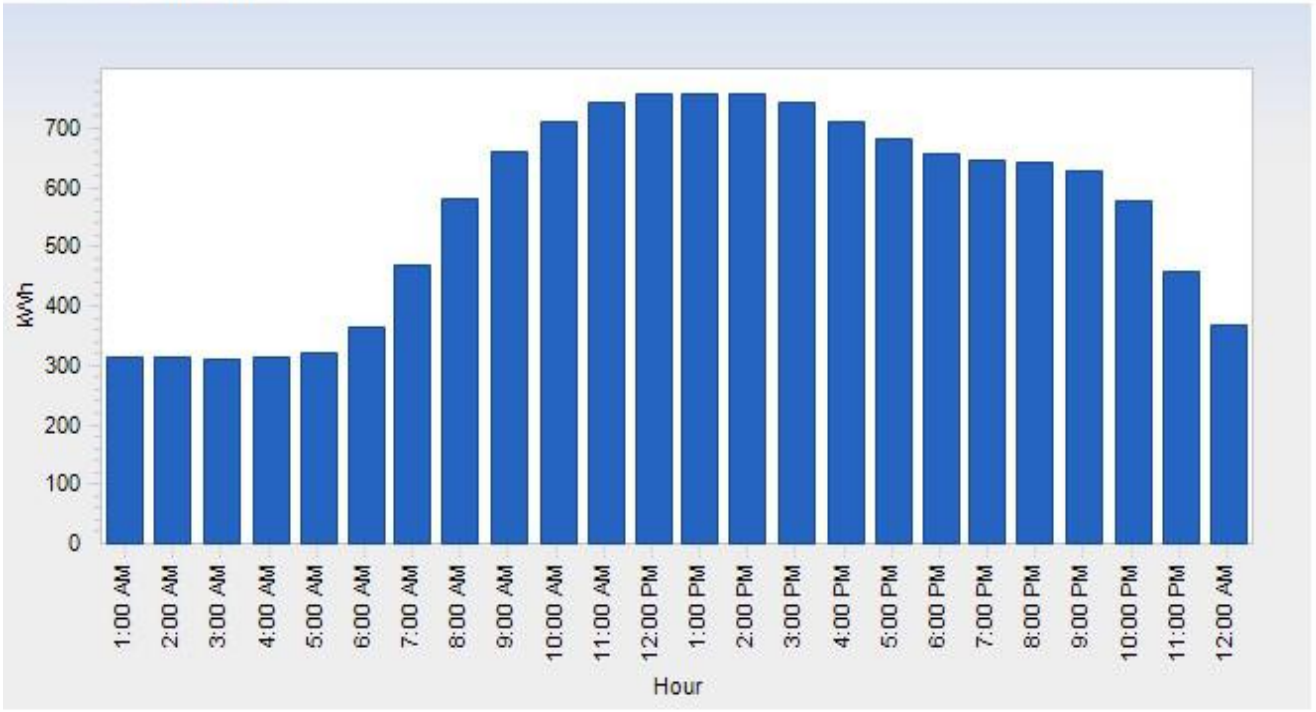


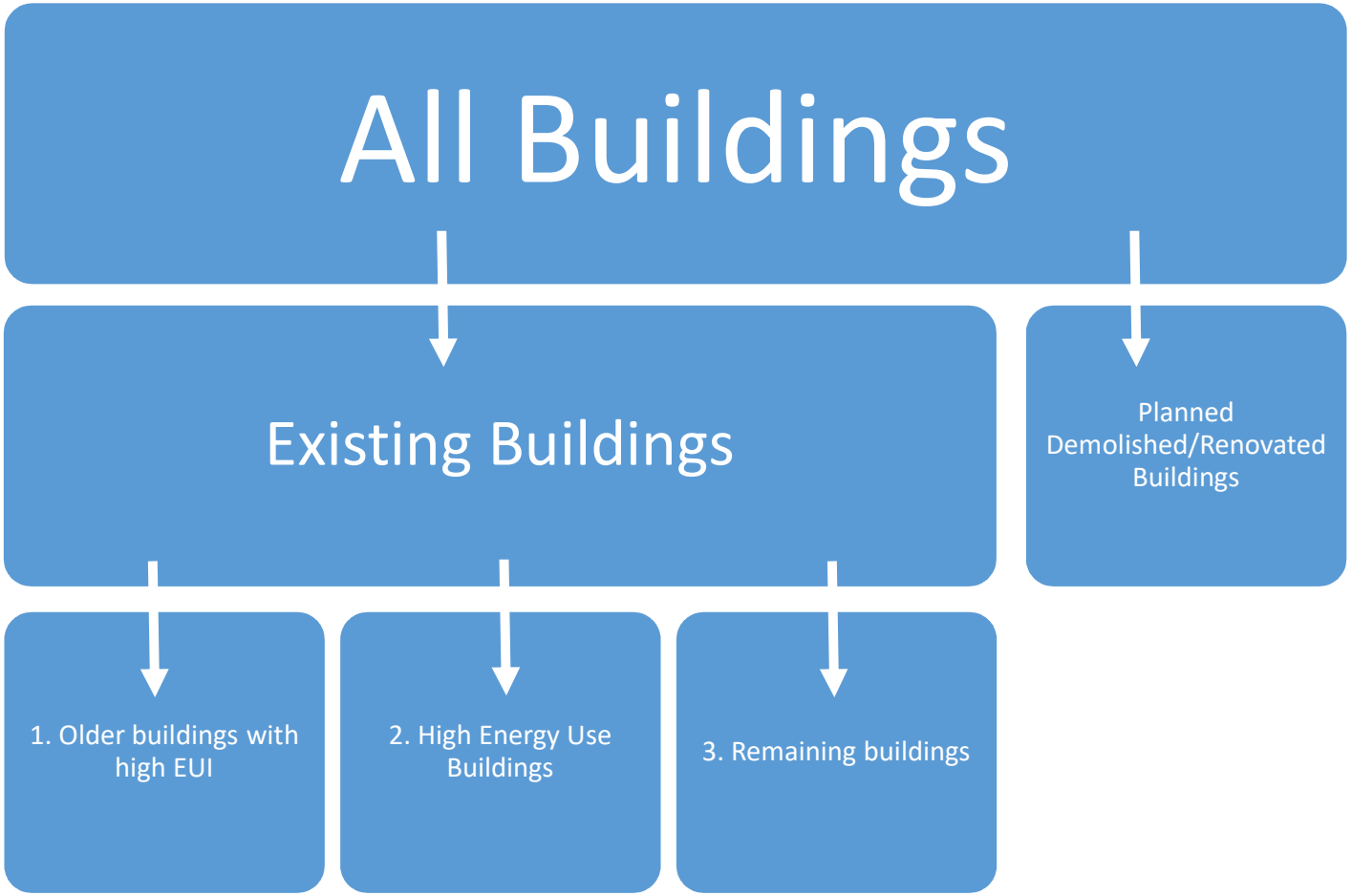
EUI (kBtu/ft2/year)		
EUI	Color	Bldg #s
31-40		4,8,19
41-50		5
51-60		3
61-70		--
71-80		--
81-90		7
91-100		1,6
101-125		--
126-150		2,7A,11,14,21

