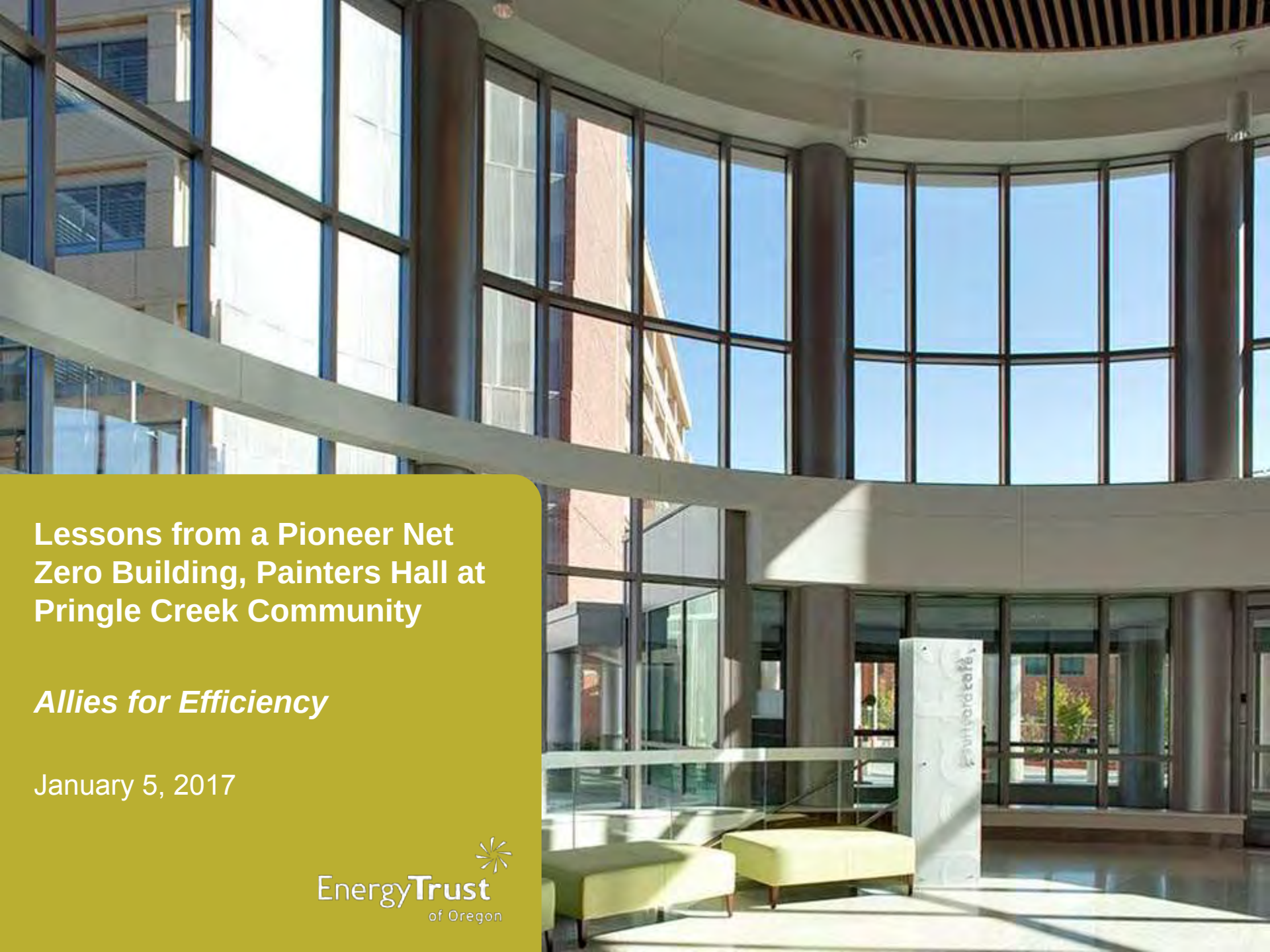


Lessons from a Pioneer Net Zero Building, Painters Hall at Pringle Creek Community

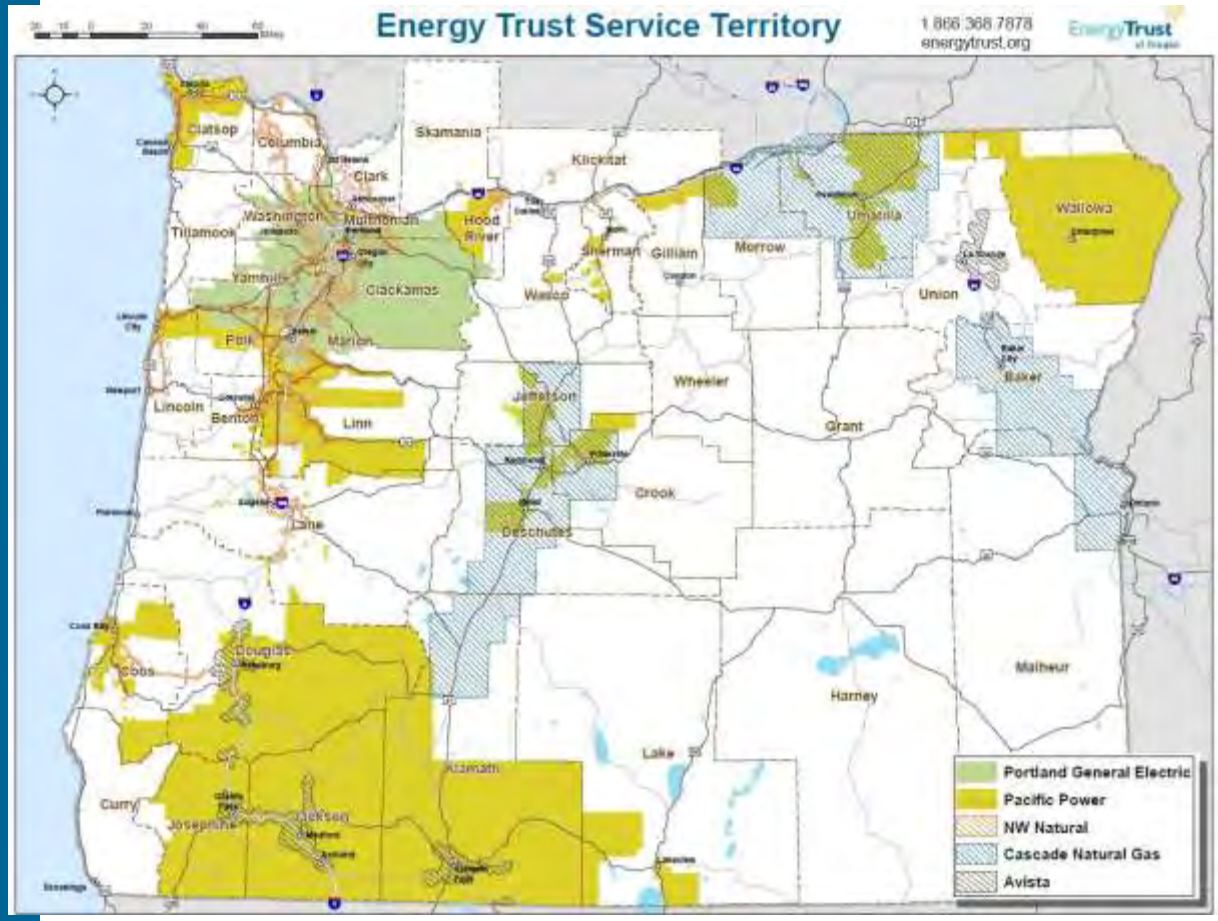
Allies for Efficiency

January 5, 2017

EnergyTrust of Oregon

About Energy Trust

- Independent nonprofit Serving customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas, and Avista.
- Providing access to affordable energy
- Generating homegrown, renewable power
- Building a stronger Oregon and SW Washington



New Buildings Events

Allies for Efficiency (AFE)

- Case study presentations on high-performance design and construction projects
- Take place 3-5 times per year in Portland + regionally

High Performance Design Technical Trainings

- Advanced training events for designers, architects and/or engineers
- Take place 2 – 3 times per year
- Content is focused on specific techniques or technologies

Building Energy Simulation Forum (BESF)

- Advanced energy modeling presentations
- Topics relevant to energy modelers / analysts, and engineers
- Take place every other month, remote access always available

Upcoming Allies for Efficiency Trainings

February 23, 2017: Allies for Efficiency

Westmoreland Union Manor – Major Renovation of a Senior Living Facility

Portland, Oregon

Upcoming Building Energy Simulation Forum Trainings

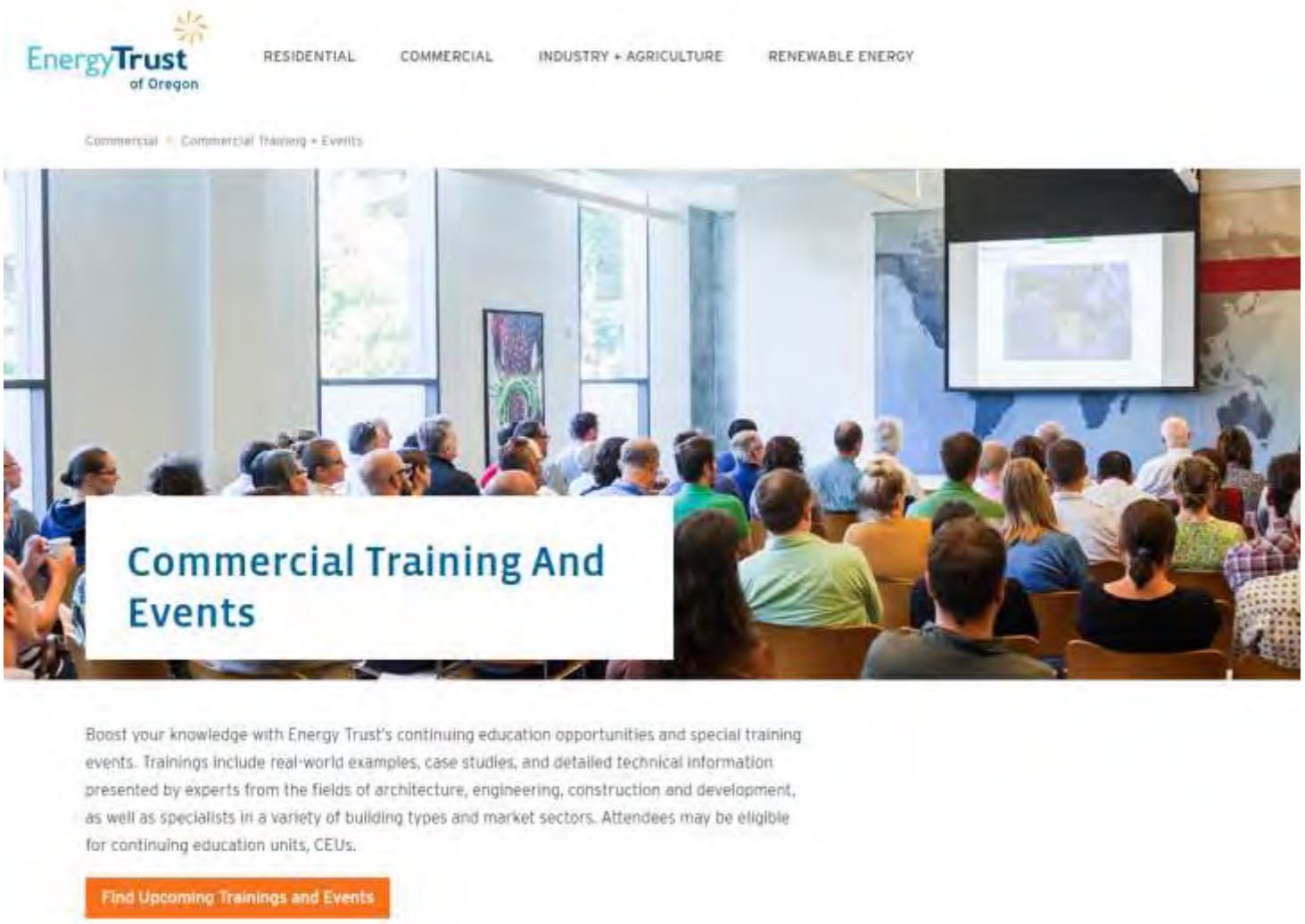
BESF usually takes place the third Wednesday of every other month at the Ecotrust Building at noon.

February 15, 2017:
Case Study – Modelling for the Bullitt Center, Presented by PAE

April 12, 2017
Presentation on ASHRAE 209P

Training & Education Webpage

energytrust.org/commercial/commercial-training-events/



Net Zero Fellowship

- Up to two fellowship grants, not to exceed a combined total of $50,000, to support net-zero energy research over 12 to18 months
- Funding for new research to advance design best practices, technologies and policies, and the overall net-zero community in Oregon
- Application deadline January 9, 2017
- Learn more at energytrust.org/zero

Questions?

Have questions about upcoming training and education opportunities *or* about becoming an Energy Trust New Buildings Ally?

Contact Amanda.Davidowitz@clearesult.com

Thank You

Amanda Davidowitz
Market Outreach Specialist
Amanda.Davidowitz@clearesult.com

EnergyTrust of Oregon

Painters Hall
Getting To Net Zero

James Meyer, Pringle Creek Community
Jeffrey Becksfort, PAE Consulting Engineers
Jonathan Schachter, Sustainable Development Inc.

www.pringlecreek.com |

Energy Trust December 15, 2016

Fairview Training Center 1908-1998

- 275-acre former state property
- Incredibly beautiful landscape
- Close-in, 3 miles from downtown

Clean, Green, Affordable, Equitable,

Fairview

Sustainable Fairview – 2001

- Planning process was collaborative and community-based from the very beginning
- Charrette and design workshops to develop master planning principles and layout of entire site.

