Utilizing Cost Effective Solutions for Getting to Zero

Getting from A to ZE: How an Oregon Utility Program is Charting the Way with Net Zero Fellowship Research Grants

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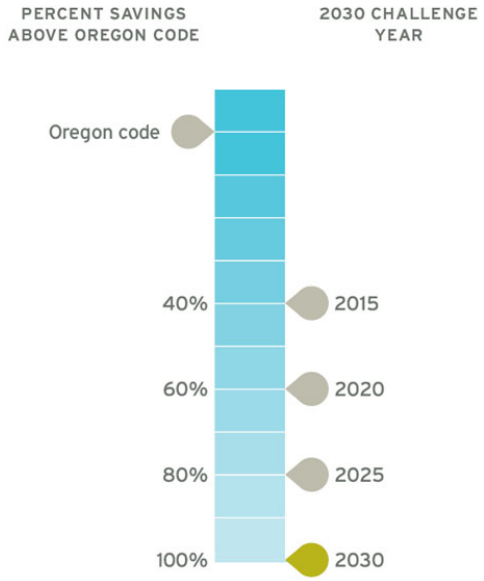
It all adds up to Zero

- Incentive design drives building load reduction
- Strategic alignment to Architecture 2030
- Project milestones, from customer kick-off to occupancy
- EUI used as a target-setting metric



Path to Net Zero is a roadmap to zero energy

- Early design assistance
- Technical assistance
- Solar ready
- Installation incentives
- Completion + post-occupancy
- Net-zero certification

A New Buildings outreach manager will meet with the project team to establish an initial Energy Use Intensity, EUI, target and energy-efficient design strategies.

Market research & trends

Research finding

Net zero buildings are possible with technologies available today – *Energy Trust's market research, 2009*

Trends

- Energy targets adopted as design goals
- Passive design strategies increased
- User-focused integrated design process
- Developing market of AEC professionals
- Different approaches to costing

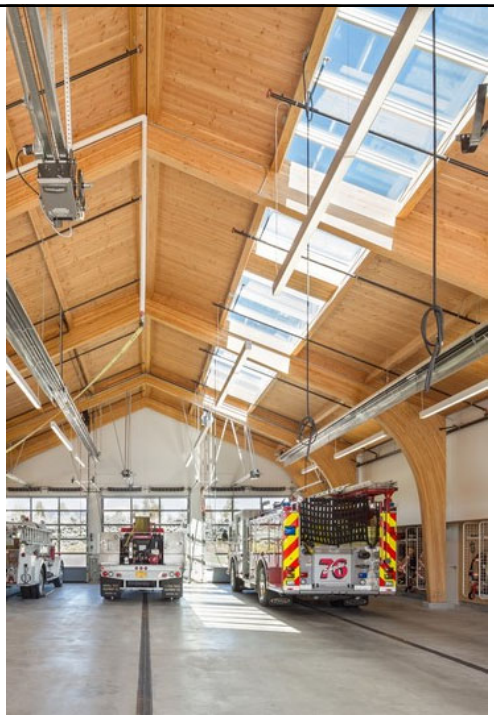


Photo: Multnomah Rural Fire Protection District Fire Station 76, Gresham

Energy Trust's market transformation approach

- Support continued market development of high-performance and net-zero design
- Address market barriers through research grants
  - Design and Engineering barriers are advancing quickly.
  - Address the barrier strategically, rather than individual projects
  - Many barriers to designing and building better buildings
- Diffusion of information from within the community
  - Bridged the gap in technical and economic considerations from a developer's perspective
  - Considers climate resilience and building performance under today's changing climate and future climate conditions in two cities.

Energy Trust of Oregon Net Zero Fellowship Research 2018

Approaching Net Zero for Today's Buildings

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Myth or Trend?

- Gap between the predicted and measured performance.

Midrise Multifamily

Low-to-Midrise Office

Myth or Trend?

