NOW THE HARD PART
Implementing a Districtwide ZNE Plan

AT A GLANCE

Dense/Urban

7th Largest

55K Students

Diverse

Low-Income

Voters

Private

SFUSD
“Financial success has come with a price tag; on the climate we have failed.”
I don’t want your hope.

I don’t want you to be hopeful.

I want you to panic...and act as if your house was on fire.

Because it is.

If the adults won’t take responsibility, then we will have to.
California’s ZNE Building Goals

- All new residential construction and all new commercial construction in California will be zero net energy by 2020 and 2030, respectively
- 50% of existing commercial buildings will be retrofit to ZNE by 2030
- All new state buildings and major renovations shall be ZNE (2025)
- 50% of existing state-owned building area by 2025 shall be ZNE
- IOUs shall launch and ramp a ZNE K-12 Schools and Community College Pilot Program in 2015-18

DOABLE

Source: NBI
THEIR SCHOOL

Source: SOM

OUR SCHOOLS
California’s ZNE Building Goals

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Oh, SH%T!
DOABLE?!  

Transforming California’s historic schools  
An approach to stepping into the future  
Case Study: Santa Barbara High School

EUI GOAL

Table 29. Energy Intensity Values for Zero Energy Schools

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Representative City</th>
<th>Primary School</th>
<th>Secondary School</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Site Energy (kBtu/ft²·yr)</td>
<td>Source Energy (kBtu/ft²·yr)</td>
<td>Site Energy (kBtu/ft²·yr)</td>
</tr>
<tr>
<td>1A</td>
<td>Miami, FL</td>
<td>25.9</td>
<td>76.4</td>
</tr>
<tr>
<td>2A</td>
<td>Houston, TX</td>
<td>24.3</td>
<td>71.1</td>
</tr>
<tr>
<td>2B</td>
<td>Phoenix, AZ</td>
<td>24.7</td>
<td>72.5</td>
</tr>
<tr>
<td>3A</td>
<td>Memphis, TN</td>
<td>23.8</td>
<td>69.0</td>
</tr>
<tr>
<td>3B</td>
<td>El Paso, TX</td>
<td>23.4</td>
<td>67.8</td>
</tr>
<tr>
<td>3C</td>
<td>San Francisco, CA</td>
<td>21.6</td>
<td>61.9</td>
</tr>
<tr>
<td>4A</td>
<td>Baltimore, MD</td>
<td>23.5</td>
<td>67.6</td>
</tr>
<tr>
<td>4B</td>
<td>Albuquerque, NM</td>
<td>23.1</td>
<td>66.6</td>
</tr>
<tr>
<td>4C</td>
<td>Salem, OR</td>
<td>22.4</td>
<td>64.2</td>
</tr>
<tr>
<td>5A</td>
<td>Chicago, IL</td>
<td>24.3</td>
<td>69.9</td>
</tr>
<tr>
<td>5B</td>
<td>Boise, ID</td>
<td>23.2</td>
<td>66.7</td>
</tr>
<tr>
<td>6A</td>
<td>Burlington, VT</td>
<td>24.5</td>
<td>70.1</td>
</tr>
<tr>
<td>6B</td>
<td>Helena, MT</td>
<td>23.5</td>
<td>66.9</td>
</tr>
<tr>
<td>7</td>
<td>Duluth, MN</td>
<td>25.9</td>
<td>74.1</td>
</tr>
<tr>
<td>8</td>
<td>Fairbanks, AL</td>
<td>28.7</td>
<td>82.5</td>
</tr>
</tbody>
</table>

Source: DOE
THERE’S HOPE

Pre-Modernization EUI
Post-Modernization EUI

Francisco MS
Monroe ES
Starr King ES
Roosevelt MS
Lowell HS
Jose Ortega ES
Cesar Chavez ES
Gordon J Lau ES
Sunnyside ES
George Peabody ES
Miraloma ES
Hilltop HS
San Miguel EES/Leadership HS
Creative Arts ES/Gateway MS

CURRENT TECH
TRANSITION FUEL?

THE ONLY WAY

Figure 5.1: EUI and Total Energy Cost for Moscone ES
UTILITY PERKS

Source: SF Public Utilities Commission

LABOR ISSUES

KAIZEN
- Data Analysis
- Mini Capital Commissioning

LIGHTING
- LEDs
- Vacancy Controls
- Daylighting Controls

ENVELOPE
- Dual Pane Windows
- Insulation
- Air Tightness
- Solar Tubes
- Light Shelves

HEATING
- Heat Pump HW
- Point Source DHW
- Variable Refrigerant Flow
- Solar Hot Water

RENEWABLES
- Onsite Solar PV
- Battery Storage
- EV Charging
HOW TO PAY FOR THEM?