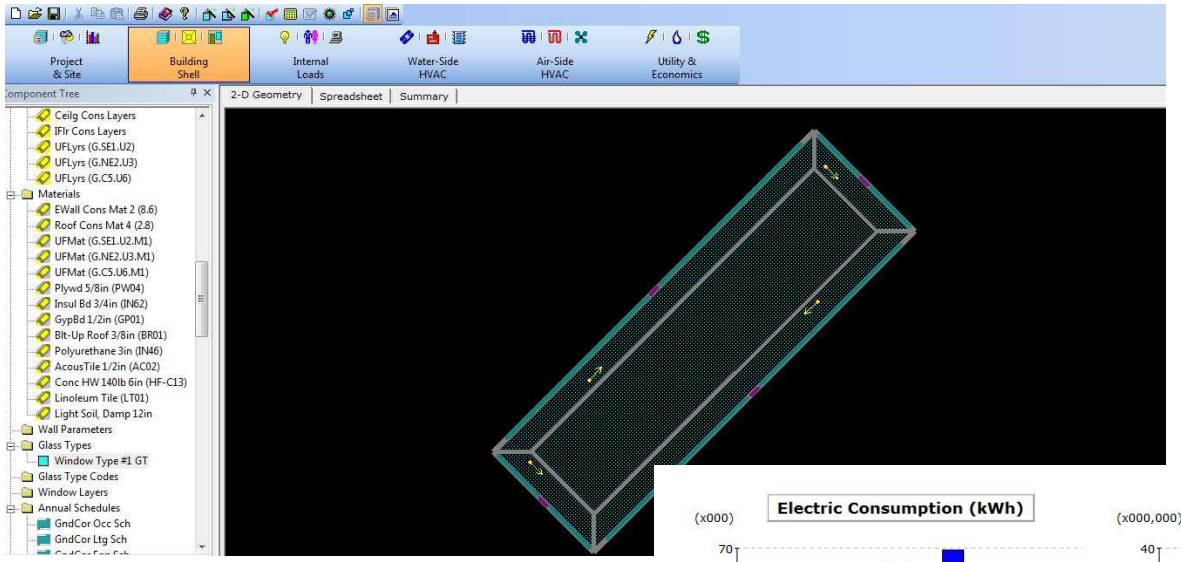
Skyline ’15-’16

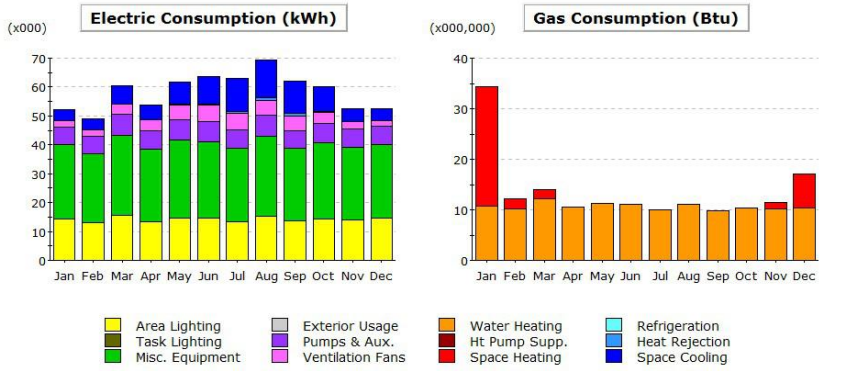


Average Hourly Profile



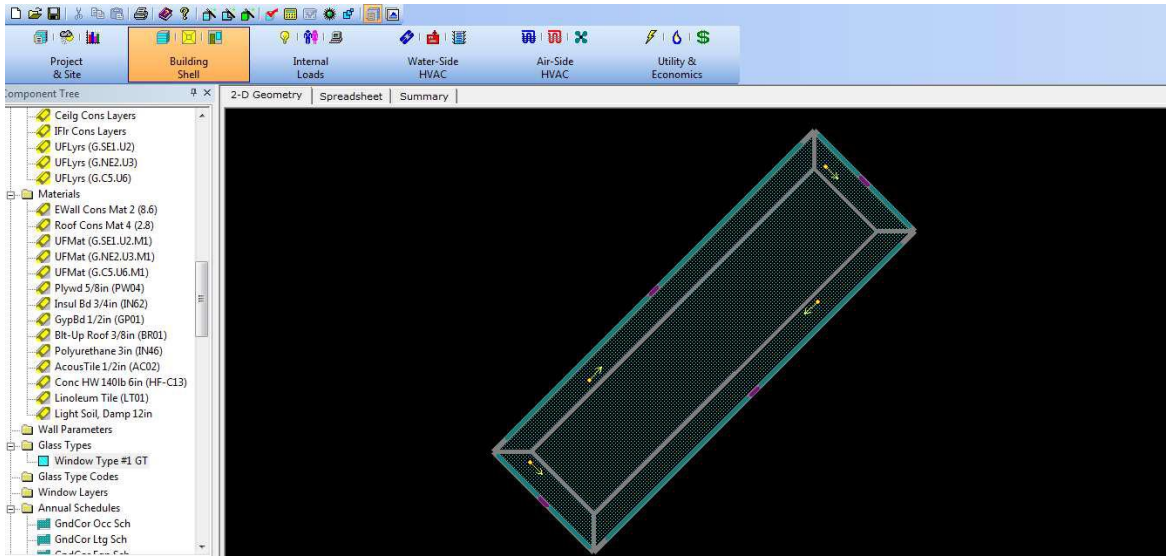

All Buildings
Existing Buildings
Planned Demolished/Renovated Buildings
1. Older buildings with high EUI
2. High Energy Use Buildings
3. Remaining buildings





Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	3.80	3.80	6.26	4.91	7.69	9.37	11.25	12.92	11.28	8.58	4.46	3.84	88.17
Heat Reject.	-	0.00	0.13	0.11	0.27	0.54	0.85	0.97	0.91	0.41	0.03	0.00	4.23
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-

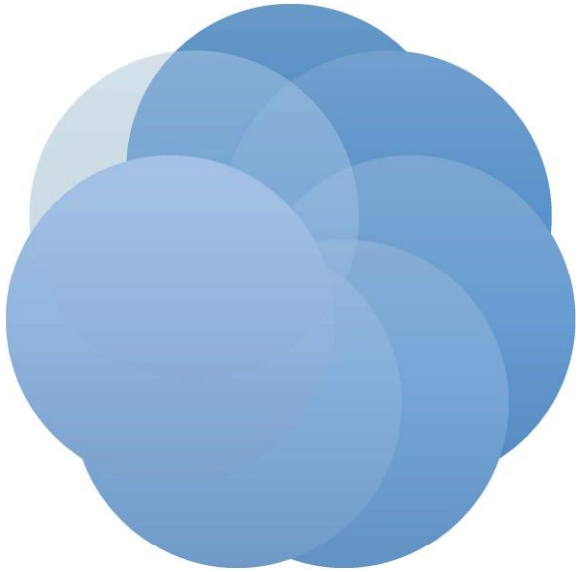

Project & Site
Building Shell
Internal Loads
Water-Side HVAC
Air-Side HVAC
Utility & Economics
Component Tree
Ceilg Cons Layers
IFlr Cons Layers
UFLyrs (G.SE1.U2)
UFLyrs (G.NE2.U3)
UFLyrs (G.C5.U6)
Materials
EWall Cons Mat 2 (8.6)
Roof Cons Mat 4 (2.8)
UFMat (G.SE1.U2.M1)
UFMat (G.NE2.U3.M1)
UFMat (G.C5.U6.M1)
Plywd 5/8in (PW04)
Insul Bd 3/4in (IN62)
GypBd 1/2in (GP01)
Blt-Up Roof 3/8in (BR01)
Polyurethane 3in (IN46)
AcousTile 1/2in (AC02)
Conc HW 140lb 6in (HF-C13)
Linoleum Tile (LT01)
Light Soil, Damp 12in
Wall Parameters
Glass Types
Window Type #1 GT
Glass Type Codes
Window Layers
Annual Schedules
GndCor Occ Sch
GndCor Ltg Sch
2-D Geometry
Spreadsheet
Summary

Next Steps

ZNE Ready New Buildings

Continued Coordination/Collaboration with BUG's and other stakeholders

Building Occupancy vs. Building Schedule Analysis



Plug-Load controls integration

Massive MBCx Effort

Training and development of staff with emphasis on trouble shooting and PM

Renewable Energy and Other DER Analyses

Discussion….