Case Study 1: Meier and Frank (Vestas) Building:

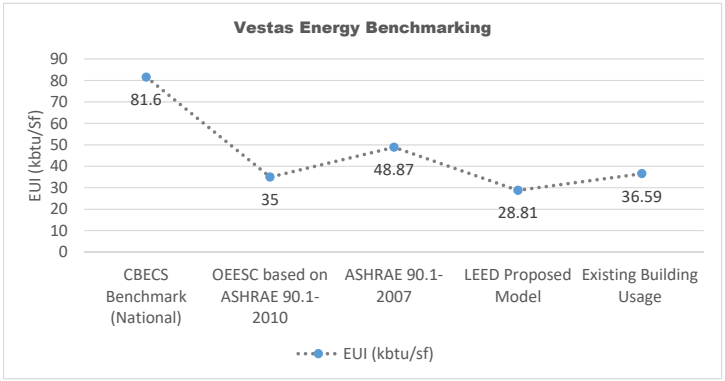
- 170,679 square feet
- 5 floors
- Commercial office tenants: GE, Vestas, Urban Shift
- Certified LEED Platinum in 2012
- Historic renovation operational since 2013

Myth or Trend?

Case Study 1: Meier and Frank (Vestas) Building:

Energy Benchmarking – EUI 36.58 kbtu/sf

- Verified through utility bills
- Gap between predicted and measured energy performance is 21.2%
- Onsite PV generation offsets 6-9% of building electricity usage



Myth or Trend?

Case Study 2: Beech Street Apartments

- 36,742 square feet (Building only managed by home forward)
- 4 floors
- 48 units of affordable housing for women and children
- New Construction (2014)
- LEED for Homes Platinum certified

SOURCE

Beech Street Apartments Sustainability Features

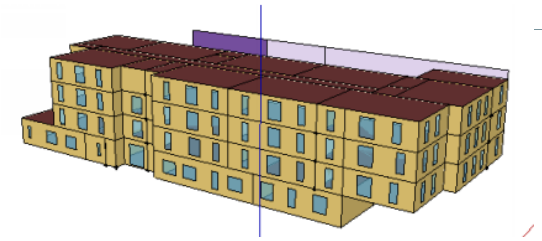
Awning Window Ventilation Challenges

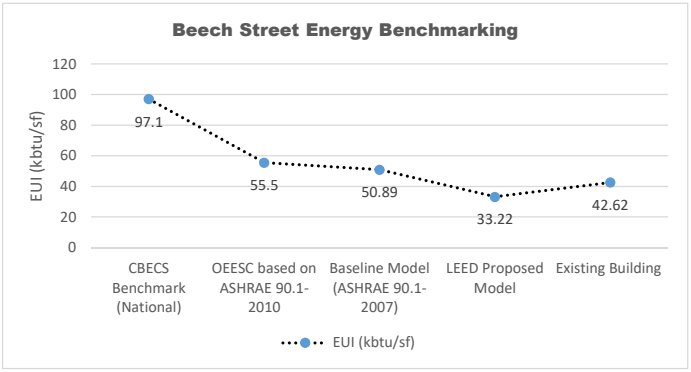
Myth or Trend?

Case Study 2: Beech Street Apartments

EUI 42.62 kbtu/sf

- Verified through utility bills
- Gap between predicted and measured energy performance is 22%





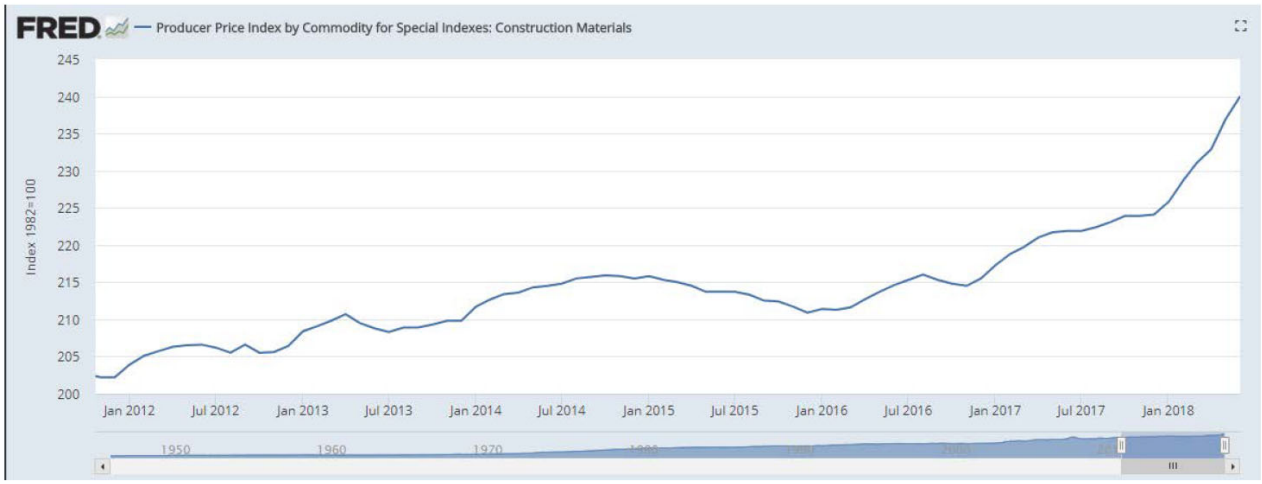
Is Cost a barrier ?