Pringle Creek Community - 2005

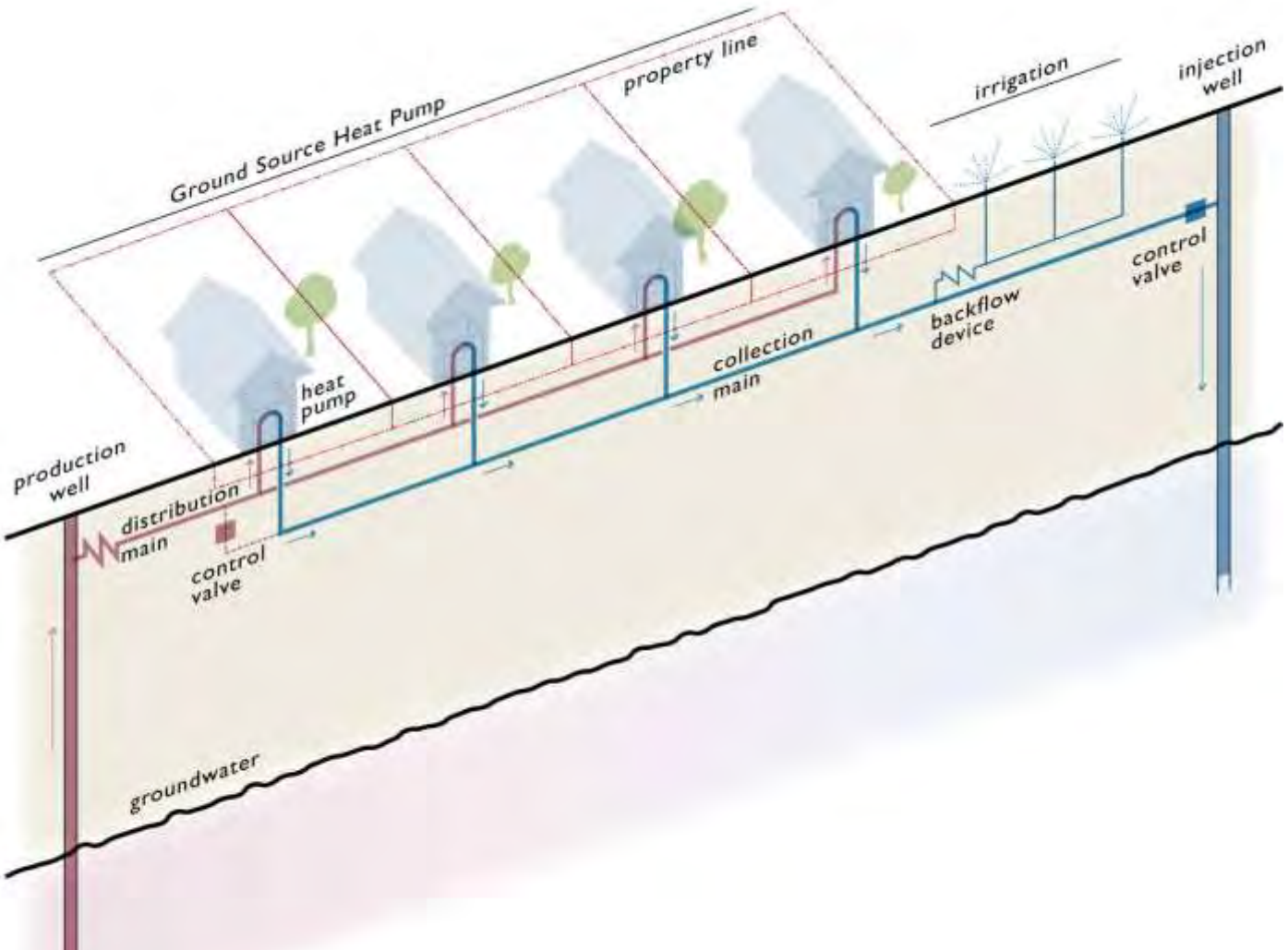
- **32** acre property: native tree stands, fish-bearing stream.
- Natural and built resources…**creek, buildings**
- Break into **thirds**; parks/streets/structures.
- **146** homesites (16 acres) and **8** commercial lots (4 acres) in Village Center.
- Design guided by
- **10 Principles** of Sustainable Development.

Sustainable Redevelopment: Pringle Creek Community

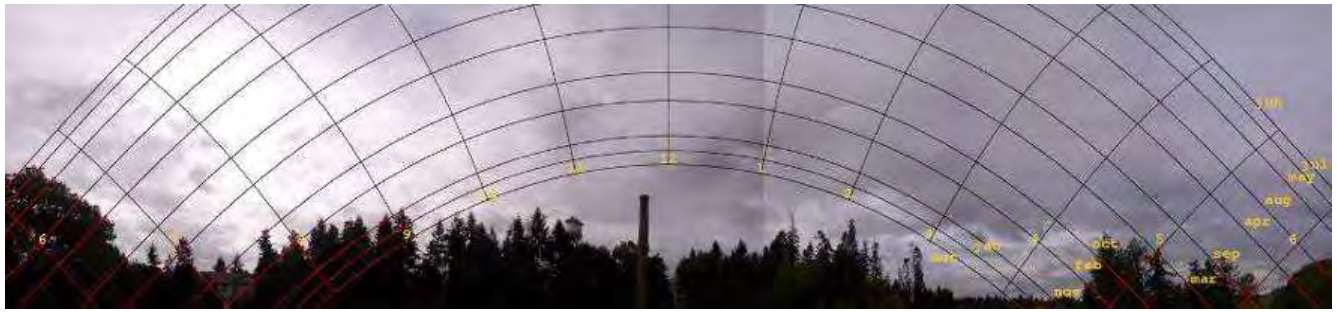
- NZEB Certification (Painters)
- LBC Petal Recognition: Energy|Equity|Beauty
- LEED Platinum (Painters)
- NAHB 2008 Energy Value Silver Award
- NAHB 2007 Green Land Development of the Year

Solar Analysis & Geothermal Potential

District Ground-Source Geothermal & Irrigation



Sun Angle Calculations



Storm Water - Porous vs. Conventional Asphalt

Cottage House

GREEN FEATURES OF COTTAGE HOME

Solar Screens
Built on south facing exposures, screens provide shade on window exteriors in summer, and allow sunlight and solar warmth in winter.

Solar Electric
Photovoltaic (PV) panels generate electricity year-round. Power generated but not used is sold back to utility company.

Solar Water
Panels pre-heat water before sending to water heater.

Layers of Efficiency
By using energy efficient roofing, framing, windows, doors and insulation, this home is designed to keep you comfortable and healthy, while keeping your energy bills extremely low.

EXTERIOR CONTRUCTION:

1 Exterior wall and roof framing uses advanced framing techniques with engineered lumber and FSC-certified* lumber to allow more insulation and reduce the need of extraneous framing lumber, without compromising the structural integrity of the house
2 High performance exterior envelope insulation at roof and walls uses a combination of formaldehyde free spray-foam insulation, blown cellulose, and rigid polyisocyanurate insulation
3 Foundation: 30% fly-ash concrete mix
4 Windows: Jeld-Wen EnergyStar™ Low-E glass
Low maintenance aluminum clad exterior on wood
U value = .32 (Code requirement: U = .40)
Locally sourced and manufactured in Bend
18% window to wall area
5 Siding: Pre-primed Hardi-Plank™ cement fiber lap siding
6 Roofing: Elk Composition Cool Color series (reflectance of .27)
7 Metal Roofing: Locally sourced, high recycled content, Cool Color series, 50 year life
8 Low-VOC** paint on exterior surfaces

*FSC: Forestry Stewardship Council
An international, non-profit organization committed to the conservation, protection and restoration of the world's working forests

**VOC: Volatile Organic Compounds
Materials made with low VOCs have almost no harmful off-gases

INTERIOR MATERIALS:

9 Flooring: Locally sourced Madrone hardwood floors with low-VOC** natural finish. Carpeting is 100% Wool (No-VOC)
10 No-VOC paint in the interior
11 Cabinets: Formaldehyde-free cabinetry with Beech doors and water-based, low-VOC finish
12 Greenguard certified Natural Quartz solid surface countertops and mantel

ENERGY & RESOURCE SYSTEMS:

13 Geothermal: Water-to-Air, High Efficiency Heat Pump
14 Zoned Energy Recovery Ventilator. Fresh air and heat recovery
15 Solar Water Pre-Heating: 40 tube thermomax system
16 Solar Electric System: 2kW Photovoltaic
17 Compact Florescent Lamps (CFLs) in all lighting fixtures
18 EnergyStar™ Appliances (kitchen, laundry, electronics)
19 Dual Flush Toilets: 1.6/.9 gallons per flush (gpf)
20 Shower Heads: 1.6 gallons per minute (gpm)
21 Kitchen Faucet: 1.0 gpm Vanity Faucet: 1.5 gpm
22 Native drought tolerant plants and limited lawn irrigated with a drip irrigation system. Optional Rainwater Harvesting collects water run-off from roofs and stores in cisterns to irrigate landscaping in the dry season. Plantings also reduce need for herbicides.

- 2 kw photovoltaic array
- 40 vacuum tube solar domestic hot water collectors

Restore / Reuse

Final Village Center Concept

Net-Zero Community Center of Activity

Getting to NZEB - Everything Matters

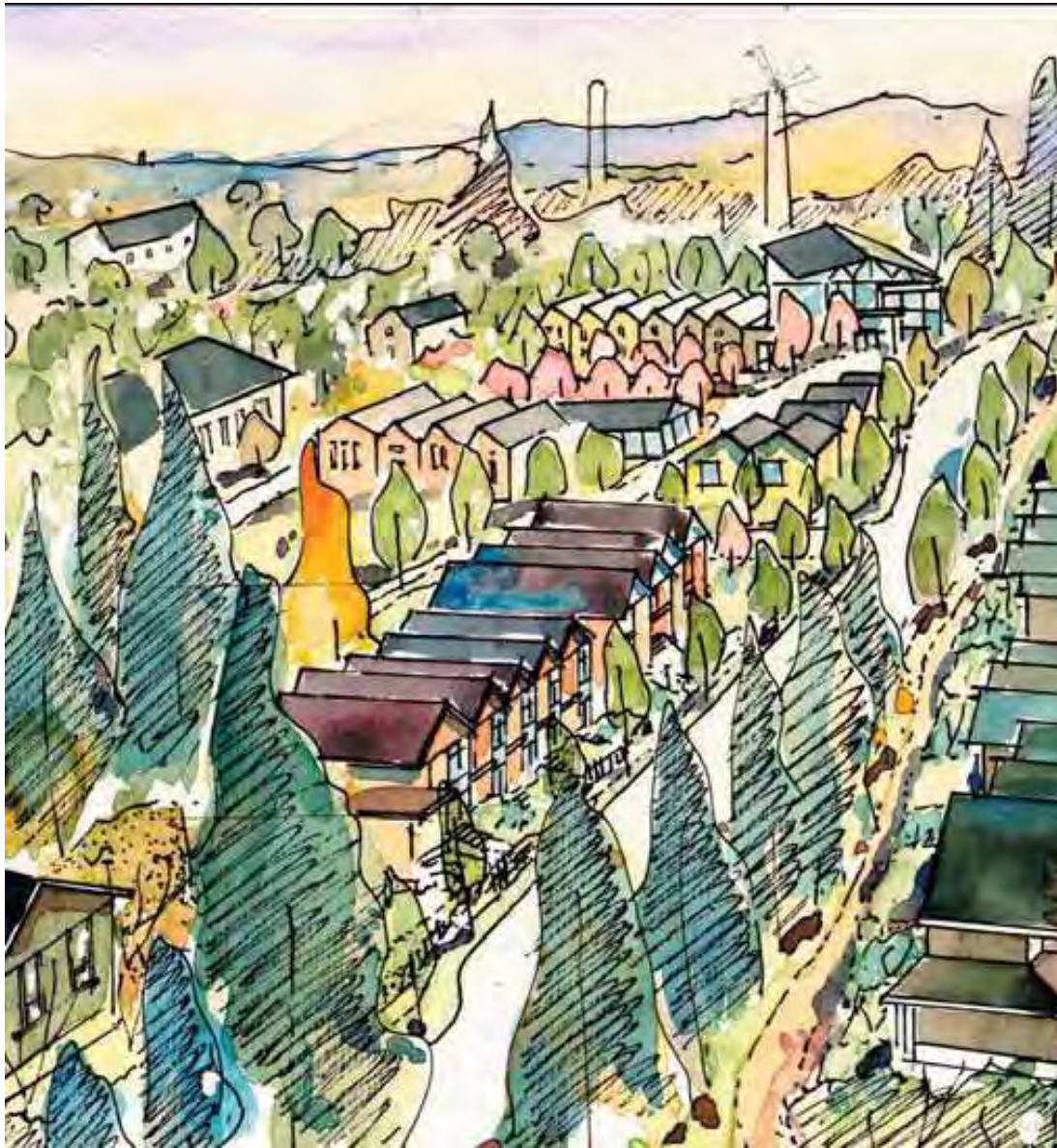
Needs of the Neighborhood

Heating and Cooling Energy
- Benchmarking
- Capacity

Water for Landscape and Gardens

Cascading Use

Disposal (Recycle)



Community Center Building – Net Zero Design

- **Integrated package of energy efficiency design features**
- **Modeled with DOE2.2 – an hour by hour energy simulation program**
- **Groundwater-coupled heat pumping and supplemental cooling**
- **Zonal supplemental heating**
- **Point of use electric potable water heaters**

How to Get NZEB +

Everything Matters

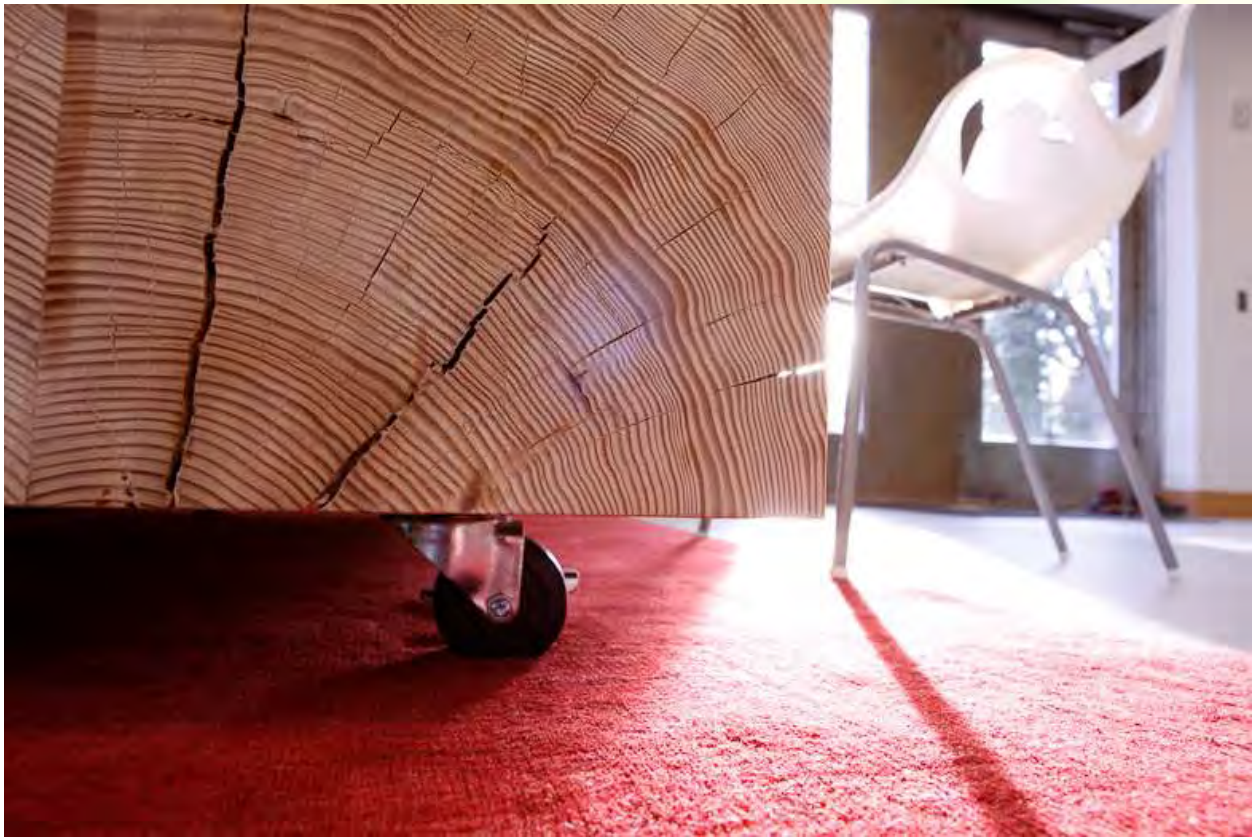
- ❑ Water
- ❑ Air
- ❑ Energy
- ❑ People

Air

Quality

Comfort

Control



Operable Windows, Individual Control, Visible CO_2 Sensors

Energy

Materials
Durability
Performance
Renewables

Site materials, salvage materials, minimum demolition, maximum reuse, good envelope, high performance systems, ghps, pv’s

Net Zero - Definitions

A building that produces at least as much energy through renewable sources as it uses over the course of a year.