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

Source: UC Berkeley

CONSTANT BATTLE
MINIMIZE THE DELTA

BUILDING STRATEGY

NEW SCHOOLS
→ ZNE Ready

MODERNIZATION
→ System Replacements

RENEWABLES
→ In Due Time
OVERVIEW & PROCESS

STRATEGY

The design team has many opportunities to improve the various footprints of the buildings.

NEW PROJECTS: Better energy performance and efficiency

OVERVIEW & PROCESS

NEW & OLD

ZNE GUIDELINES

EFFECTIVE: increasing design goals and satisfying the needs of the users.

The ZNE Guidelines document, developed by the UC Berkeley Design Studio and the UC Berkeley ZNE Lab, provides a framework for designing ZNE buildings. These guidelines are intended to help architects, engineers, and other professionals design ZNE buildings that are efficient, affordable, and sustainable.

To be a ZNE building, a building must meet the following three criteria:

1. The building must have a net zero energy balance. This means that the energy produced by the building's on-site renewable energy systems must equal the energy consumed by the building.

2. The building must have a net zero water balance. This means that the water conserved by the building's efficient fixtures and systems must equal the water consumed by the building.

3. The building must have a net zero greenhouse gas emissions. This means that the emissions avoided by the building's efficient systems must equal the emissions produced by the building.

These guidelines are based on the latest scientific research and are intended to help architects, engineers, and other professionals design ZNE buildings that are efficient, affordable, and sustainable.

PROCESS

NEW PROJECTS: Better energy performance and efficiency

OVERVIEW & PROCESS

NEW & OLD

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These guidelines are based on the latest scientific research and are intended to help architects, engineers, and other professionals design ZNE buildings that are efficient, affordable, and sustainable.
I DON'T THINK SO

COMMISSIONING

"Have I registered for the Design-Build conference yet?"

"I don't recall seeing that in the plans?"

"The lawyers are going to love this!"

"Damn! I forgot my glasses."

"How could somebody have missed this?"

"Nobody said anything about a front door!"

"#$@*!"
SMALLER PROJECTS

➔ LED Lighting
➔ Windows
➔ Roofing
➔ Controls
➔ Hot Water
➔ Pipe Insulation
➔ NO: New Gas Boilers

Source: Alta Planning

I've got it all figured out.
~ Said No Successful Person Ever

MattMcWilliams.com/SuccessNeverSays
ZNE STAIRCASE

KAIZEN
- Data Analysis
- Mini Capital
- Commissioning

LIGHTING
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- Vacancy Controls
- Daylighting Controls

ENVELOPE
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- Insulation
- Air Tightness
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RENEWABLES
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- Battery Storage
- EV Charging
ZNE ADVENTURE

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KAIZEN
- Data Analysis
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NEW ZNC BUILDINGS
WHY CAN'T WE JUST GET ALONG?

LESSONS LEARNED

TRY → FAIL → SUCCESS
HEAT PUMPS ARE COMING

“Electric equipment isn’t available”

CA Residential Natural Gas Consumption

- Space Heating 37%
- Water Heating 49%
- Dryer 3%
- Pool/Spa/Misc 4%
- Cooking 7%

SOURCE: 2014 California Residential Appliance Satisfaction Survey

TAKE IT SLOW

HEATING OPTIONS

1. Stick with working systems
2. Choose passive strategies
3. Pilot @ few sites
   → There’s always next time!
HEAT PUMPS ARE COMPLEX
HEAT PUMPS
1. Three types
2. Multiple brands
3. Interface w/EMS

Choose wisely!
TRAINING IS KEY

SOME THINGS TAKE TIME

**ELECTRIC DHW**

1. Split maintenance
2. Recovery rate
3. Replacement costs

→ Only @ fuel switch
LOOK AHEAD

EITHER OR

VS.
BOTH AND

KEY TAKEAWAYS

- Create a framework
  - involve stakeholders
  - set energy targets
  - consider utility rates
- Share it with design teams
- but check their work
- Be ambitious but pragmatic
- Compromise with colleagues

Source: FCPA
BACKGROUND

QUESTIONS?