- Pricing is the direct cost of construction materials and labor, including standard markups.
- Work is priced in 2018 dollars in the City of Portland
- Pricing assumes a competitive bid process with at least 3 bidders and no preference for union or non-union labor.

SOURCE

Is Cost a barrier ?

Market Context – Construction Costs are HIGH



Is Cost a barrier ?

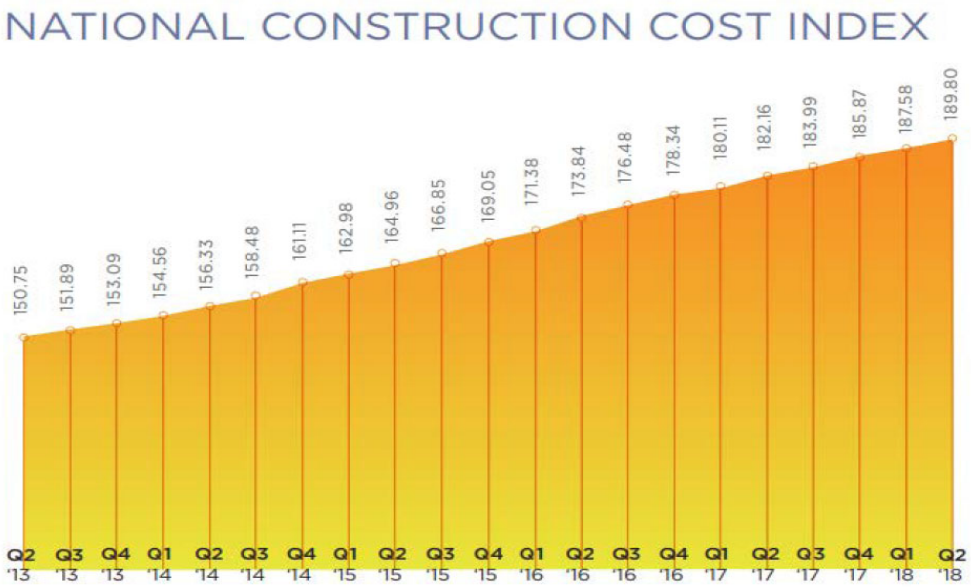


Image: Rider Levett Bucknall, Quarterly Construction Cost Report, Second Quarter 2018

Is Cost a barrier ?

City	April 2017	July 2017	October 2017	January 2018	April 2018	Annual % Change
Boston	20,835	20,989	21,176	21,325	21,563	3.49%
Chicago	20,414	20,652	20,905	21,177	21,394	4.80%
Denver	14,097	14,187	14,337	14,513	14,649	3.92%
Honolulu	24,060	24,050	24,058	23,663	23,804	-1.06%
Las Vegas	13,510	13,614	13,777	13,922	14,081	4.22%
Los Angeles	19,997	20,326	20,586	20,874	21,010	5.07%
New York	24,499	24,698	24,927	25,104	25,387	3.62%
Phoenix	13,785	13,900	14,080	14,248	14,442	4.77%
Portland	14,830	15,044	15,302	15,524	15,768	6.32%
San Francisco	24,039	24,546	24,760	25,151	25,704	6.93%
Seattle	16,419	16,654	16,804	17,017	17,250	5.06%
Washington, DC	19,774	19,884	20,054	20,212	20,437	3.35%

Image: Rider Levett Bucknall, Quarterly Construction Cost Report, Second Quarter 2018

Is Cost a barrier ?