NET ZERO*

[net][zeer-oh] n. adj.

- Net Zero Site Energy
- Net Zero Source Energy
- Net Zero Costs
- Net Zero Carbon

*http://www.nrel.gov/docs/fy08osti/41957.pdf


Architect: Miller|Hull

The earth receives more energy from the sun in just one hour than the whole world uses in a year. *

*solarbuzz.com

- Why Net Zero?

WILDLIFE

OUR ENVIRONMENT

CARE

PRESERVE

FUTURE GENERATIONS

THE BIG PICTURE

QUALITY OF LIFE

CHERISH

WORKING TOGETHER

Challenges

Cultural, Technical, Financial

Owner + Occupant Impact

Hour of operations

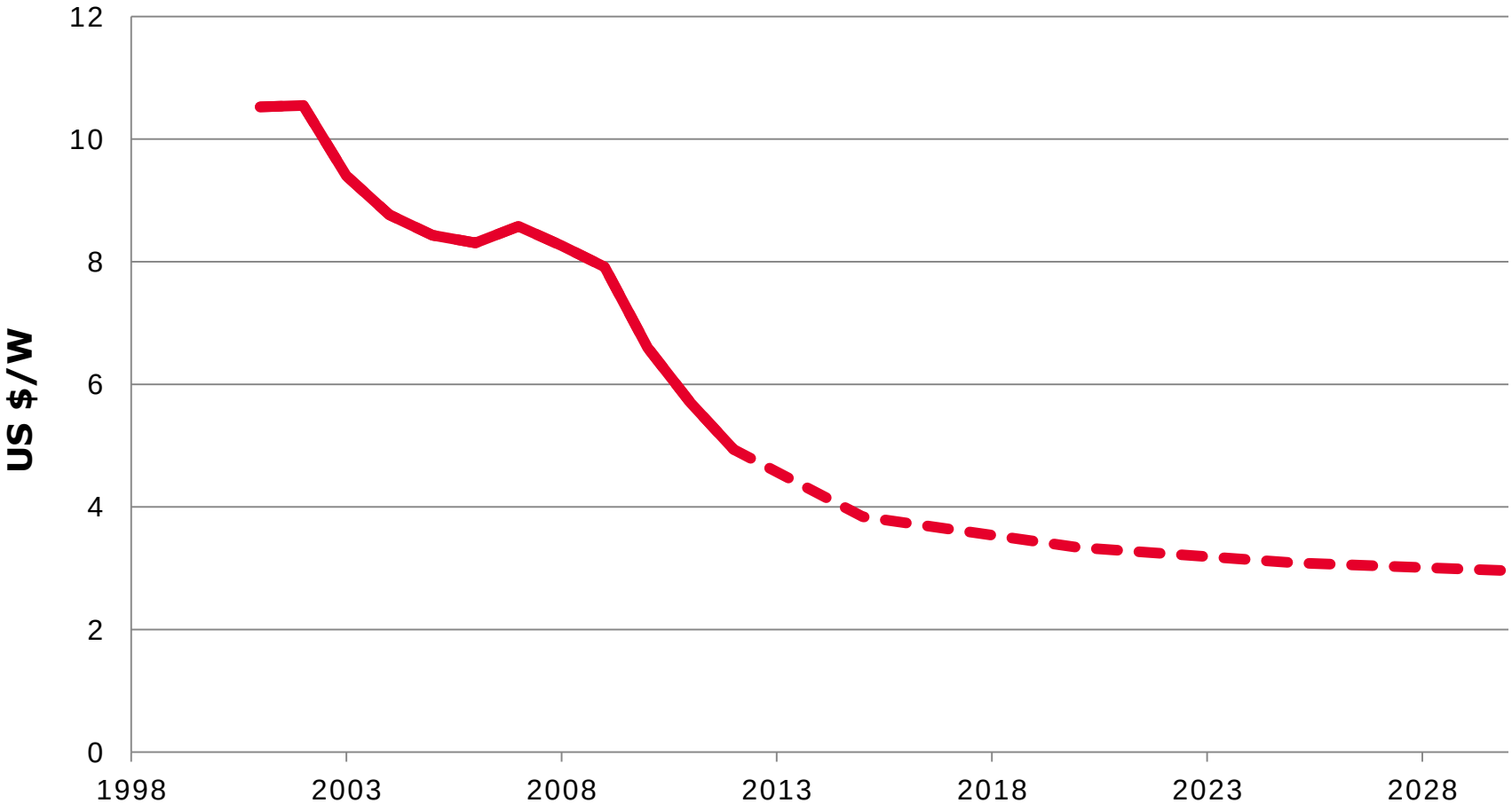
Choice of computers

Energy use feedback to tenants

Post occupancy survey

First Cost Trend

Average Price of PV



Source: Barbose, Galen L., Darghouth, Naïm, Weaver, Samantha, and Wiser, Ryan H. *Tracking the Sun VI: An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2012*. Berkeley, 2013.

Incentives

Simplified Regulation
(Net Metering)

Preferential Treatment
(Zoning)

Investment Based
(% of Cost)

Capacity Based
($ per kW, Power)

Production Based
($ per kWh, Energy)

Net Zero Today

Rocky Mountain Institute HQ – 15,600 SF

The Bullitt Center – 51,000 SF

Zenger Farms – 16 Acres

Georgia Tech – 42,500 SF

Sokol Blosser Winery - 11,670 SF

Achieving Net Zero

PAE's 6-Step Approach

Set Aggressive Goals

Analyze the Climate

Reduce Loads

Choose Efficient Systems

Opt for Renewables

Verify Performance

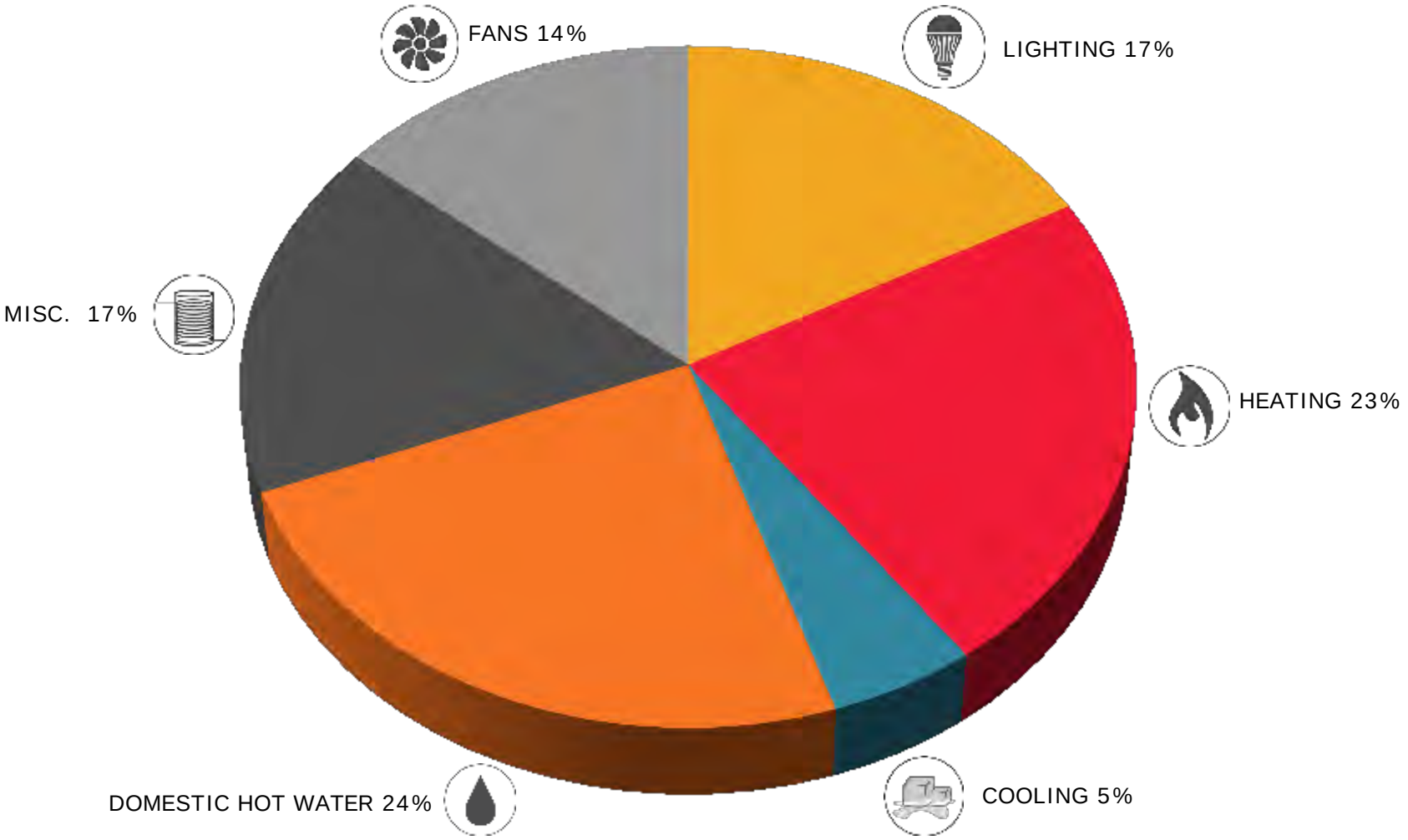
Set Aggressive Goals

LIVING
BUILDING
CHALLENGE™

MINERGIE-P®

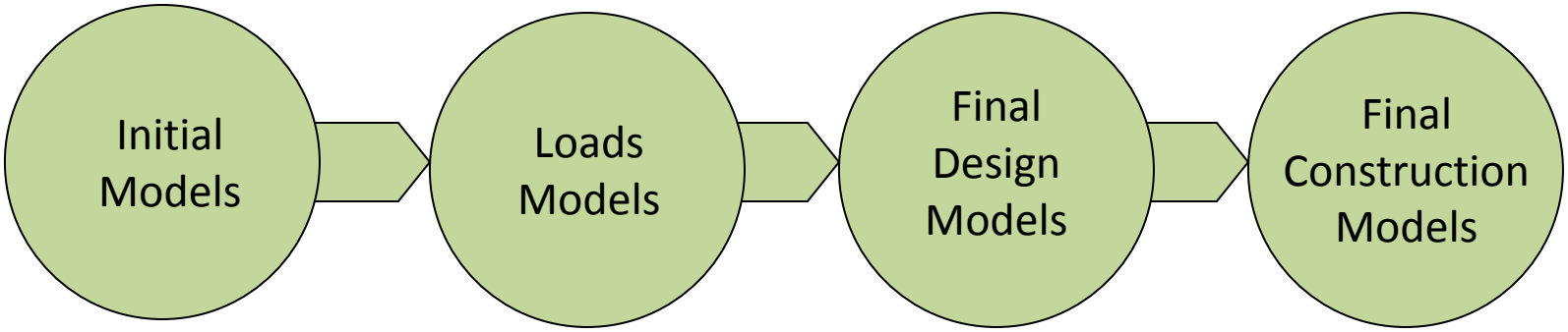
Analyze the Climate

Reduce Energy Use



Typical Commercial Building

Energy Modeling



Schematic Design:

Explore energy strategies (insulation, windows, mass, lighting, heat pumps)

Design Development:

Size Heat Pump (7.5 tons)

Construction Documents:

Minimum renewable energy system size (8.3 kW)

Review lighting system design (0.65 Watts/SF)

Construction and Occupancy:

LEED

External incentives

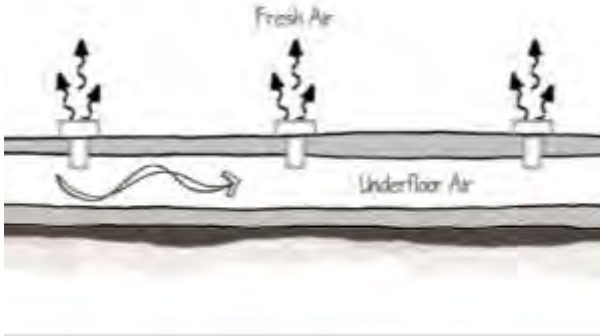
As-built

Energy Modeling

- Used to Develop and Test Design
- Evolved in Step with Design
- Used Sounding Board to Push for Design Revision as Needed
- Used to Understand the Heating and Cooling Loads
- Used to Iteratively Test Design Strategies that Reduce Loads to Validate Passive Design Solutions (insulation, mass, natural ventilation, daylighting)

