Energy Trust of Oregon Panel Discussion

June 4, 2018
Outline

- Things to Consider
- Project Approach
- Coastal Climate
- Case study: Clatsop CC
- Case Study: OES
- Case Study: RMI
Sustainable Schools

Issues to Consider

– Simplicity
– Maintainability
– Lower operating expenses
– Acoustics
– Comfortable learning
– Early design collaboration
– Early modeling and costing
– Passive classrooms
– Fully conditioned other areas
– Occupant control
Best Project Approach

- Set Aggressive Goals
- Analyze the Climate
- Reduce Loads
- Choose Efficient Systems
- Opt for Renewables
- Verify Performance
Goal Setting

Energy Use Goal Setting and Solar Resource

- Existing
- Typical
- Good (Code)
- Better
- Best
- Solar Resource

Arch 2030 and Net Zero Energy Goal

270 kW Array

EUI (kBtu/sf/year)
Climate Analysis – Average Monthly Temps

- Average Daily High
- Average Daily Low
- Monthly High
- Monthly Low

Jan: 66°F, 28°F
Feb: 68°F, 27°F
Mar: 73°F, 34°F
Apr: 70°F, 34°F
May: 73°F, 42°F
Jun: 78°F, 45°F
Jul: 71°F, 46°F
Aug: 73°F, 47°F
Sep: 76°F, 43°F
Oct: 68°F, 40°F
Nov: 67°F, 30°F
Dec: 59°F, 30°F
Climate Analysis – Daytime Temperature BINS

# of Hours

- < 0°F
- 0°F - 5°F
- 5°F - 10°F
- 10°F - 15°F
- 15°F - 20°F
- 20°F - 25°F
- 25°F - 30°F
- 30°F - 35°F
- 35°F - 40°F
- 40°F - 45°F
- 45°F - 50°F
- 50°F - 55°F
- 55°F - 60°F
- 60°F - 65°F
- 65°F - 70°F
- 70°F - 75°F
- 75°F - 80°F
- 80°F - 85°F
- 85°F - 90°F
- 90°F - 95°F
- 95°F - 100°F
- > 100°F
Climate Analysis – Passive Cooling Effectiveness

- **< 50°F**
  - 22%
  - Heating is required

- **50°F - 75°F**
  - 78%
  - Optimal temperature range for natural ventilation

- **> 75°F**
  - 0%
  - Too warm for unassisted natural ventilation
Clatsop Community College Patriot Hall

Astoria, OR | Architect: SRG Partnership
36,400 sf | $10.9 M | $299/sf | 37 EUI
CCC Patriot Hall

Clatsop CC Patriot Hall - EUI Benchmarking

<table>
<thead>
<tr>
<th></th>
<th>kBtu/sf/yr</th>
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<tbody>
<tr>
<td>Typical Building</td>
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<tr>
<td>Code Building</td>
<td>99</td>
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<tr>
<td>PTNZ Target</td>
<td>38</td>
</tr>
<tr>
<td>Design</td>
<td>37</td>
</tr>
</tbody>
</table>
Oregon Episcopal School Lower School

Portland, OR | Architect: Hacker
45,000 sf | $11.8 M | $257/sf | 22 EUI
OES Summary

- 45,665 sf
- 2-Story Wing & 3-Story Wing
- K-5 Classrooms
- Media Center
- Commons/Cafeteria
- Administration
- EUI = 22
- Architecture 2030
- Energy Trust of Oregon Path to Net Zero Energy project

<table>
<thead>
<tr>
<th>Area</th>
<th>Cost</th>
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<tbody>
<tr>
<td>TOTAL</td>
<td>$270/sf</td>
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<tr>
<td>Shell</td>
<td>$60/sf</td>
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<tr>
<td>Interiors</td>
<td>$40/sf</td>
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<tr>
<td>Natural Ventilation Shafts</td>
<td>$2.50/sf</td>
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<tr>
<td>HVAC</td>
<td>$17/sf</td>
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<tr>
<td>Electrical</td>
<td>$20/sf</td>
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</table>
OES

Natural Daylight from Skylight to Help Light Corridor and Classroom Interiors

Natural Ventilation Stack

Electric Cove Heater

Super Insulated Envelope

Fixed Shades (Preferred)

Exposed Slab

Natural Daylighting

Heat Gain

Manually Operable Windows

Green LED Light and Push Button to Activate Natural Ventilation
Rocky Mountain Institute Innovation Center

Basalt, CO | Architect: ZGF Architects
15,600 sf | $8.9 M | $570/sf | 17.2 EUI - Net Zero
Results: Zero Energy

- **Average Building (Energy Star Score = 50)**
- **LEED V3 Baseline**
- **Architecture 2030 Target**
- **Proposed Building**
- **PV Budget**

- **Domestic Hot Water**
- **Vent Fans**
- **Pumps & Aux**
- **Space Cooling**
- **Space Heating**
- **Plug Loads**
- **Lights**

- **74% Savings**
- **63% Savings**

[Graph showing energy comparisons and savings]
Creating a Better Environment

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Owner’s Project Managers

Building a Successful Project
Defining Projects

Case Study: Lafayette Elementary School
Program

• Program defines the use of the space. It drives every aspect of the project. Throughout design, Program determines the direction of the project.

• What problem is the project going to solve and what function does the space have?

• In this case, six classrooms were needed. The district has defined the size of each classroom and the components of each room.

• At each phase of design, project team should confirm design meets program.
Scope

• Scope is defining the need:
  • New classrooms are required to meet this school's program.
  • The added space needed to accommodate large flexible space, custodial closets, traditional restrooms, staff and single user restrooms.
• Scope must meet program.
Standards

• Standards are the specific products, methods or systems that an owner has defined for use throughout buildings.

• Standards shall meet the scope and program.
• “Hard Cost” & “Soft Cost”
• Our goal is to limit the soft costs on every project.
• Defining budget items: various hard costs & soft costs
• Estimates at conclusion of each phase of design. This ensures that design is in-line with budget.
• Healthy contingencies based on risk (level of design)

For this project, we began with cost models for a traditional stick-framed building vs. a factory built building.
Design

• Design is the process of implementing the program, scope and standards into a solution that meets the needs and budget of the owner.

• Intentional design will encompass the owner’s needs. Additionally, it will implement best practices and attain energy efficiencies.

• In this project we spec’d LED lights, utilized gas split-systems, which were connected to the district’s DDC system.

• The return air was designed to relief into the attic space. Louvers, connected to the DDC system, relieved the building to maintain building pressure. Relieving the conditioned air into the attic space acts as insulation for the below classroom spaces.
Delivering the Project

- ORS279C defines two delivery methods: Design-Bid-Build and ESPC
- Other common delivery methods:
  - CM/GC
  - Design-Build
  - Two Step – RFQ-ITB
    - This was used at Lafayette
Value Added Services

• Constructability
• Commissioning
  • HVAC
  • DDC Controls
  • Lighting
  • PV
  • Etc.
• Window Testing – Moisture/Air Test
• Building Envelope Consultants
  • Design Review/Input
  • Onsite Inspections
Incentives

• Seismic Grants
• Early Design Meeting
• Building Commissioning
• OCSIM Grant
Thank you

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