



ARCH | NEXUS

Net Zero Energy:
From Theory to Reality

INSPIRATION
STEWARDSHIP
REGENERATION

NET ZERO ENERGY DEFINITION

- Department of Energy

Combustion Allowed
Source Energy

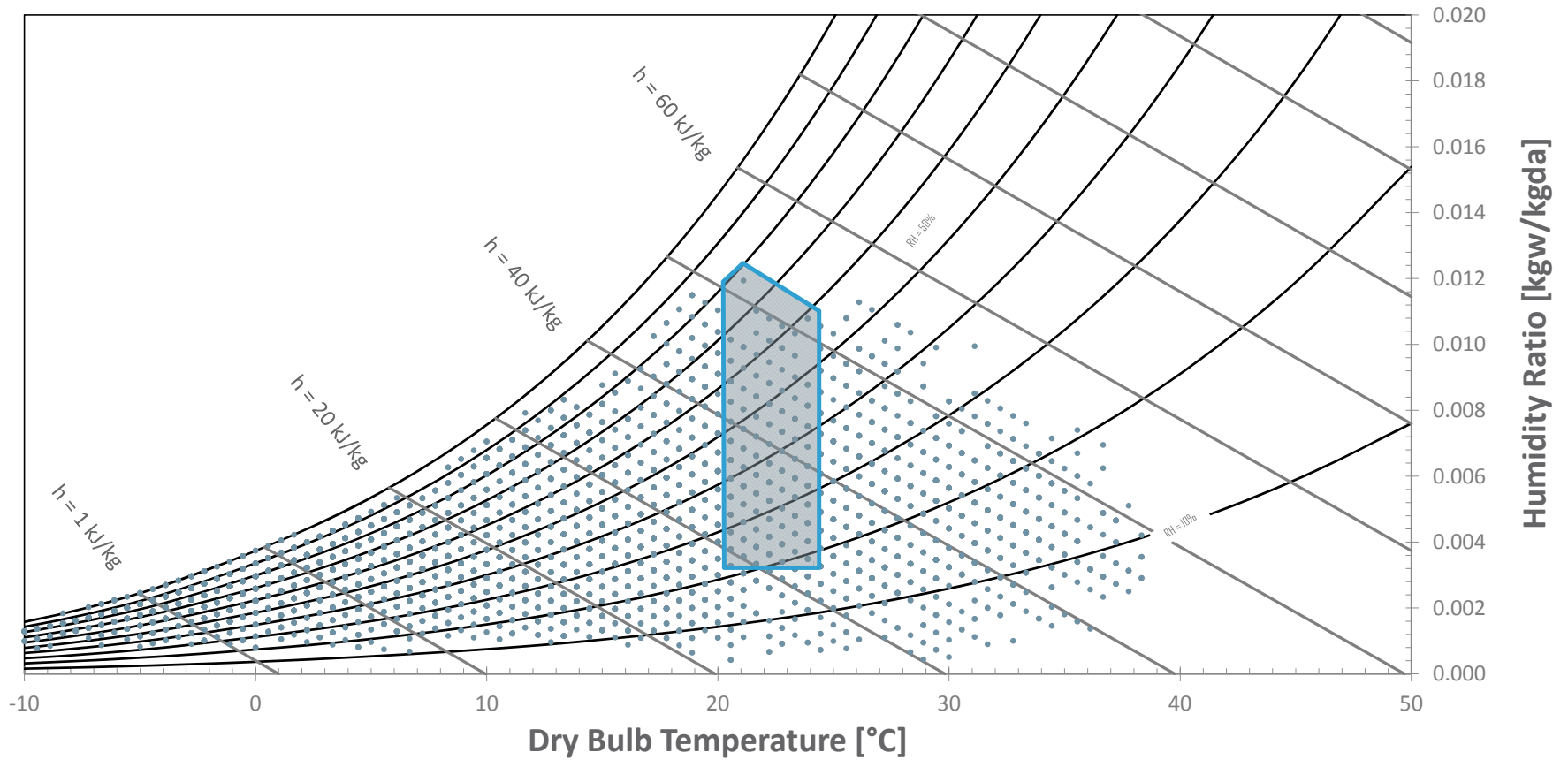
- ILFI

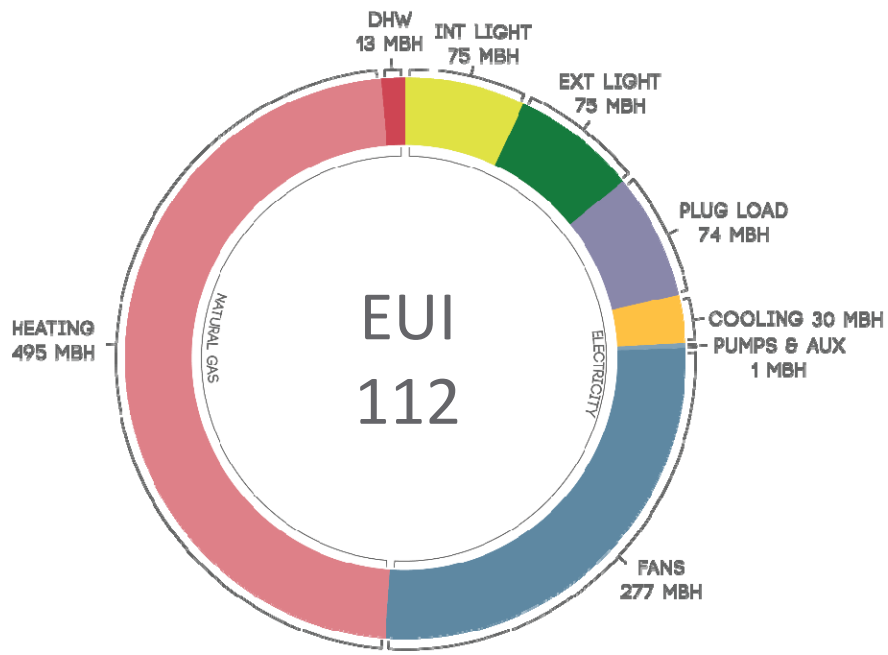