Choose Efficient Systems

Radiant Floor



Underfloor Air

Natural Ventilation

Geothermal

Radiant Ceilings

VRF

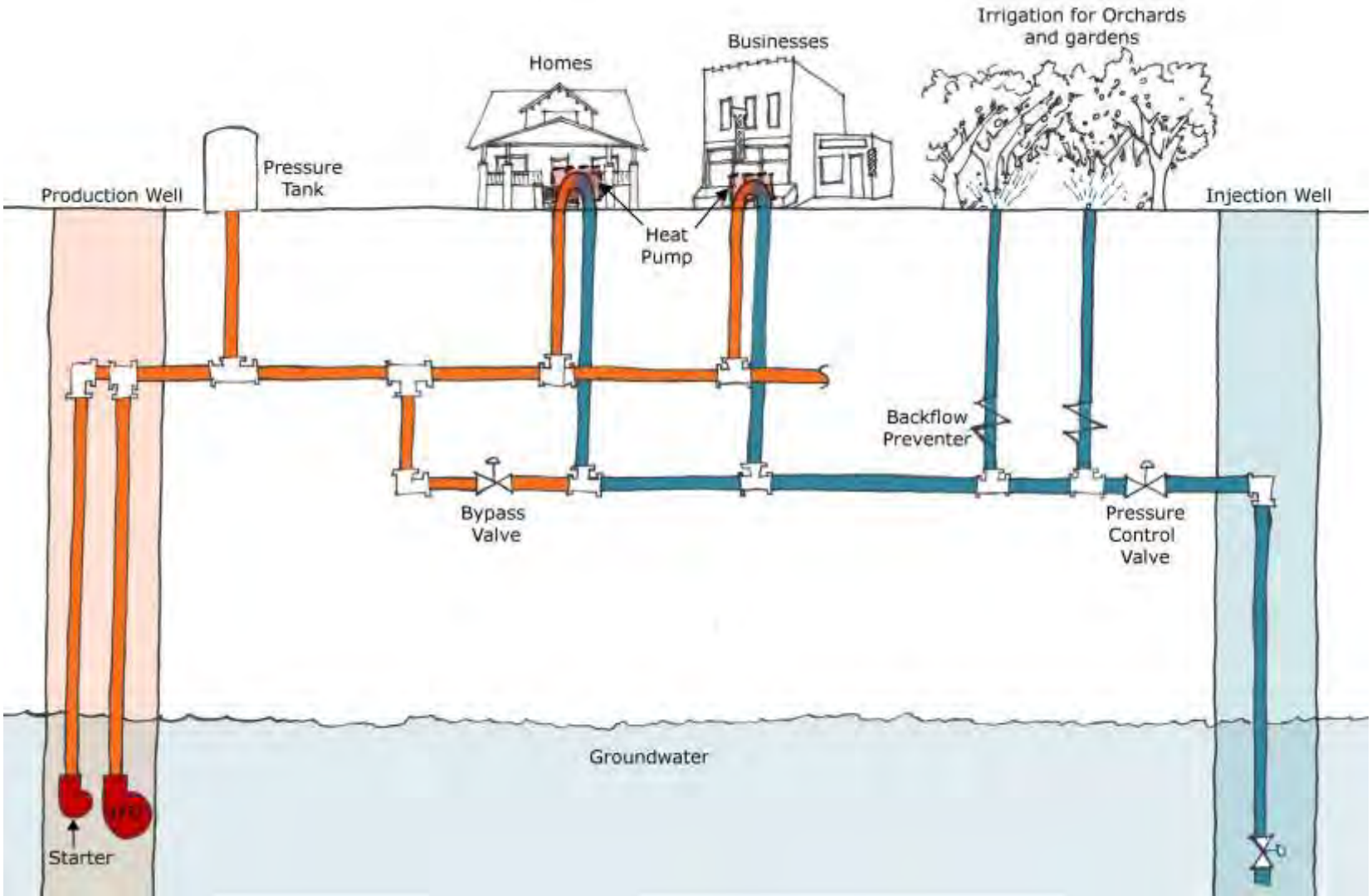
Choose Efficient Systems – Painters Hall

- Wall (R-19) and attic insulation (R-30)
- Air-tight Construction (0.02 cfm/sf)
- Window replacement (U-0.32)
- Ultra-efficient electric lighting (0.72 w/sf)
- Daylighting / occupancy sensors / reflective colors
- Passive ventilation and cooling
- Zonal supplemental heating (to support off-hour use)
- Point of use water heaters
- On-site Photovoltaic System (20.2 kW installed)
- Well-water coupled heat pumping (6-ton GSHP)

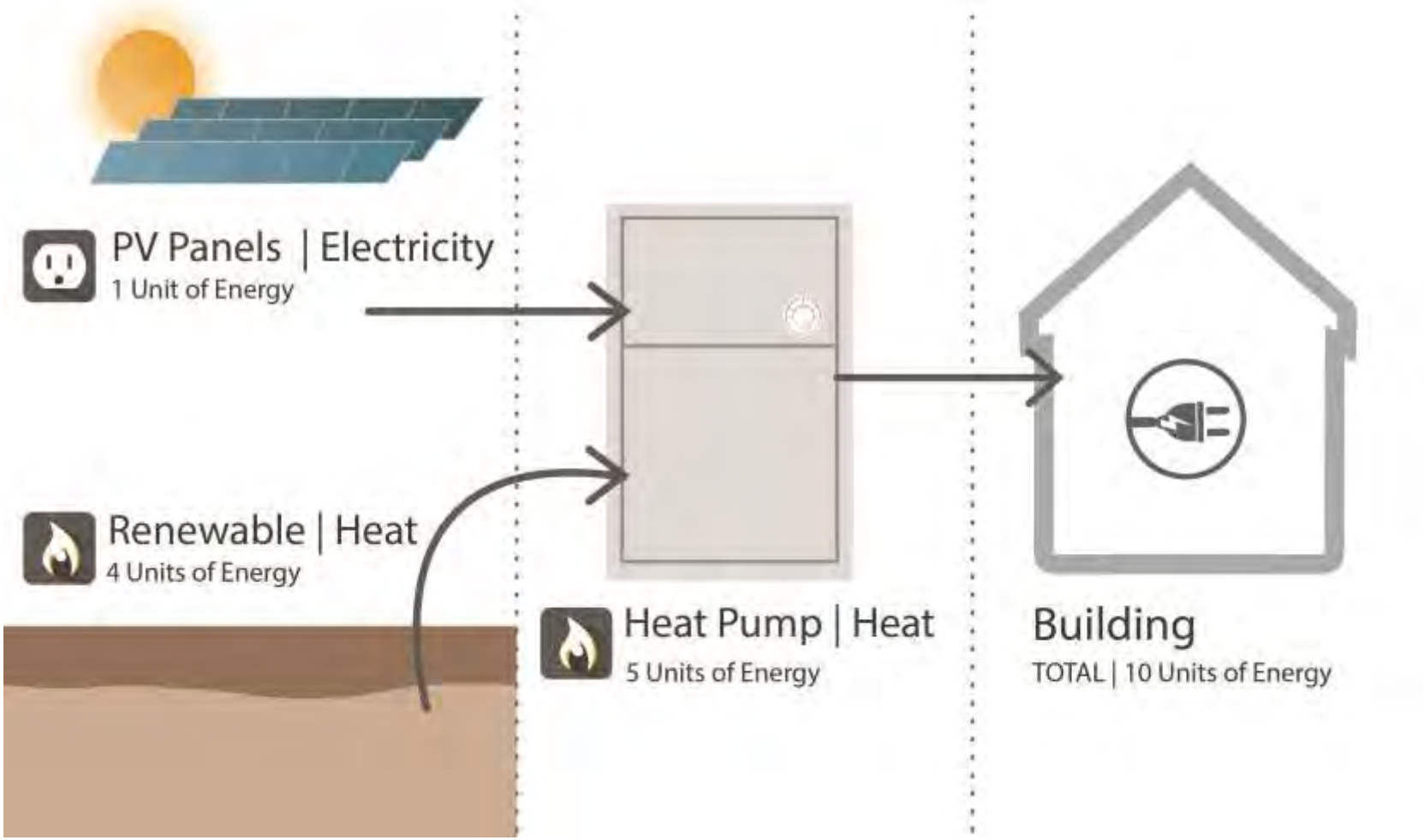
Painters Hall

District Geothermal Loop

Painters Hall – District Geo-Exchange System



Painters Hall – Harvester of Renewables



Opt for Renewable Energy

Renewables – Painters Hall PV

- System Capacity = 20.2 kW
- System cost: $210,901.
- Incentives: $163,669.
- Depreciation: $61,012.
- Value of kWh: $2,743/yr
- 4 Year Return
- Savings by 2014: $24,752
- Savings by 2030: $68,640

Roof Tilt: 26 degrees
Azimuth: 205 degrees
96 SANYO 210N panels

Renewables - Painters Hall Geothermal Loop

- Significant energy savings Painters Hall HVAC 3,219 kWh or $360 for year.
- Cost of infrastructure 90% lower, as a shared resource for neighborhood.
- Some homeowners seeing a $250 heating and air conditioning cost for the entire year.

Verify Performance

Testing &
Commissioning

Post-occupancy
Evaluation

Measurement &
Verification

Painters Hall – Actual Performance

PAINTERS HALL

Salem, OR

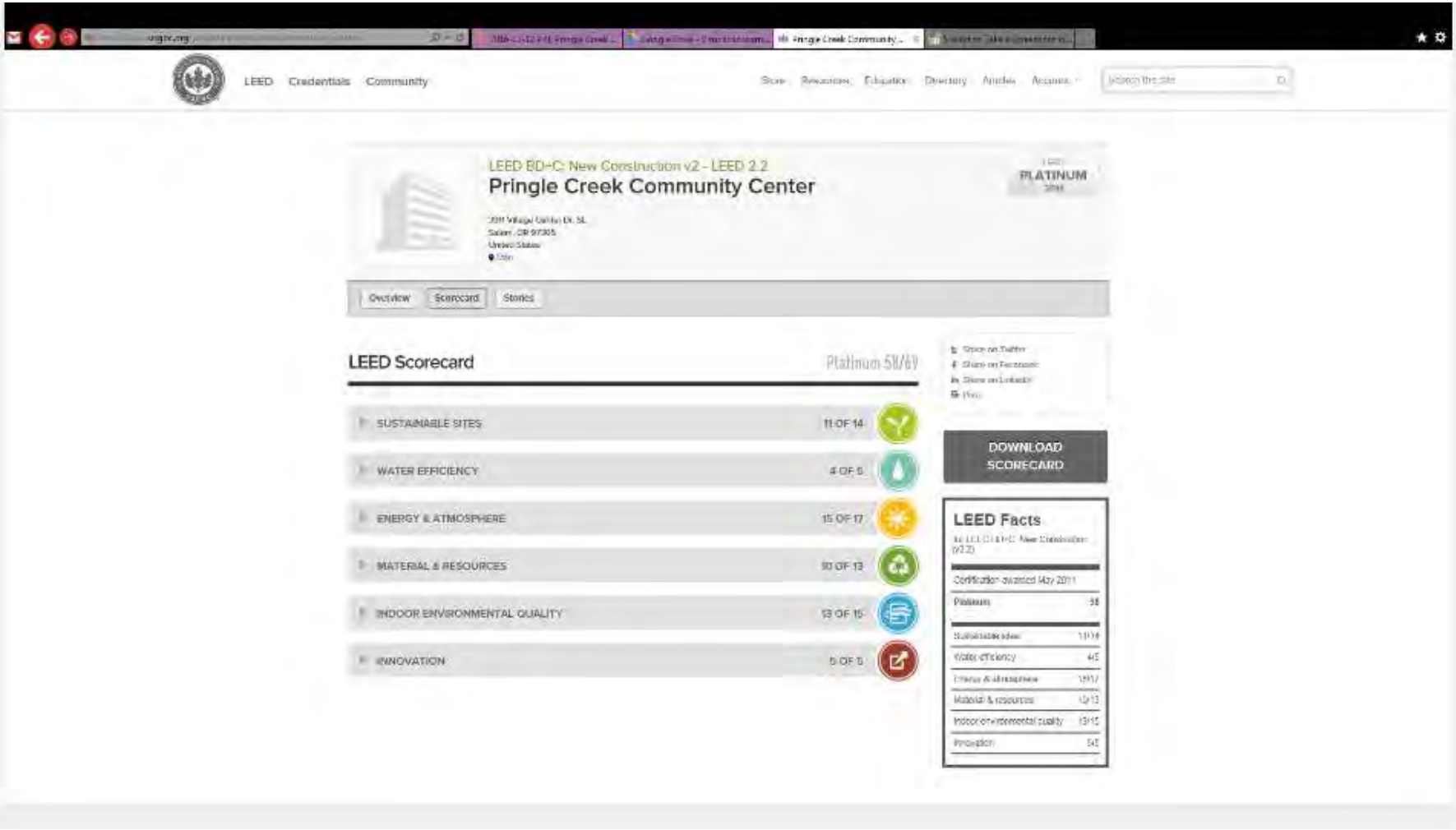
OVERVIEW

- PLACE
- ENERGY
- EQUITY
- BEAUTY

CERTIFIED PETAL

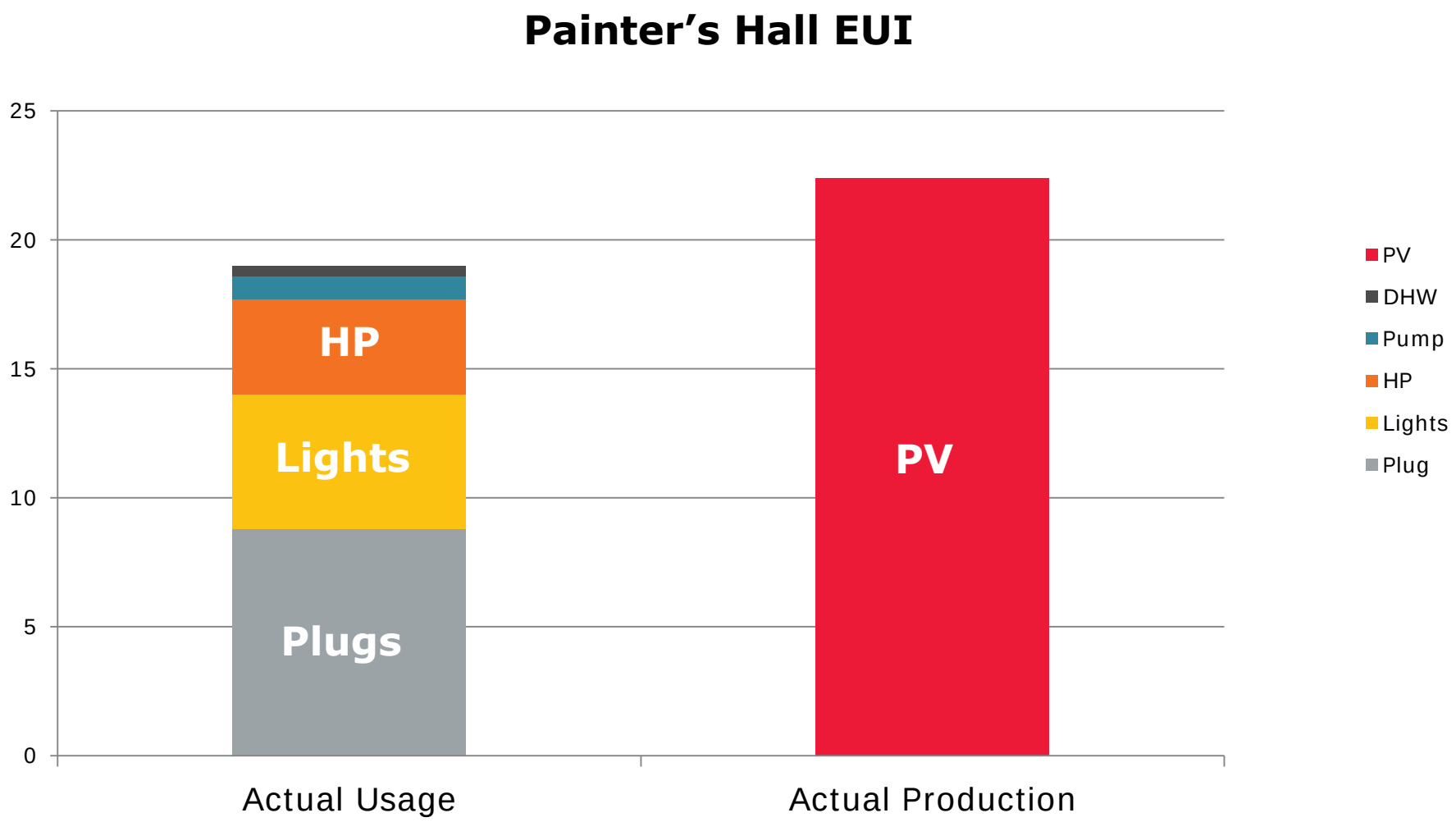
PAINTERS HALL

Painters Hall is Pringle Creek's Community Center, Café, Office, art gallery, and event venue. Originally built in the 1930's, Painters Hall was renovated to LEED Platinum Net Zero Energy Building standards in 2010, demonstrating the potential of converting existing building stock into high-performance, sustainable building sites. Painters Hall features simple low-cost solutions for energy reduction, such as natural daylighting and passive cooling lighting, that save money and increase comfort. A district ground-source geothermal loop serves the building's GSHP for highly efficient heating and air conditioning. Excess generation from the 20.2 kW rooftop solar array offsets pumping for the neighborhoods geo loop system. Key pieces of furniture were fashioned out of heavy timbers and slabs from trees milled onsite. Materials collected from deconstructed buildings onsite were incorporated into the renovation of Painters Hall, and the building's Zero Waste Initiative significantly reduces garbage produced by events and activities. Open to the public,