Thank You

Contact information:

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San Mateo County Community College District

Facilities Planning, Maintenance and Operations

650-358-3848

fullertonj@smccd.edu

www.smccd.edu/sustainability

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Developing Your Pitch to ZNE

1. Who are your primary stakeholders? What are the key messages for those decision makers about high performance schools and ZE schools?

2. What communication tactics did you learn that might be successful with your decision makers? I.e. communicating benefits, highlighting the current progress of your district, etc.

3. Are there stakeholders mentioned that you had not considered targeting before? Who and why?

4. What other comments do you have about the presentations that you would liked to have see more of?

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ZNE Resources

Join us!
2018 Proposition 39 ZNE School Trainings

Workshops

Inefficiency is Old School: A Technical Deep Dive Into ZNE School Retrofits
October 30, 1-5 PM
Pasadena, CA

Webinars

More webinars scheduled for **September 27, 2018** and **November 29, 2018**!
Check back for details at: https://newbuildings.org/proposition-39-trainings/

You can also listen to the previous Prop 39 Webinars on demand at:

- **Prop 39 ZNE Pilot Case Studies:** https://newbuildings.org/webinar/prop-39-zne-school-retrofit-pilot-case-studies/
- **Dreaming the Future: How Zero Net Energy Design Can Transform the School Environment**:

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NBI Prop 39 Retrofit Case Studies