Combustion for cooking only
Site Energy



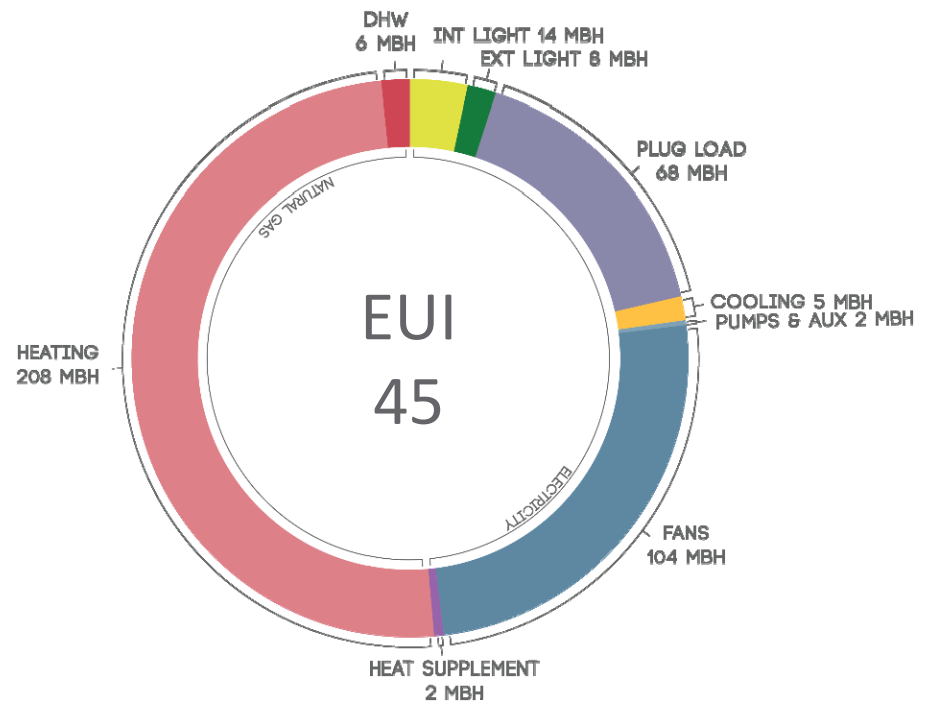
BOR PLEASANT GROVE

CLIMATE





Baseline



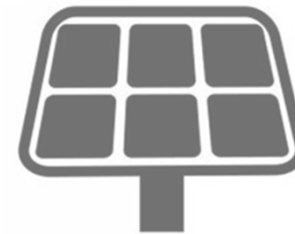
NZEB

SOURCE ENERGY CONVERSION FACTOR

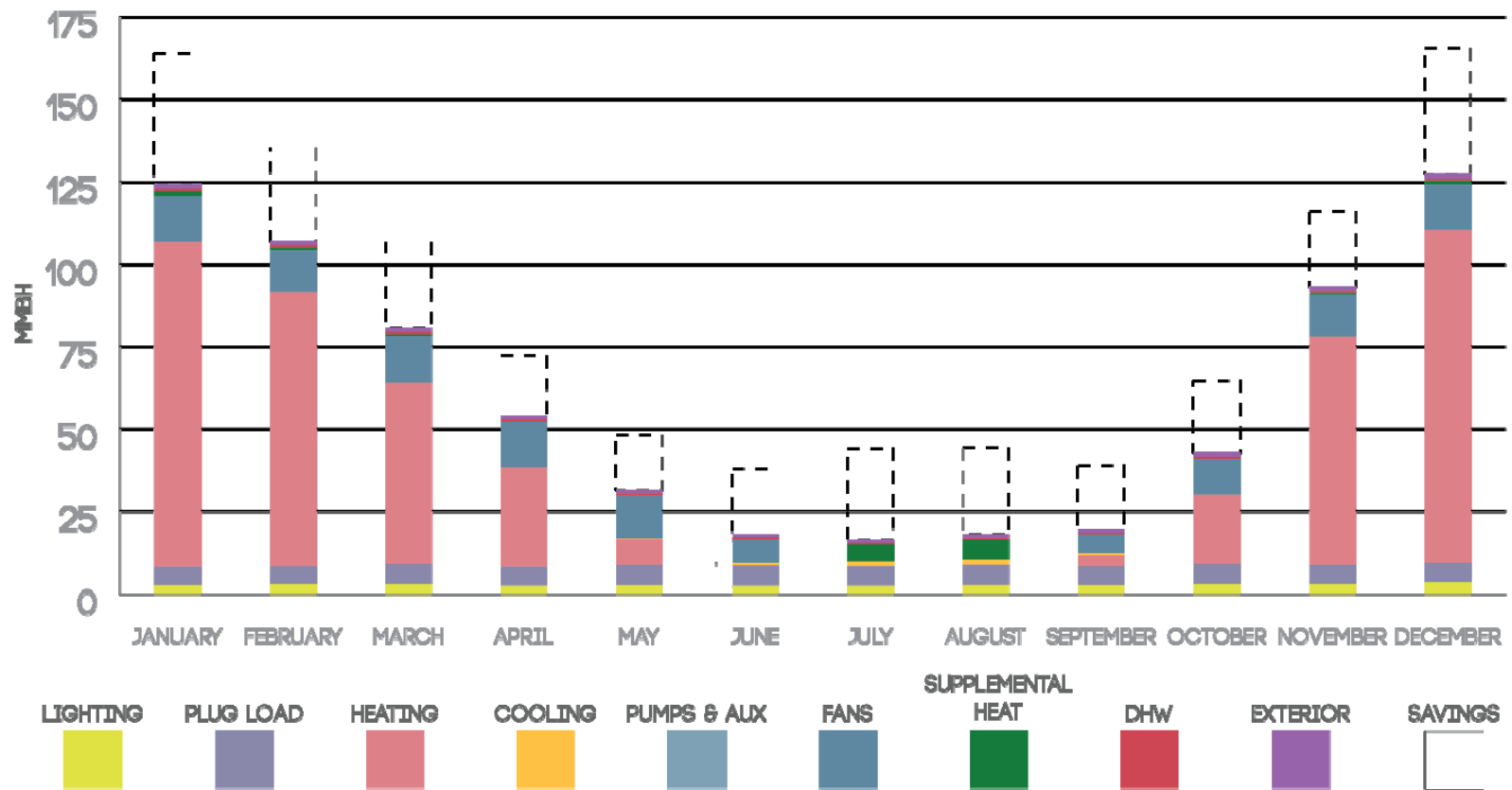