LEED
Credentials
Community
LEED BD+C: New Construction v2 - LEED 2.2
Pringle Creek Community Center
PLATINUM
Overview
Scorecard
Stories
LEED Scorecard
Platinum 58/69
SUSTAINABLE SITES
11 OF 14
WATER EFFICIENCY
4 OF 5
ENERGY & ATMOSPHERE
15 OF 17
MATERIAL & RESOURCES
10 OF 13
INDOOR ENVIRONMENTAL QUALITY
13 OF 15
INNOVATION
5 OF 5
DOWNLOAD SCORECARD
LEED Facts
Certification awarded May 2011
Platinum
58

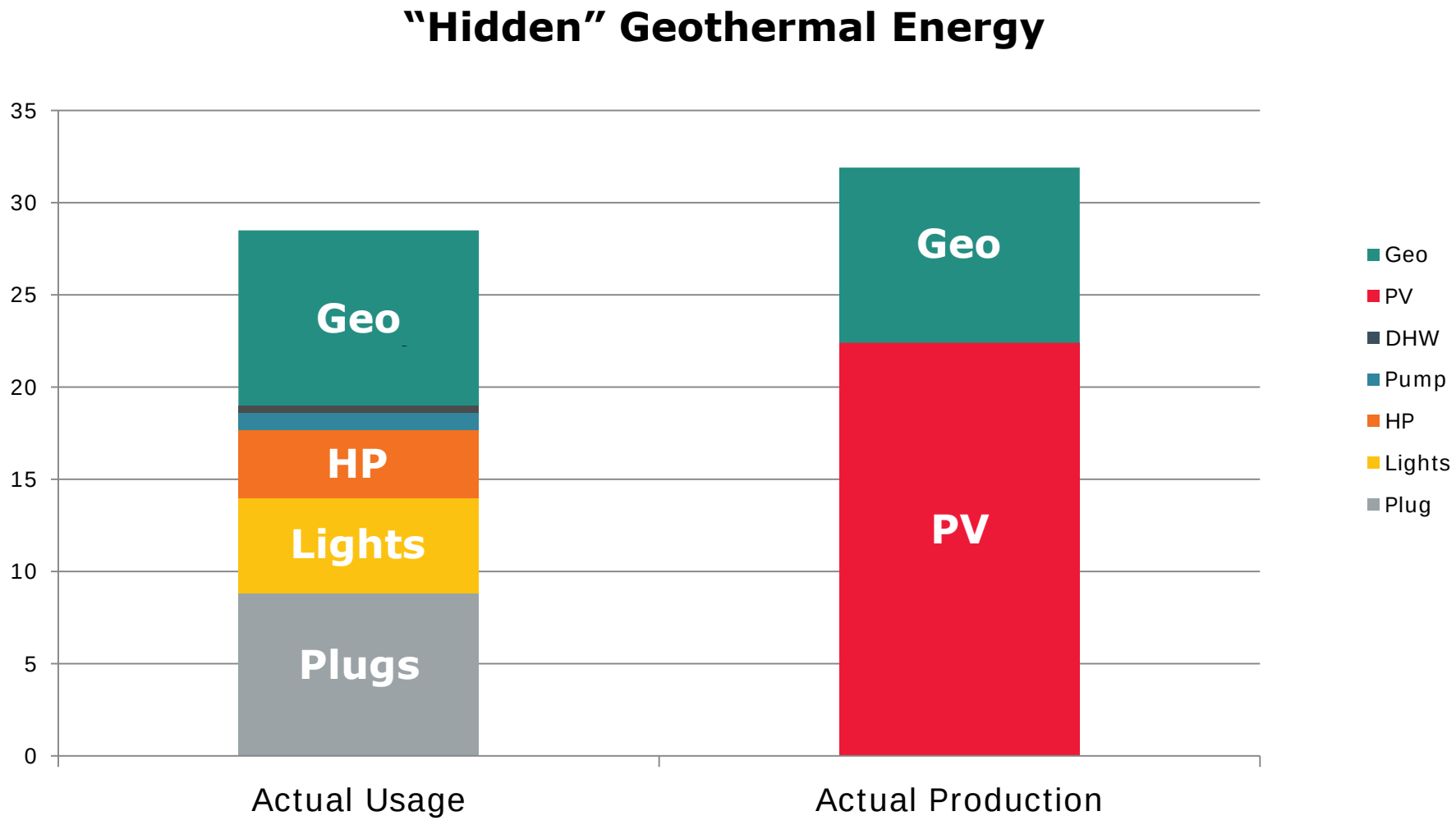
Painters Hall

Actual Performance



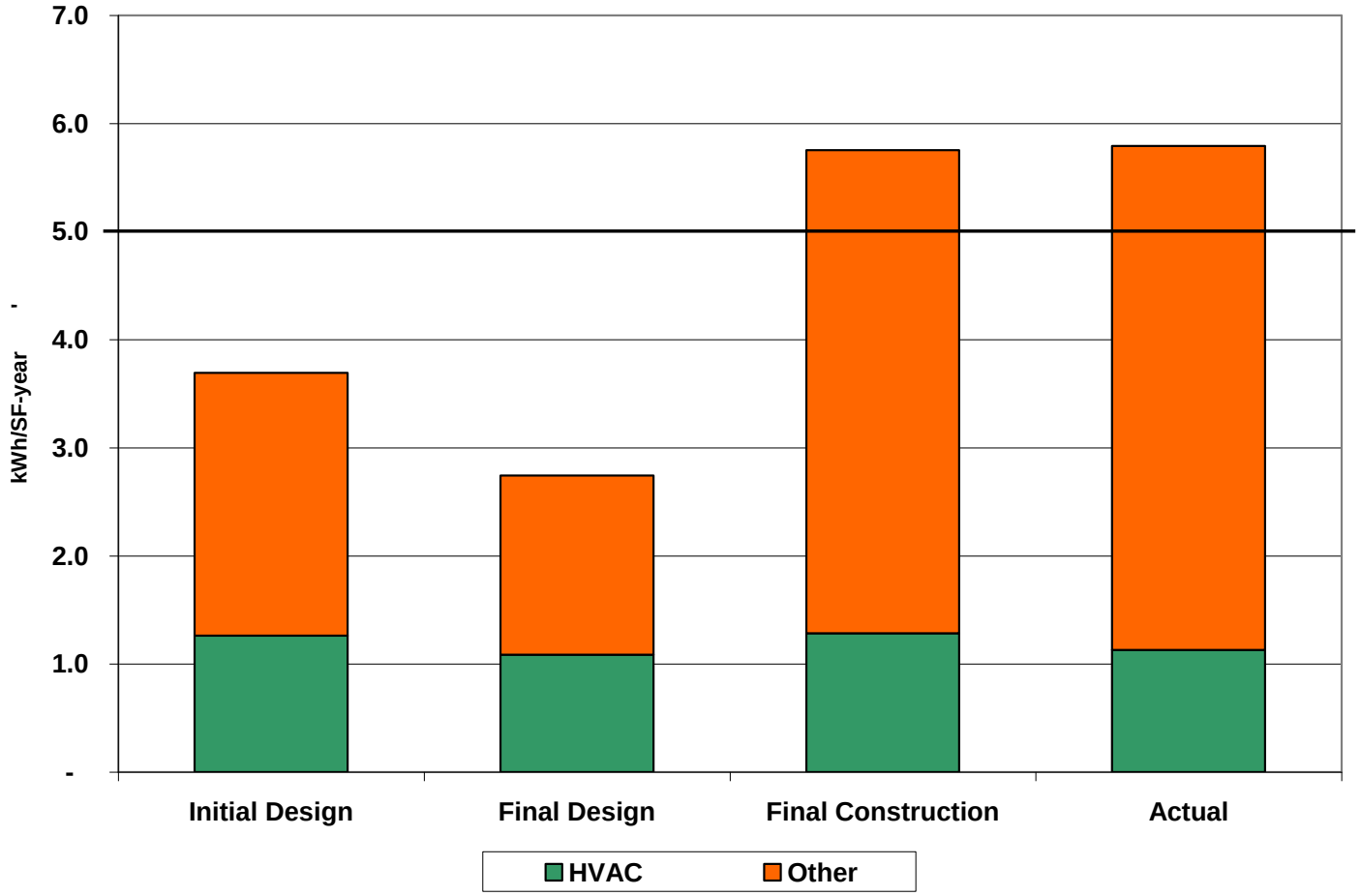
Painters Hall

Actual Performance



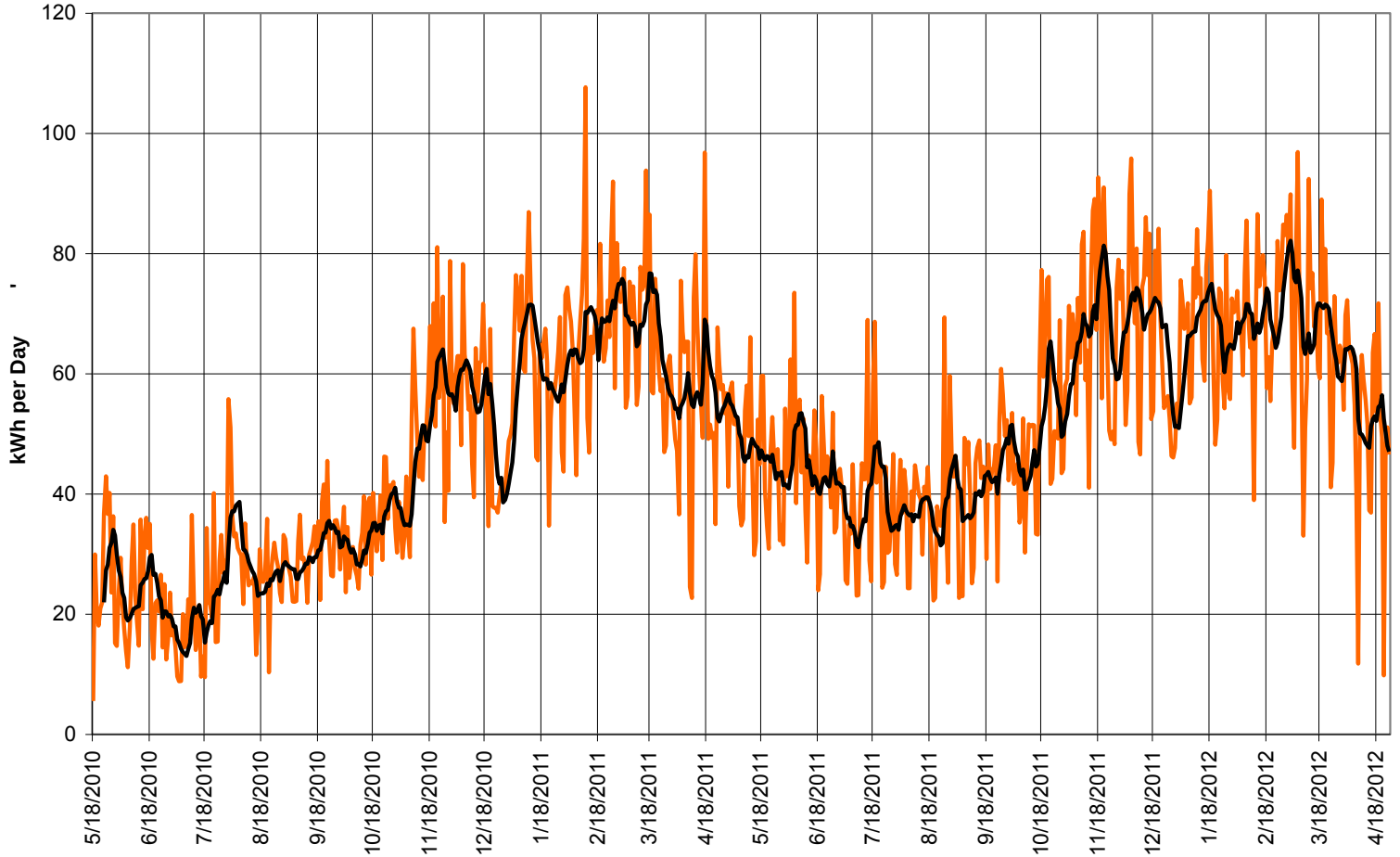
Painters Hall

Modeled vs. Actual Energy Use