Financial Analysis - Basics

- Key variables for a project to move forward or “pencil”:
  - Cost to build ($$$ paid by owner)
  - Income/Rents ($$$ to owner)
- Project must provide enough economic return to attract investors
- $Return = \frac{Net\ Income\ (Rents)}{Net\ Cost}$
- Rents must be high enough and cost must be low enough to generate return
- Net Cost is cost less subsidies, grants, tax credit equity, etc.

Is Cost a barrier ?

Financial Assumptions

- Timing: the projects are in today's construction costs with today's rents
- Location: building location stays the same
- No additional rent premium for Path to NZ building versus Baseline LEED Platinum buildings
- However, we DO assume utility savings benefits proforma

Is Cost a barrier? EUI Reduction Strategies With Costs – Vestas Office

Bundled Strategies	EUI (kbtu/sf)	Annual Energy Savings	Annual Cost Savings	First Cost	Cost/sf	Cost/EUI/sf
Building As Is	36.12	-	-	-	-	-
1: Envelope Upgrade	34.97	3.19%	$13,432	$1,034,718	$6.06	$5.28
2. Shading	35.38	2.05%	$8,182	$259,038	$1.52	$2.06
3. Lighting/Plug Load Reductions	33.90	6.14%	$7,261	$270,124	$1.85	$0.84
4. Heat Pump Water Heater	35.97	0.41%	-$4,057	$11,466	$.07	$0.46
5. Ground Source Heat Pump	22.67	37.23%	$44,395	$1,526,850	$8.95	$0.67
All Strategies, Bundled	20.50	43.25%	$54,062	$3,148,117	$18.44	$1.18

Is Cost a barrier ? Resulting Economics – Vestas Office

- Target Return on Cost for Portland Office: 7.00%

Vestas Office Building	No Historic Tax Credits		Path to Net Zero	
Feasibility	Baseline	Path to Net Zero	Premium	$/GSF
Total Costs in 2018 dollars	**$82,080,000** $454/GSF	**$85,490,000** $473/GSF	4%	$473
Additional Capital Incentives /GSF	**$52.43**	**$66.51**		$14.08

Vestas Office Building	With Historic Tax Credits		Path to Net Zero	
Feasibility	Baseline	Path to Net Zero	Premium	$/GSF
Total Costs in 2018 dollars	**$82,390,000** $456/GSF	**$85,800,000** $475/GSF	4%	$475
Additional Capital Incentives /GSF	**$15.54**	**$28.02**		$12.48

Is Cost a barrier ? EUI Reduction Strategies With Costs – Beech Street

Bundled Strategies	EUI (kbtu/sf)	Annual Energy Savings	Annual Cost Savings	First Cost	Cost/sf	Cost/EUI/sf
Building As Is	36	-	-	-	-	-
1: Envelope Upgrade	35	3.55%	$1,162	$425,621	$11.58	$9.78
2. 20% Lighting Reduction	35	3.29%	$1,153	$40,301	$1.10	$0.93
3. Nighttime Plug Load Reduction	35	2.36%	$828	$119,480	$3.25	$3.83
4. Heat Pump Water Heater and Hot Water Reduction	27	23.83%	-$1,539	$23,318	$0.63	$0.07
5. Add DOAS w/ HRU/VRF in Units	35	2.18%	$765	$342,576	$9.32	$11.91
All Strategies, Bundled	24	33.02%	$1,361	$951,297	$25.89	$2.24

Is Cost a barrier ? Resulting Economics – Beech Street

- Target Return on Cost for Portland Multifamily: 5.75%

Beech Street Apartments	Market Rate		Path to Net Zero	
Feasibility	Baseline	Path to Net Zero	Premium	$/GSF
Total Costs in 2018 Dollars	$13,000,000	$14,020,000	8%	$380
Additional Capital Incentives/GSF	$104.76	$132.24		$27.49

Is Cost a barrier ?

- Commercially available technology today is readily available to build net zero buildings. The market conditions are not quite there yet.
  - Increased demand on labor and materials, combined with not enough supply, has skyrocketed construction costs.
- Increasing baseline standards for code or comfort will make the relative premium costs smaller.
- The current construction market pricing makes net zero buildings challenging. New financing options can make a difference.
  - Financial subsidies and technical resources can help, but there is still a gap.

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