Gas
1.09

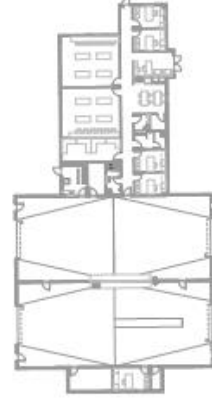
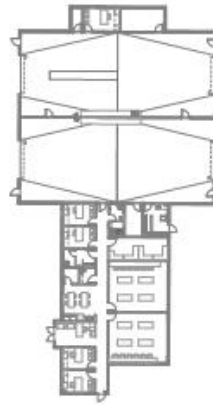
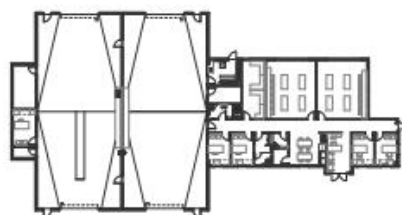
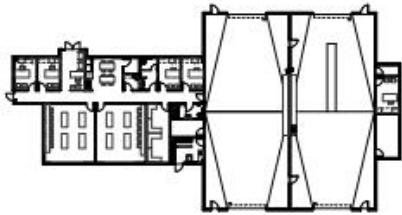
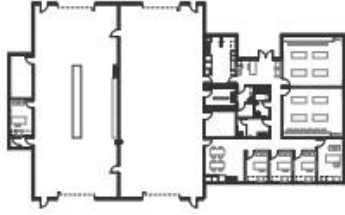
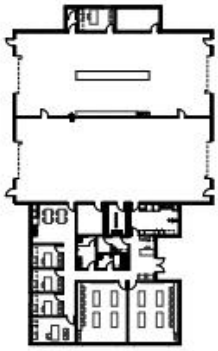