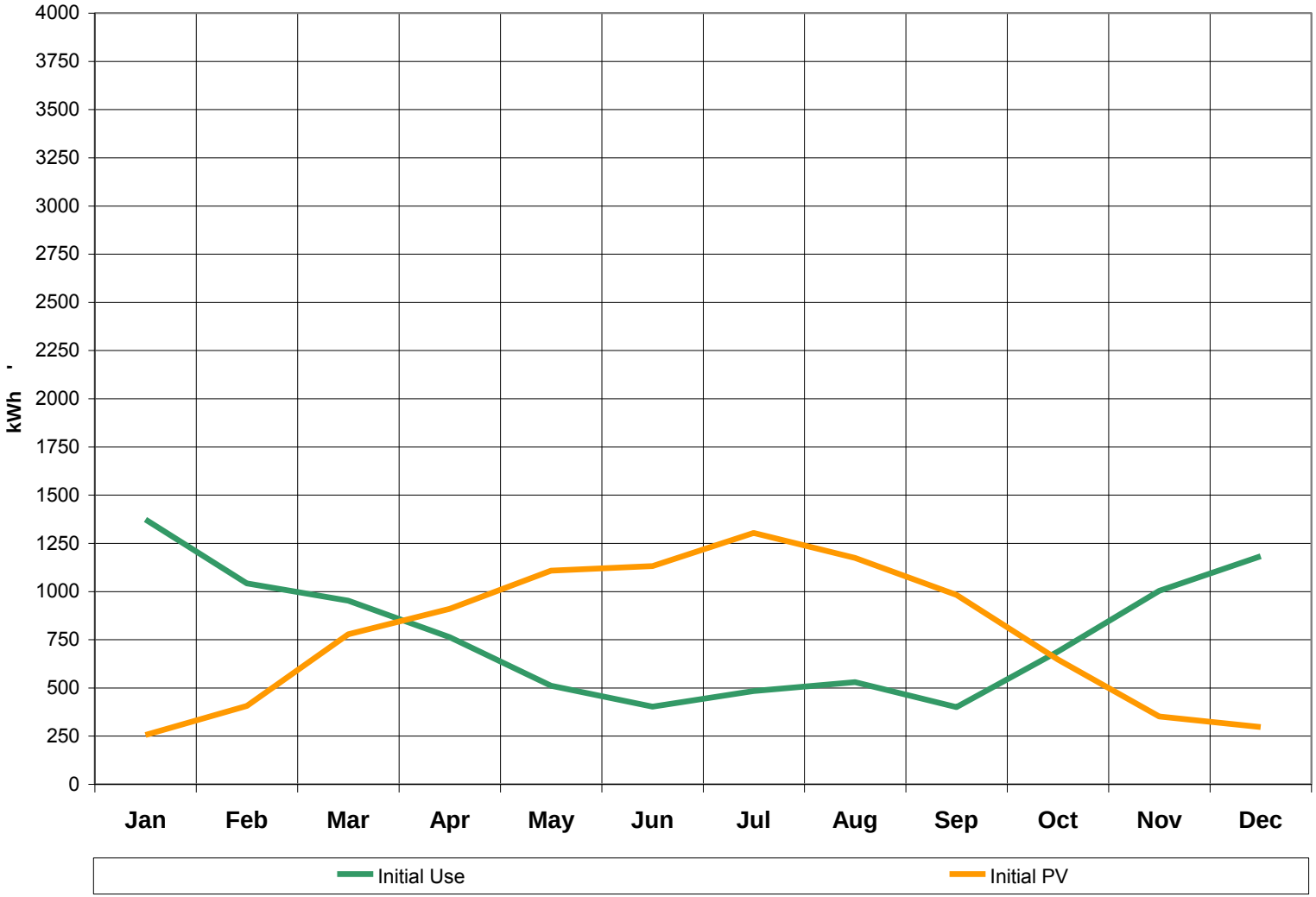
Painters Hall

Building Energy Use (May 2010 – April 2012



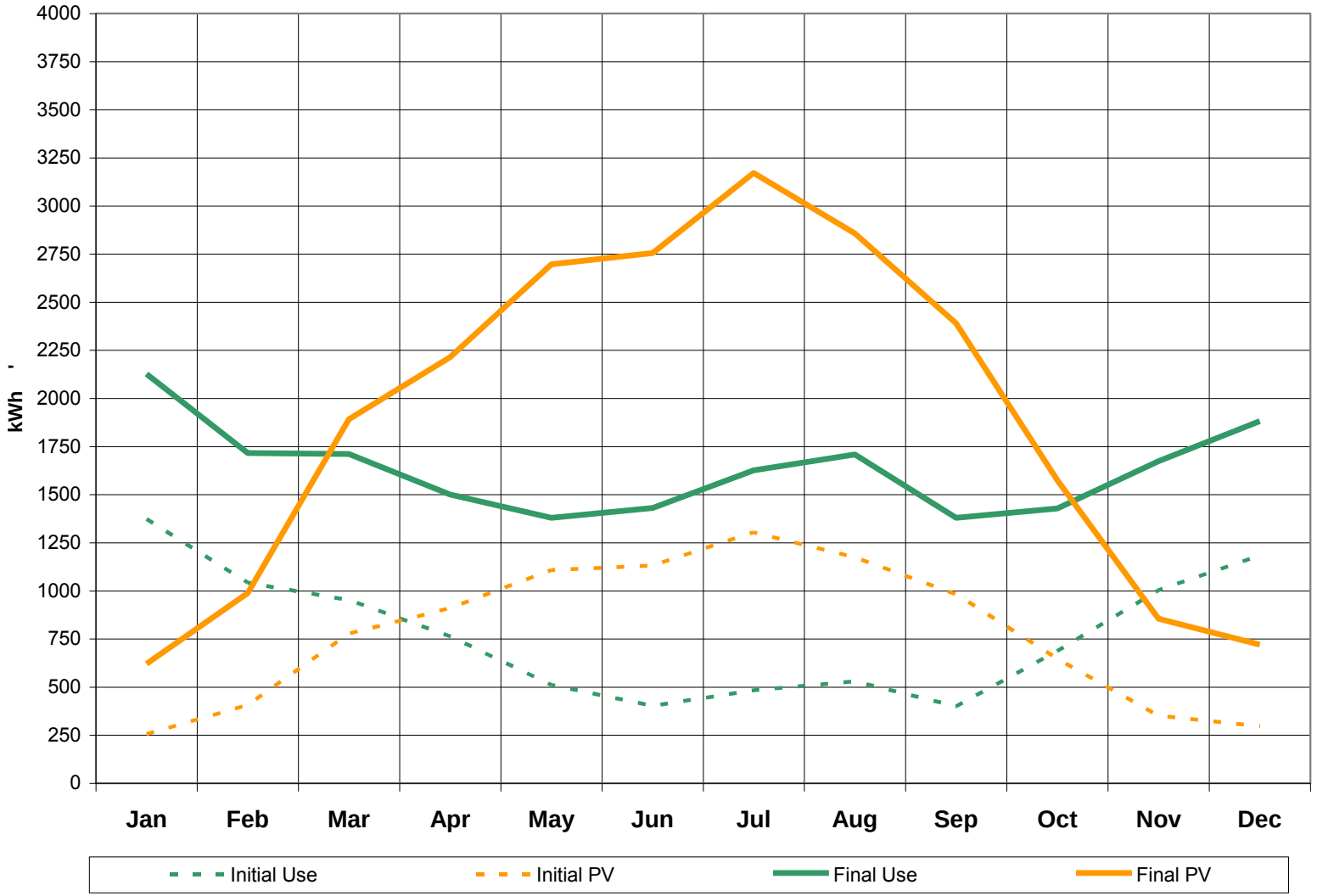
Painters Hall

Initial Models



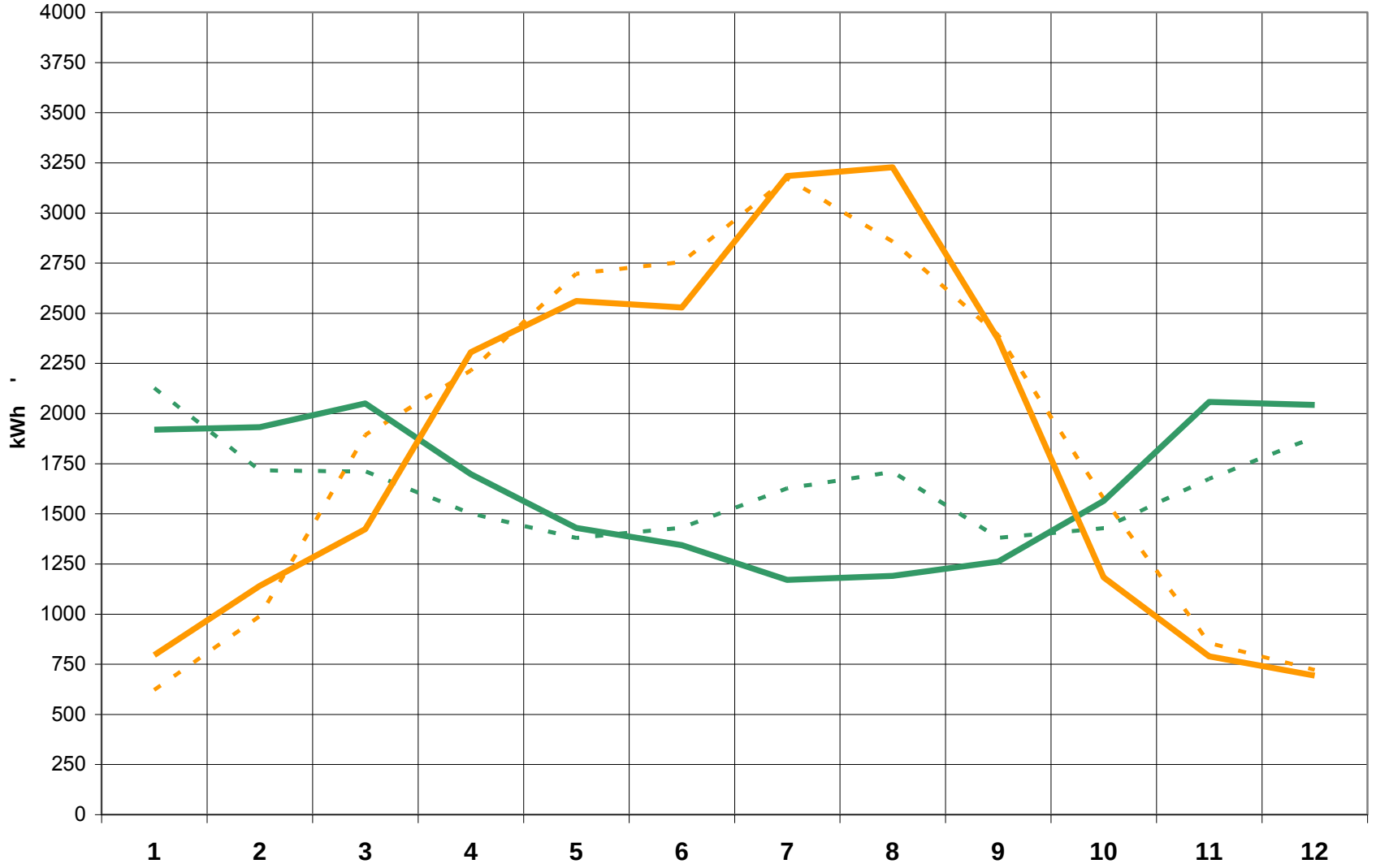
Painters Hall

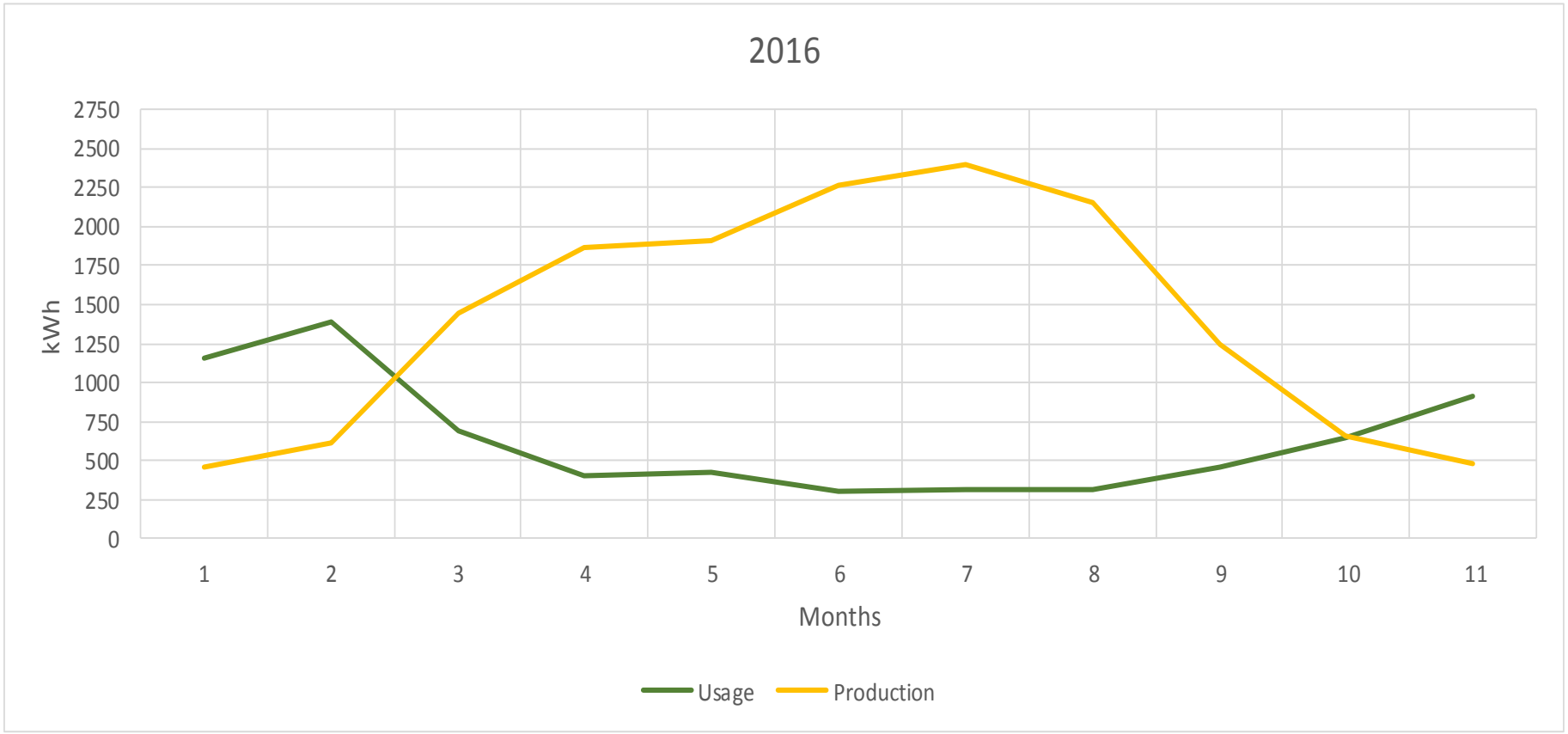
Initial vs. Final Models



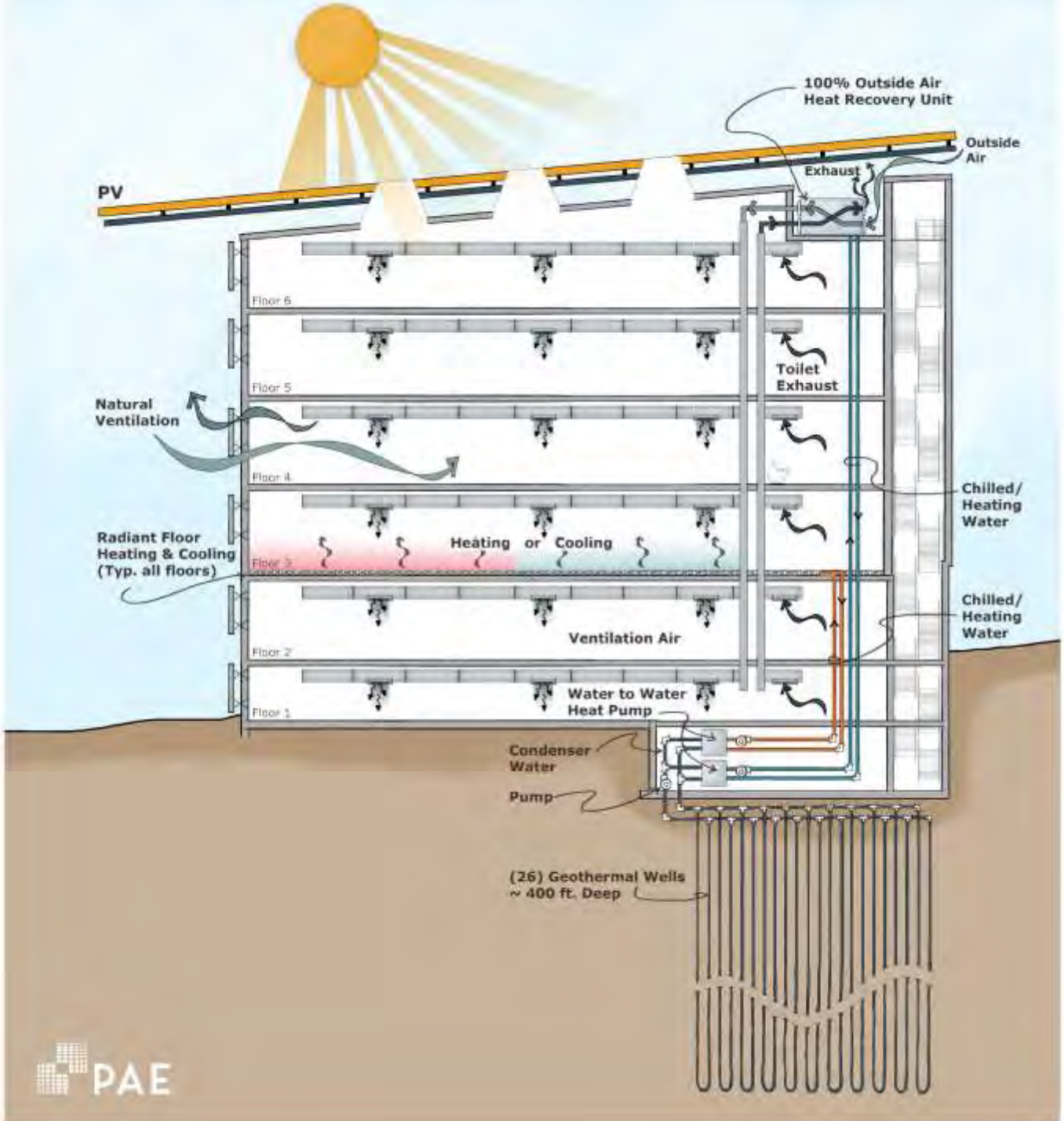
Painters Hall

Final Model vs. Actual



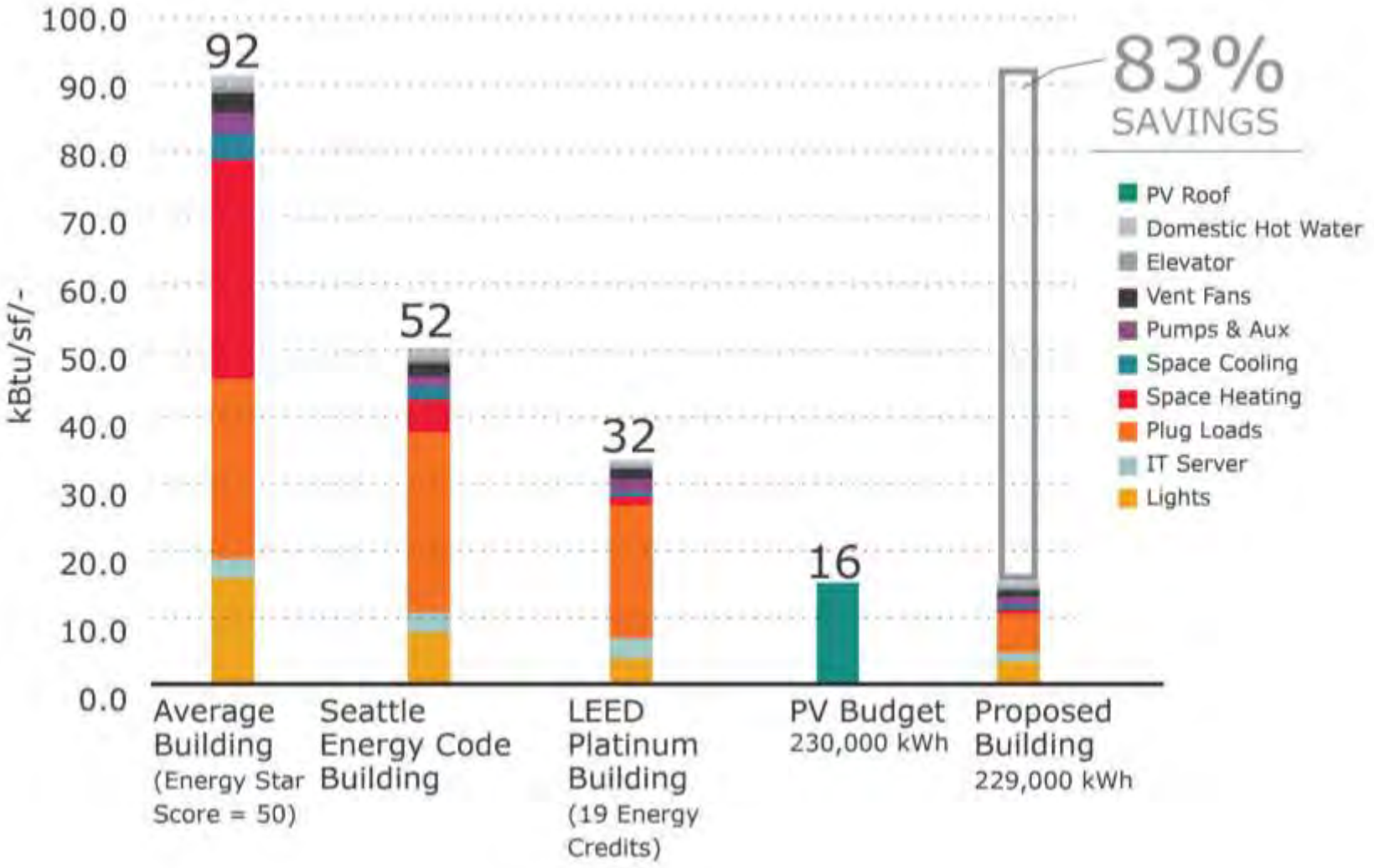

2016
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
kWh
1
2
3
4
5
6
7
8
9
10
11
Months
Usage
Production

Case Study:
The Bullitt Center


100% Outside Air
Heat Recovery Unit
Outside
Air