COMMERCIAL

BUILDING TYPE: K-12 SCHOOL

LOS OSOS MIDDLE SCHOOL

LOS OSOS, CA

VIEW CASE STUDY

COMMERCIAL

BUILDING TYPE: K-12 SCHOOL

NEWCASTLE ELEMENTARY SCHOOL

NEWCASTLE, CA

VIEW CASE STUDY

COMMERCIAL

BUILDING TYPE: K-12 SCHOOL

GARDEN GROVE UNIFIED SCHOOL DISTRICT

GARDEN GROVE, CA

VIEW CASE STUDY

https://gettingtozeroforum.org/schools/

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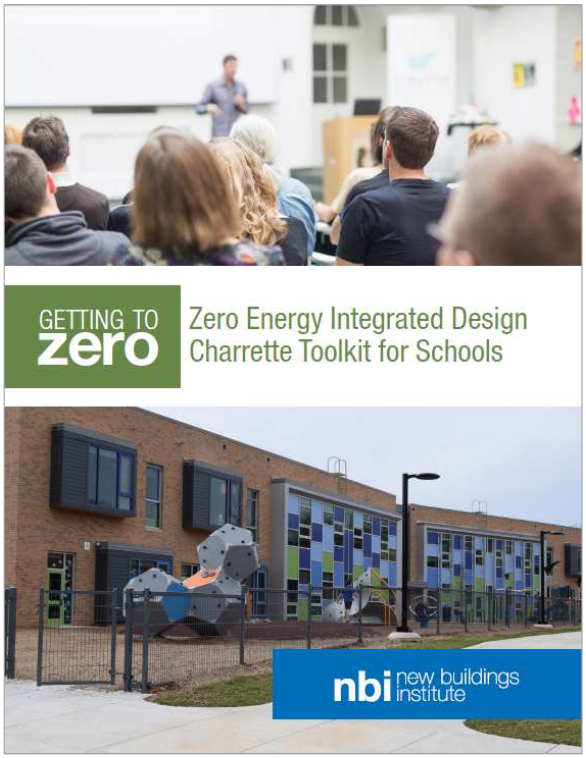
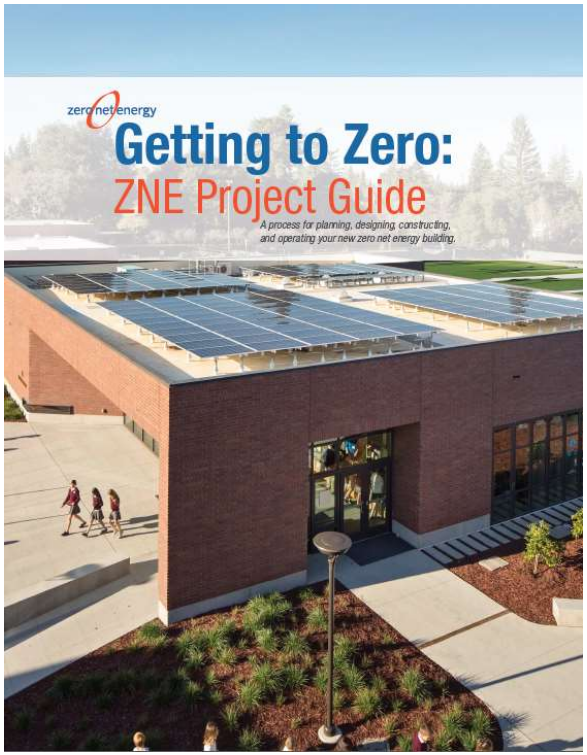
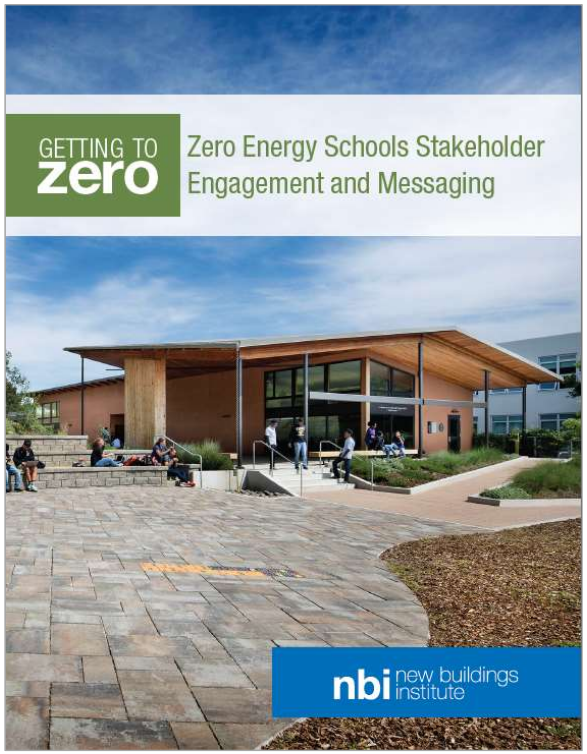
Tools for Zero Net Energy Schools







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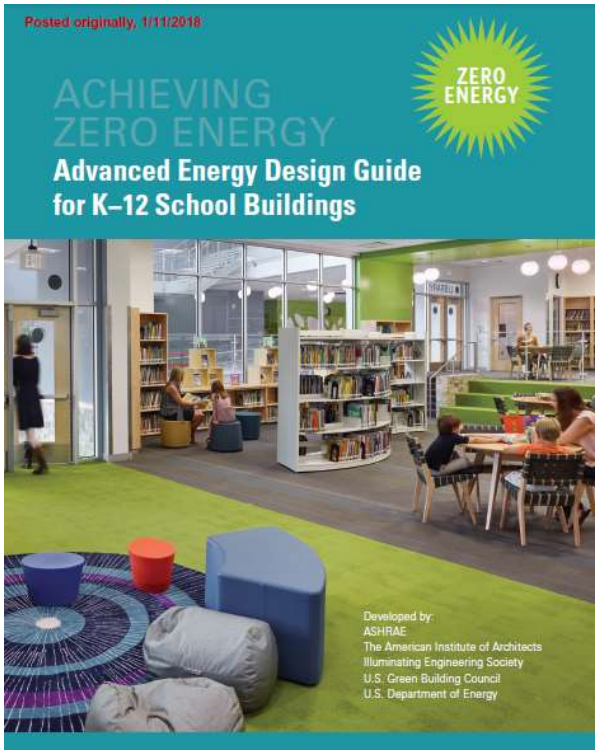
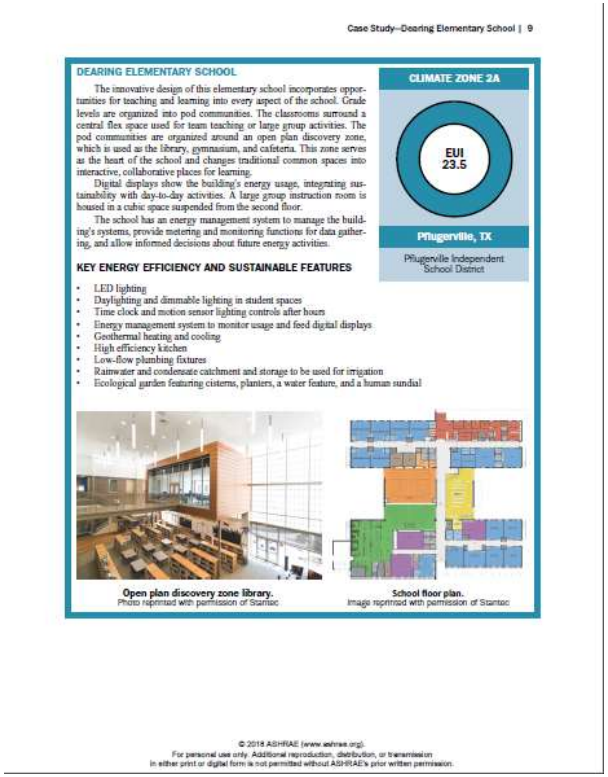
AEDG Zero Energy K-12 Schools Guide





