Path to Net Zero
Pushing the Limits in the Oregon New Construction Market

Spencer Moersfelder, Business Sector Manager
Topics

• Pilot development
• Offerings, with examples
  – Early Design Assistance
  – Technical Assistance
  – Installation & Commissioning
  – Monitoring & Reporting
Energy Trust of Oregon
New Buildings Program

Projects we serve:
- Commercial new construction
- Major renovations
- Tenant build-outs
- Additions to existing buildings
- LEED®
- ENERGY STAR®

What we offer:
- Financial incentives for energy-efficient equipment and energy studies

www.energytrust.org/newbuildings
Growing momentum for net zero

- Financial & Technical Support
  - Energy Trust of Oregon
  - Architecture 2030
  - NBI New Buildings Institute
  - U.S. Department of Energy Efficiency Alliance

- Education, Research & Partnerships
  - NBI New Buildings Institute
  - U.S. Department of Energy Efficiency Alliance

- Legislation & Standards
  - Energy Trust of Oregon

Diagram showing various organizations and their contributions to net zero initiatives.
Reaching net zero

Developing the pilot

Define "net-zero" ➔ Define the process ➔ Consider design ➔ Consider costs ➔ Develop tools & resources

Step 1 ➔ Step 2 ➔ Step 3 ➔ Step 4 ➔ Step 5
Defining “net-zero”
Measuring success

EUI (kBtu/sf/yr)

Average for Restaurant
Code for Restaurant?
Modeled code restaurant

Proposed restaurant (total use)
Net proposed restaurant (including onsite renewables)

Average for Office
Code for Office?

Net-zero energy

50% beyond code
60% beyond code
Measuring success

Participants must be committed to achieving:

- at least 60% energy savings beyond Oregon code through energy efficiency and renewable energy \textit{and}
- at least 50% energy savings beyond Oregon code through energy efficiency alone

Where code doesn’t apply, projects must use common practice as the baseline
Lessons from Stakeholders
Process for designing a net-zero building

• NZ goal must be identified early and whole team must be committed to the goal
• Whole project team must meet early and often (integrated design)
• Commissioning agents need to be on-board early and involved throughout the process.
  – $10,000 in Early Design Assistance
• Monitoring and reporting needs must be considered early.
  – M&R plan review
Design considerations

- Energy models used as a design tool; must be iterative.
- Other energy-related studies should inform design: climatic studies, CFD analysis and daylighting analysis.
- Identifying and optimizing passive and innovative building systems takes time and expertise.
- Impact of plug loads and occupant behavior is crucial but difficult to measure.
  - Doubled Technical Assistance
Cost considerations

- Owners and designers perceive that they are taking a risk.

- Energy efficiency is incrementally more expensive (up to a point).

Necessary tools and resources

• Design community needs access to more tools and resources
  – Energy Studies in Buildings Laboratory seminars and project consultations

• Monitoring needed to measure success and ensure savings over time

• Different levels of monitoring and control needed for various building sizes and types
  – Flexible incentives for whole-building and subsystem monitoring (up to $30,000)
  – M&R Applications Guide
Pilot projects

• 15 buildings throughout Oregon
• 2,000 sq. ft. to 500,000 sq. ft.
• New and major renovations
• Office, school, college, multifamily, community spaces
Early Design Assistance
Early Design Assistance Offering

**Purpose:** Bring all team members to the table early to brainstorm energy-saving concepts

**Incentive:** $10,000

**Assistance:** Review agenda; attend the charrette; offer guidance as needed

**Deliverable:** Meeting report from integrated design charrette
Typical Design Process

Use  
Occupancy Program & Schedule

Load  
Building & Site Design

Systems  
HVAC, Lighting

Climate

Owner/Developer  
Architect  
Engineer
Integrated Design Process

[Diagram showing a cycle of Design Context, Climate, HVAC, Efficient Systems, Small Loads, Use, Occupancy Program & Schedule, Building Context, and Finding Synergies.]