Exhaust
PV
Floor 6
Floor 5
Toilet
Exhaust
Natural
Ventilation
Floor 4
Chilled/
Heating
Water
Radiant Floor
Heating & Cooling
(Typ. all floors)
Heating
or
Cooling
Floor 3
Chilled/
Heating
Water
Ventilation Air
Floor 2
Water to Water
Heat Pump
Floor 1
Condenser
Water
Pump
(26) Geothermal Wells
~ 400 ft. Deep
PAE

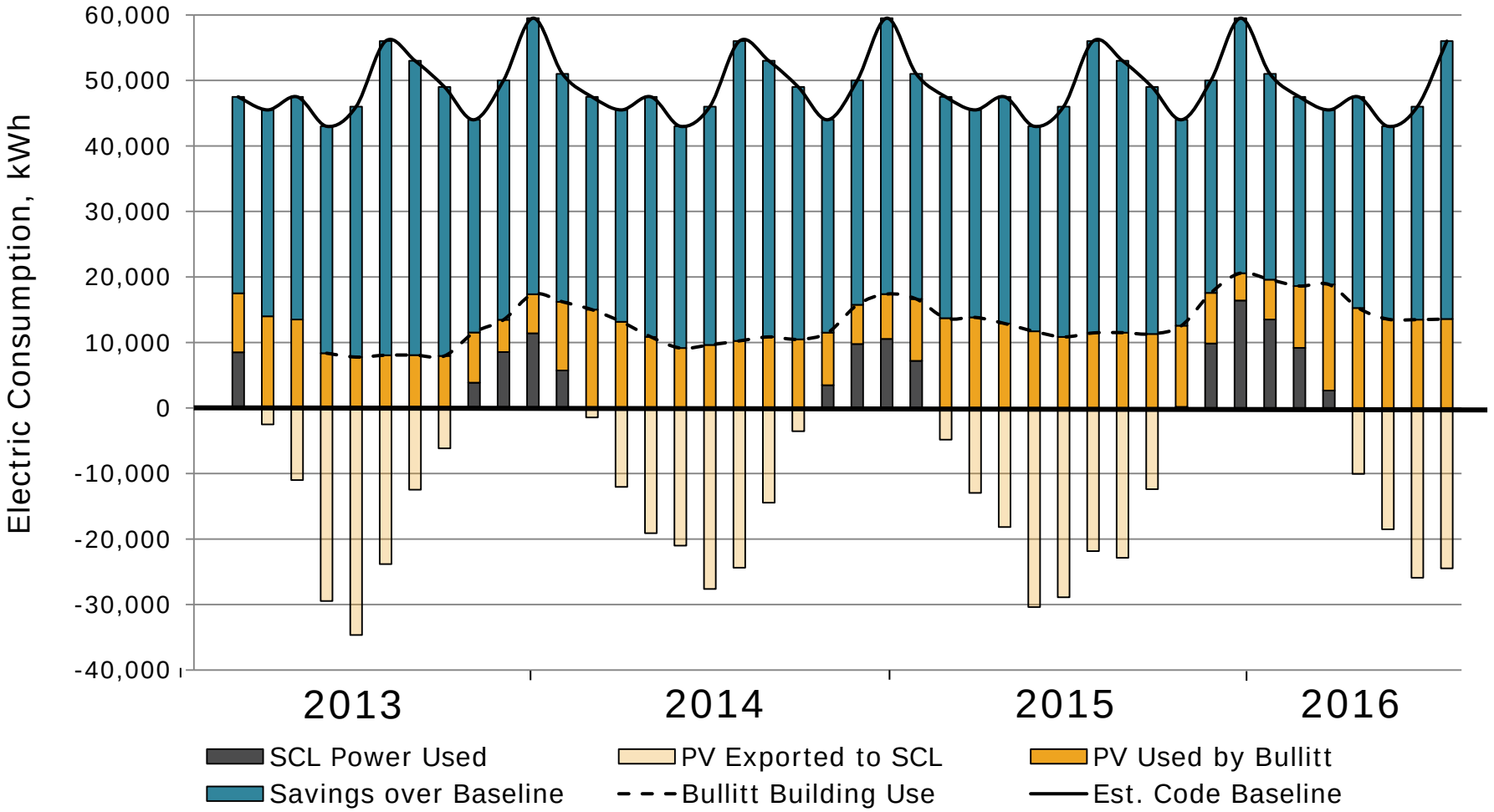
Net Zero Energy in Seattle

Energy Use + Solar Budget



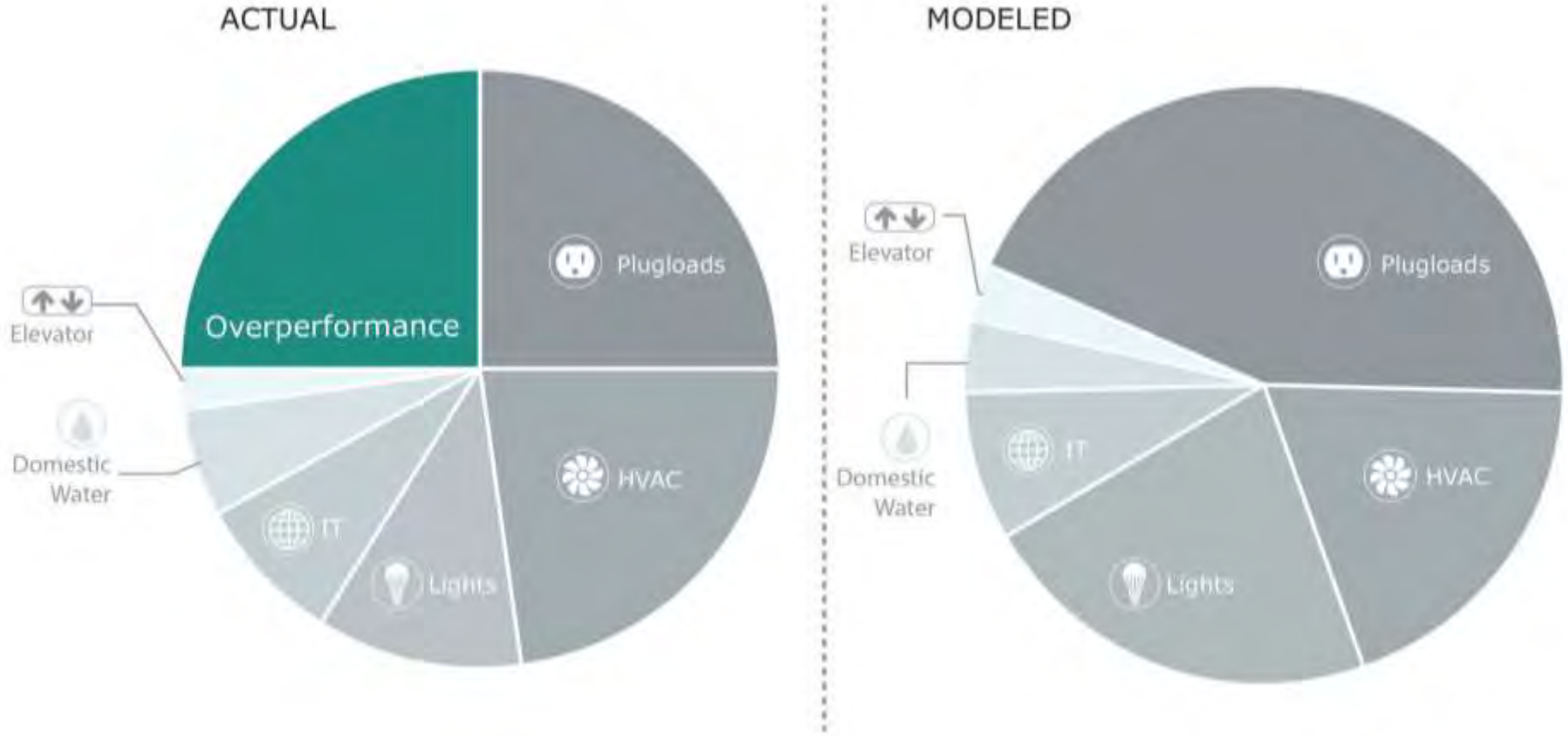
Bullitt Center Performance

Predicted vs. Actual



Bullitt Center Performance

Modeled and Actual



Painters Hall
Post-Occupancy

Value of Existing Building

Renovation Cost (3200 sf)

