OVERVIEW

• Objectives
• The Project – A Net Zero Energy Facility
• Definition of NZE building
• Design Methodology
• Pathway to NZE building
• Questions
OBJECTIVES

• Gateway/Terminus Building
• Highly sustainable Net Zero Energy building
• Minimize natural resources – water and energy
• Ease of maintenance and operation
• Reduced operational and maintenance costs
• Aesthetically pleasing facility
THE PROJECT

- 34,000 GSF, 3-story Classroom Building
- Highly sustainable Net Zero Energy building
- Seeking LEED Platinum Certification
- 95% naturally daylit spaces with mixed-mode ventilation
- Externalized all circulation to reduce energy use
- Energy Use Intensity (EUI) is estimated at 27 kBTu/ft$^2$-yr
- 55% below 2013 Title 24 baseline
- Collaborative Design Build Delivery Method
- $20.5M Budget
PROPOSED BUILDING
NET ZERO ENERGY BUILDING

(Zero Energy Building)

TOTAL ENERGY CONSUMPTION OF A BUILDING

\[
\text{GROSS BUILDING AREA} = \text{FU} \times \text{renewables}
\]

\[= 0 \text{ NET-ZERO ENERGY} \]
DEFINITIONS OF NET ZERO ENERGY FACILITY

(Net ZEB Definition)

- Net Zero Site Energy Building
- Net Zero Source Energy Building
- Net Zero Energy Emissions Building
- Net Zero Energy Cost Building
DEFINITION OF NET ZERO ENERGY FACILITY

Net Zero Site Energy

“Produces as much energy as it consumes over the course of a year, when accounted for within the building site boundary”
DEFINITION OF NET ZERO ENERGY FACILITY

Net Zero Source Energy

“Produces as much energy as it consumes over the course of a year when accounted for at the energy generation source.”
DEFINITION OF NET ZERO ENERGY FACILITY

Net Zero Energy

Emissions

“Produces or purchases enough emissions-free renewable energy to offset emissions from all energy used in the building over the course of a year.”
DEFINITION OF NET ZERO ENERGY FACILITY

Net Zero Energy Cost

“ZNE TDV is a California Energy Commission (CEC) developed and promulgated definition for the "utility cost" value of energy whereby the energy consumed by the building over the course of a typical year is less than or equal to the utility cost value of the on-site renewable energy generated.”
ADOPTED DEFINITION OF NET ZERO ENERGY FACILITY

Net Zero Source Energy

• Used by DOE, Federal Agencies and adopted by AIA and ASHRAE

• Smaller renewable energy requirement - whenever buildings use natural gas or other energy types

• Converts all energy sources into common units of kBtu using national average conversion factors
# National Average Source Energy Conversion Factors

<table>
<thead>
<tr>
<th>Energy Form</th>
<th>Source Energy Conversion Factor (r)</th>
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<tbody>
<tr>
<td>Imported Electricity</td>
<td>3.15</td>
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<tr>
<td>Exported Renewable Electricity</td>
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<tr>
<td>Natural Gas</td>
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<tr>
<td>Fuel Oil (1,2,4,5,6,Diesel, Kerosene)</td>
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<tr>
<td>Propane &amp; Liquid Propane</td>
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<tr>
<td>Steam</td>
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<tr>
<td>Hot Water</td>
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<tr>
<td>Chilled Water</td>
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<tr>
<td>Coal or Other</td>
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DESIGN METHODOLOGY

DESIGN
• Building shape, siting and orientation
• Windows
• Insulation
• Roof

USE EFFICIENTLY
• Heating, cooling and ventilation
• Lighting
• Plug load
• Controls / building energy management system (BEMS)
• Implement Passive Strategies

PRODUCE
• Renewable energy

SOURCE: ASHRAE, INTERNAL JCI ANALYSIS
DESIGN METHODOLOGY

LOADS REDUCTION
- Optimized building footprint
- Orientation
- Efficient Envelope
- 95% Spaces with Natural Daylighting

SYSTEMS EFFICIENCY
- Radiant heating and cooling system
- LED lighting with occupancy controls and daylight harvesting
- Mixed mode ventilation – natural ventilation and DOAS system
- Occupancy controlled power outlets

PRODUCE
- Photovoltaic system on roof and over sustainable landscaped area
PATHWAY TO NET ZERO ENERGY
PATHWAY TO NET ZERO ENERGY
PATHWAY TO NET ZERO ENERGY
IMPORTANT CONSIDERATIONS – ZNE PROCESS

• Work on Minimizing Internal and External Loads
  • Building Siting, Shape and Orientation
  • Efficient Envelope
  • Daylighting
  • Passive Strategies
• Conduct Energy Modeling *Early* - Monitor throughout the design process
• Identify Efficient MEP Systems and Get Concurrence from Owner
• Identify Control Strategies to Limit Hours of Operation of Each System
• Identify Type of Renewables Energy Generated and Space Requirements
QUESTIONS