Case Study–Dearing Elementary School | 9

DEARING ELEMENTARY SCHOOL

The innovative design of this elementary school incorporates opportunities for teaching and learning into every aspect of the school. Grade levels are organized into pod communities. The classrooms surround a central flex space used for team teaching or large group activities. The pod communities are organized around an open plan discovery zone, which is used as the library, gymnasium, and cafeteria. This zone serves as the heart of the school and changes traditional common spaces into interactive, collaborative places for learning.

Digital displays show the building's energy usage, integrating sustainability with day-to-day activities. A large group instruction room is housed in a cubic space suspended from the second floor.

The school has an energy management system to manage the building's systems, provide metering and monitoring functions for data gathering, and allow informed decisions about future energy activities.

CLIMATE ZONE 2A

EUI 23.5

Pflugerville, TX

Pflugerville Independent School District

KEY ENERGY EFFICIENCY AND SUSTAINABLE FEATURES

- LED lighting
- Daylighting and dimmable lighting in student spaces
- Time clock and motion sensor lighting controls after hours
- Energy management system to monitor usage and feed digital displays
- Geothermal heating and cooling
- High efficiency kitchen
- Low-flow plumbing fixtures
- Rainwater and condensate catchment and storage to be used for irrigation
- Ecological garden featuring cisterns, planters, a water feature, and a human sundial

Open plan discovery zone library.
Photo reprinted with permission of Stantec

School floor plan.
Image reprinted with permission of Stantec

Getting to Zero Resources HUB

https://gettingtozeroforum.org/zero-energy-schools-resources/

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Additional Resources

- **Energy Star Portfolio Manager:** https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager
- **NEEP High Performance Schools:** http://www.neep.org/initiatives/energy-efficient-buildings/high-performance-schools
- **Collaborative for High Performance Schools (CHPS) Criteria:** http://www.chps.net/dev/Drupal/node/212
- **Green Ribbon Schools:** https://www2.ed.gov/programs/green-ribbon-schools/index.html
- **NCEF School Buildings Assessment Methods:** http://www.ncef.org/pubs/sanoffassess.pdf
- **U.S. DOE Zero Energy School Accelerator:** www.zeroenergy.org
- **NREL Technical Feasibility for K-12 Schools:** http://www.nrel.gov/docs/fy17osti/67233.pdf
- **DOE Toolkit: K-12 Solutions for Building Energy Excellence:** https://betterbuildingsinitiative.energy.gov/toolkits/k-12-solutions-building-energy-excellence

Sandy High School | Sandy, OR
Photo Courtesy Josh Partee

Thank You!

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