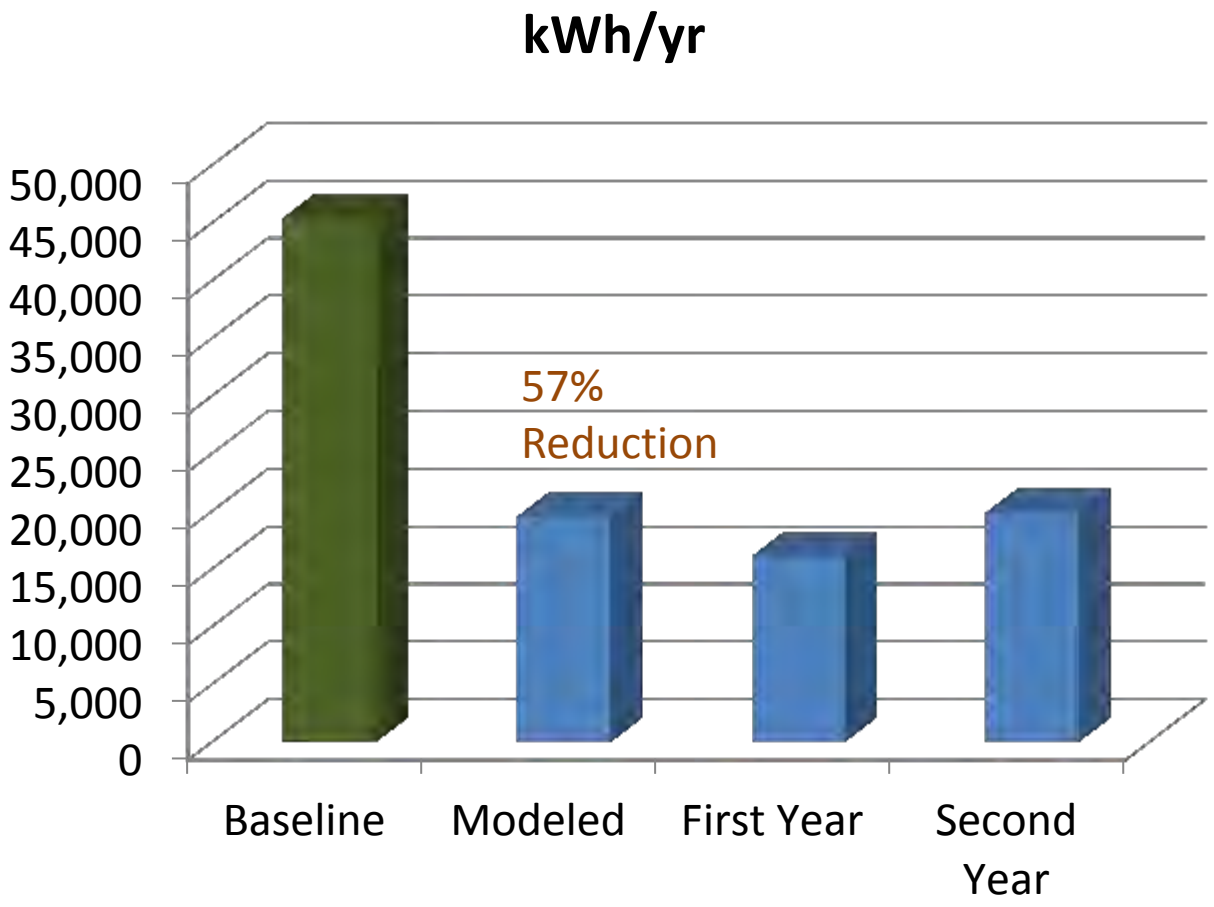
Time, materials, labor, FF&E:	$404,485
Design, engineering, LEED, NZEB:	$39,922
Site, landscaping, concrete, paint:	$7,617

Total: $485,288 ($151psf)

+ Land 0.32 acre: $111,140

Grand TOTAL: $596,428 ($186 psf)

Operational Cost



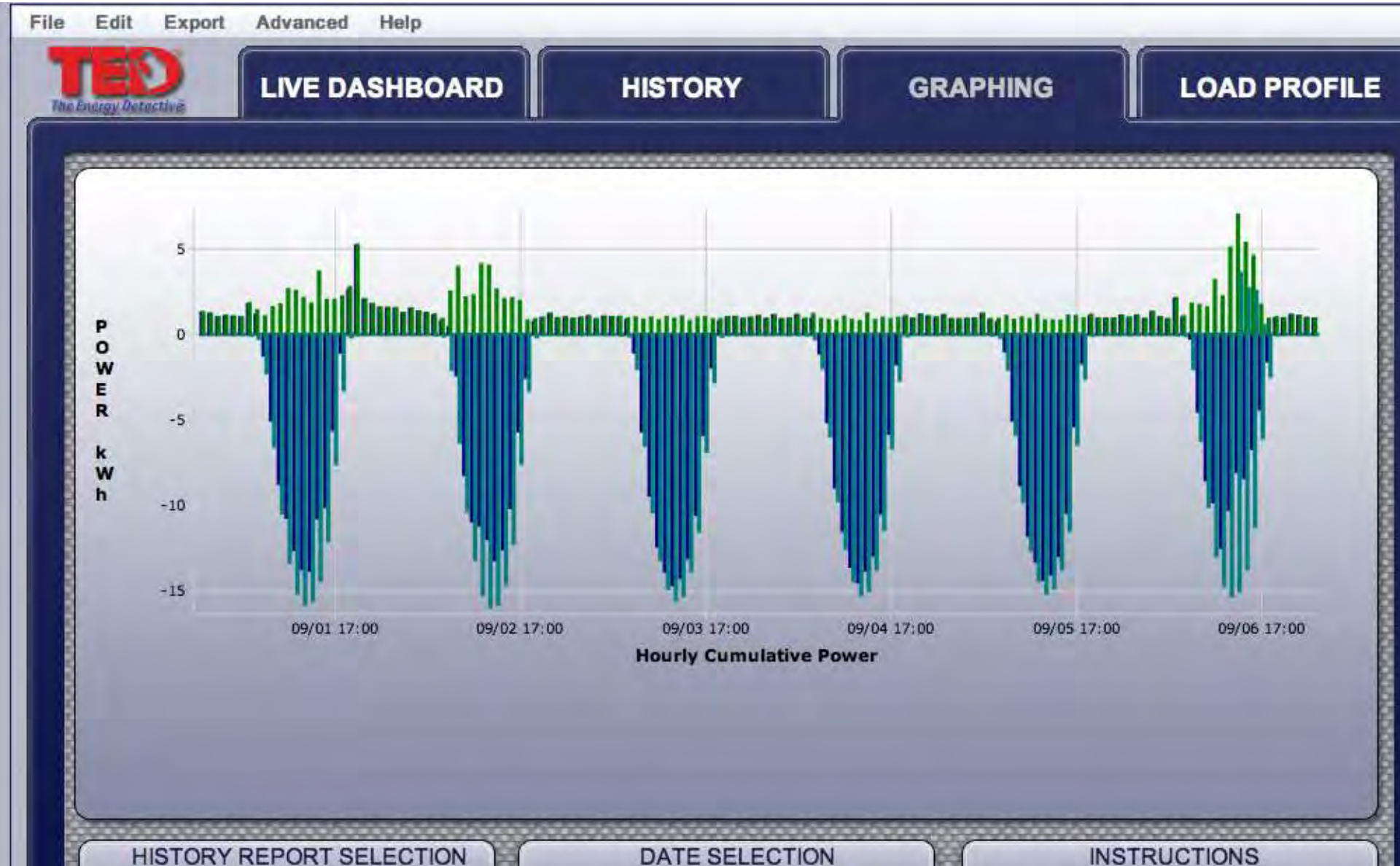
Cost: $2,385 per year

Savings of around $3,064 per year or 56% reduction

OPERATIONAL COSTS

- Baseline: 60,578 kWh/yr
- Projected: 19,565 kWh
  - 68% reduction from baseline.
- Actual: 15,292 kWh
  - 22% further reduction.
- Overall energy use reduction: 75%
- Annual energy savings: around $5,434 per year.

Typical Week: Blue is our “net”

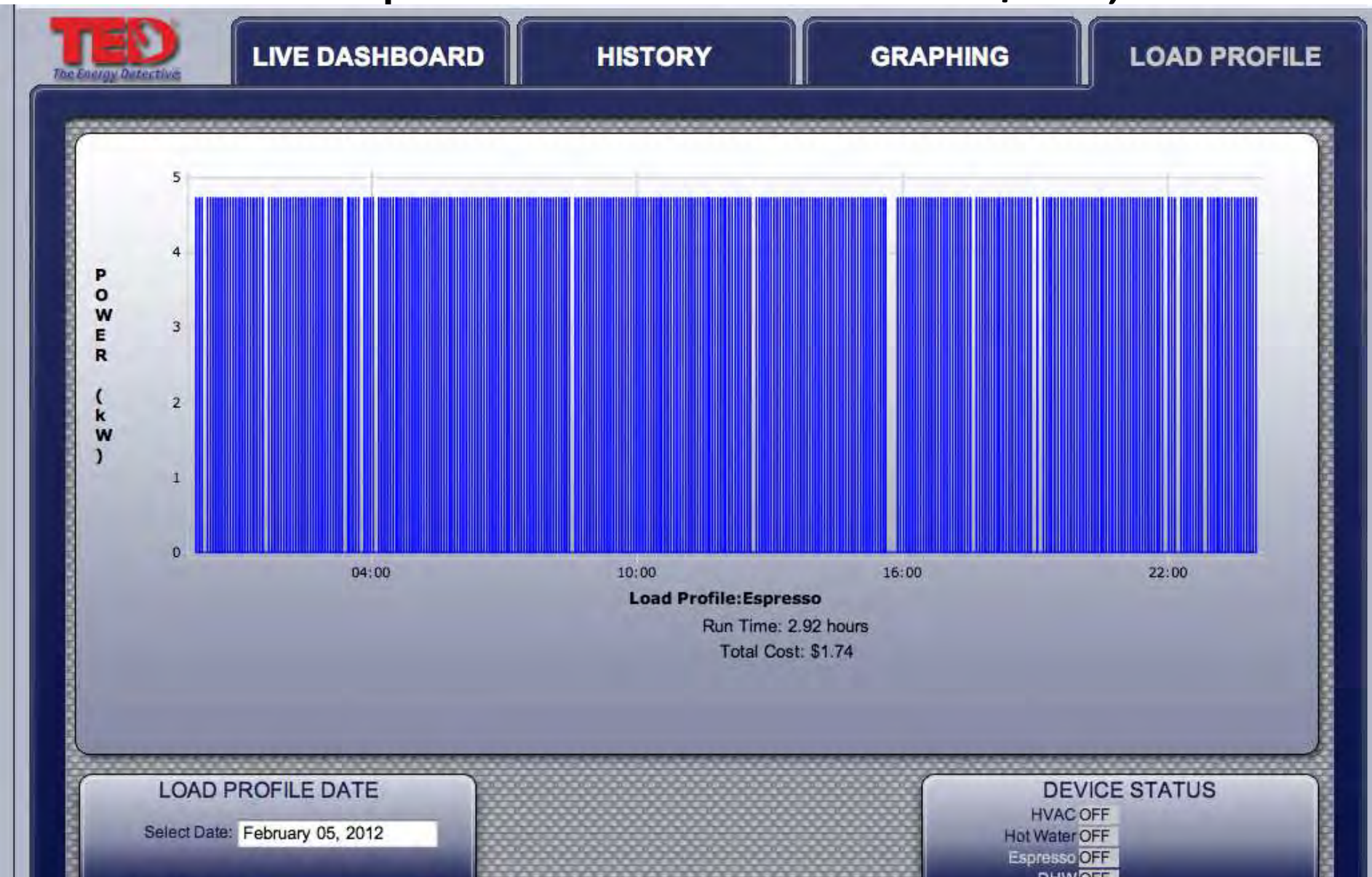


Typical Morning & Early Afternoon

Typical Morning & Early Afternoon


LaSanMarco

5,293 kWh per year! 25% of total building consumption. 24 PV Panels – $35,000



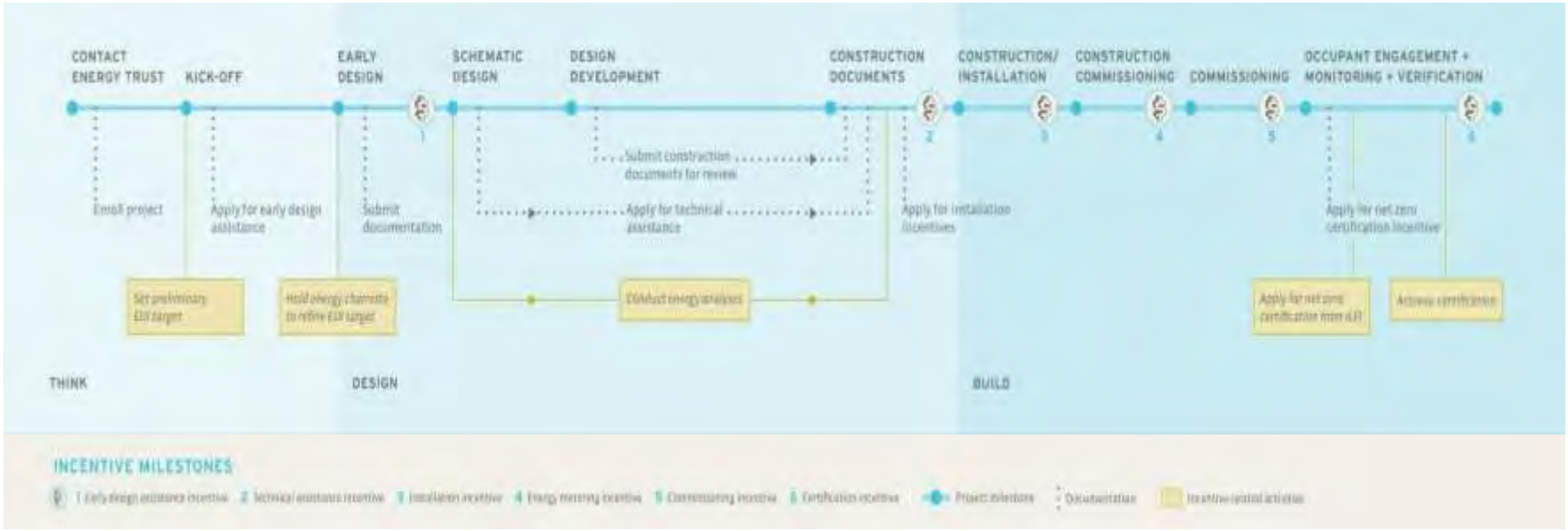
Equity Imperative 16: Human Scale + Human Places

www.pringlecreek.com

Energy Trust, New Buildings Path to Net Zero Incentives

It all adds up to zero

- Increased incentives for early design, technical assistance, installation and post-occupancy
- Technical resources and assistance from kick-off through occupancy
- Incentives for net-zero certification



Path to Net Zero

- Increased incentives for early design, technical assistance, installation and post-occupancy
- Technical resources and assistance from start to finish
- Incentives for net-zero certification

Chemeketa Applied Technology Building

Path to Net Zero high-efficiency academic building, featuring:

- High efficiency hot water heating
- Improved building envelope
- Daylighting with lower light levels
- Heat recovery
- Natural ventilation

Energy Trust incentives: $78,400

Estimated annual savings:
133,829 kWh and 7,253 therms

Estimated utility cost savings:
$16,500/year

Solar Resources for Public Buildings

Solar Trade Allies

- Provide expertise in solar technology
- Complete incentive paperwork

Cash Incentives

- Solar Feasibility—Up to $1,700
- Solar Installation—Up to $150,000

Questions?