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Case Study: XVI Vernon

**Type:** 5-story mixed use

**Size:** 50,000 sq. ft.

**Project Phase:** Schematic Design
How close to net zero?

Estimated on-site generation 11.92 kbtu/sf

Path to Net Zero goal (60% < code)

Code
XVI Vernon: Brainstorming Results

Shading devices

- Residential
- Residential
- Residential
- Residential
- Live/Work
- Courtyard
- Retail

Cooling and Ventilation Strategies
- Ceiling fans

Lighting Strategies
- Improved Envelope

Heating and DHW Strategies
- WSHP
- HW Storage tank
- Tie into solar thermal or air-to-water heat pumps

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XVI Vernon: Brainstorming Results

Tackle Plug Loads and Occupant Behavior

- Create feedback loop to tenants
- Schedule laundry times to utilize solar HW
- CFL “trade outs” for tenant task lights
- Occupancy sensors in receptacles
- Discourage window-shakers
  - Misting system in courtyard on hot day
Technical Assistance
Technical Assistance Offering

Purpose: Help to cover the cost of energy modeling fees or other studies (e.g. daylighting study, CFD analysis)

Incentive: Up to $50,000

Assistance: Scoping meeting with analyst; review of proposed analysis

Deliverable: Energy analysis report, energy models, and other studies
Case Study: Chemeketa Community College Health & Sciences Center

**Type:** Education  
**Size:** 67,000 sq. ft.  
**Project Phase:** construction documents complete
Chemeketa Design Features

Other features:
- De-coupled HVAC
- Radiant panels
- Night flush
- Advanced lighting controls

50% more efficient than code
Chemeketa

50.4% more efficient than OR code – how?

- CFD modeling to determine natural ventilation air flow and placement of openings
- Daylighting study
- Energy model in eQuest
  - Had to model details, e.g. low flow fixtures
- 130 kW PV on roof and surrounding grounds
Case Study: Hood River Middle School Science & Music Classroom

Type:  
School/Classrooms

Size: 5,600 sq. ft.

Project Phase:  
Construction
Hood River Design Features

Other features:

• Plug load occupancy sensors
• Geothermal heat pump loop tied to irrigation water loop
• Night flush
Installing & Commissioning
Installation & Commissioning Offering

**Purpose:** Cover cost of measures and equipment

**Incentive:** $0.20/kWh saved, $1.60/therm saved

**Assistance:** Review commissioning plan

**Deliverable:** Site verification and invoices, Cx plan and final Cx report
Monitoring & Reporting
Monitoring & Reporting Offering

Purpose: Help to cover costs associated with advanced monitoring and reporting; provide data to inform future designs

Incentive: Up to $30,000

Assistance: Review plan; Applications Guide; quarterly check-ins

Deliverable: M&R plan, equipment cutsheets, monthly utility data for 18-months post-occupancy, quarterly meetings
M&R Requirements

- Whole-building interval meters required
- System and subsystem encouraged
- Defined mechanism for reporting data
Case Study: Hood River Middle School

• **Whole building monitoring:**
  – Electric: 15 minute interval meter
  – Solar: 15 minute interval meter

• **Sub-metering**
  – Geothermal heat pumps
  – Lighting

• **Performance tracking**
  – Energy management controls system (EMCS) with whole building and sub metering equipment
  – Custom dashboard to track whole building energy use
Common themes

- Decoupled HVAC
  - More efficient to move water than air
  - Stop reheat
- Synergies with environment
  - Natural ventilation
  - Displacement ventilation
  - Heat recovery or geothermal
- Lighting
  - Daylighting opportunities
- Envelope
  - High performance glazing and envelope; justify cost with lowered HVAC size costs
  - Air barrier
  - Thermal mass for night flush
- Find ways to tackle the plug loads
  - Feedback loops to occupants
  - Occ sensors on plug load equipment
Questions and Contact Info.

Spencer Moersfelder  
Business Sector Manager  
Energy Trust of Oregon  
503-445-7635  
spencer.moersfelder@energytrust.org