Electric
3.15



A Common Definition for Zero Energy Buildings

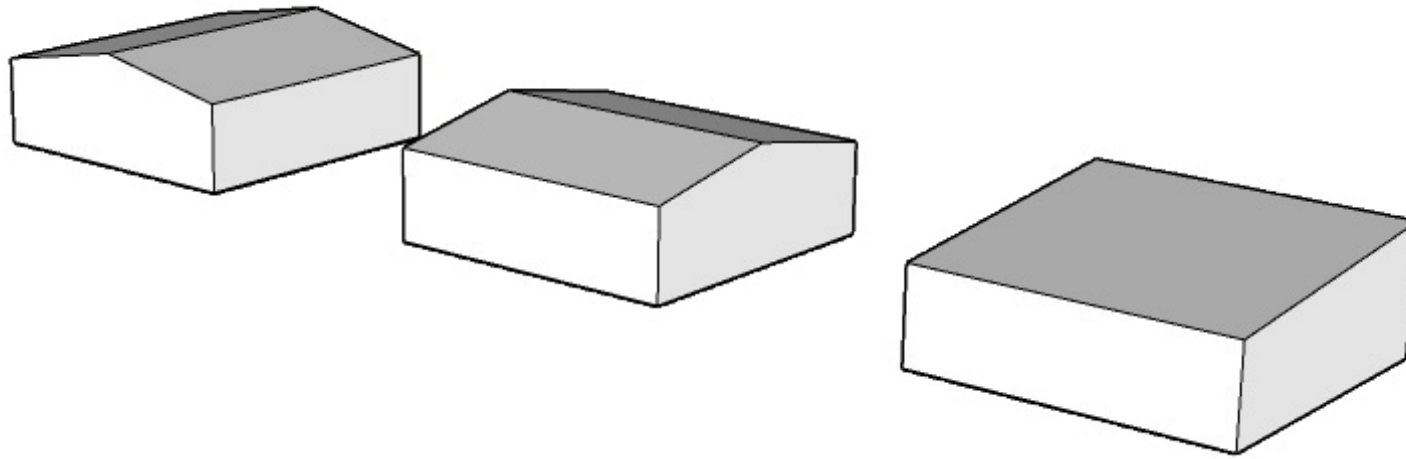




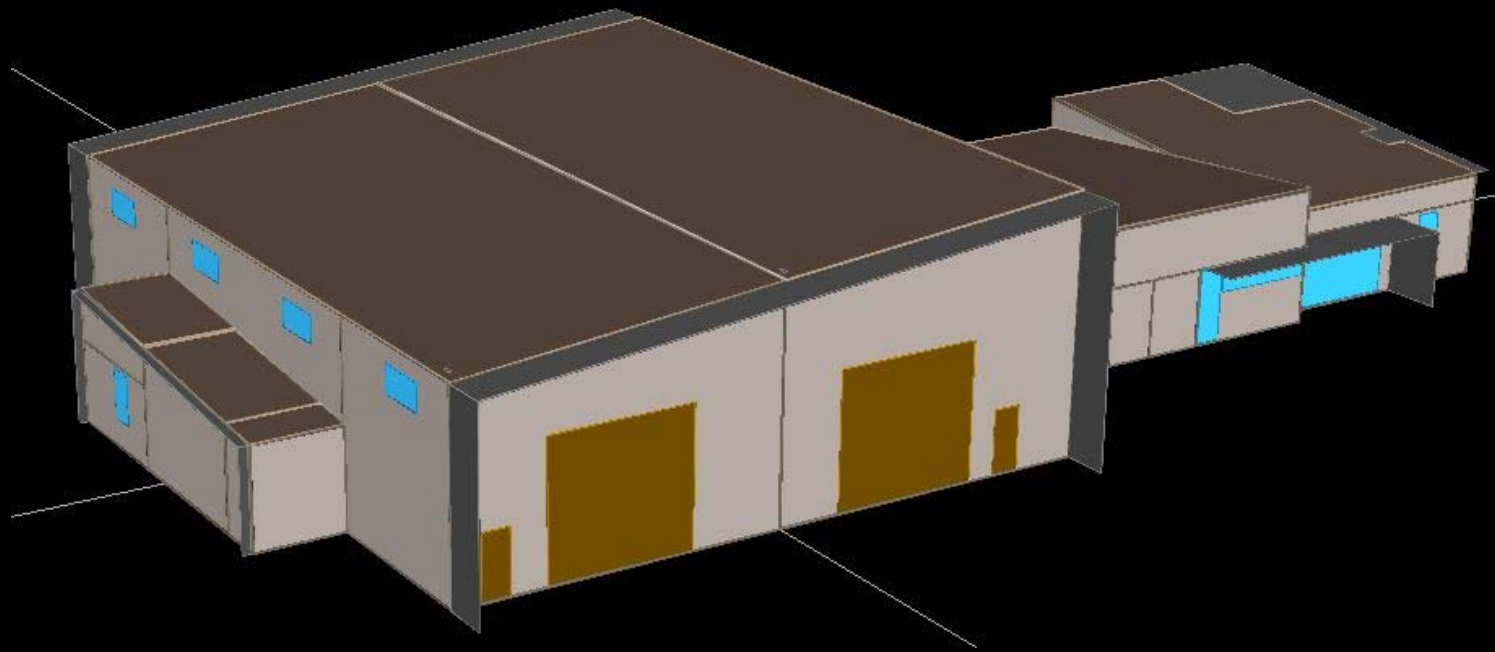
MOST EFFICIENT

LEAST EFFICIENT





Energy Form	kWh by surface	Total kWh	EUI Offset [kBtu/SF/YR]
Gable North/South	44,922	82,335	29.2
	37,413		
Gable East/West	41,432	82,695	29.3
	41,263		
Shed Roof South	89,703	89,703	31.8



ENVELOPE

- Roof Assembly R-32.3 Assembly; SRI 79
- Exterior Wall Assembly R-21.3 Assembly; SRI: 35
- Exterior Door Assembly Swinging: R-14.97
Nonswinging: R-4.0
- Window Assembly PPG SB70XL on Clear w/ thermally broken frames
Translucent Panels @ Shop
WWR: <10%
- External Shading Canopy over office man doors
PV Array over Shop
- Slab-on-Grade R-10 to 24" below grade
- Infiltration 0.10 ACH50 Maximum
- Thermal Bridging Minimize via details

LIGHTING

- Interior LPD
 - Office: 0.5 W/SF (All LED)
 - Shop: 0.5 W/SF (All LED)
 - Interior Surface Reflectance - 90/75/30
 - No furniture above 42" Height
 - Office (w/ task lights) 20 footcandle max
 - Shop (w/ task lights) 30 footcandle max
- Occupancy Sensors
- Daylight Harvesting Controls
 - 100% coverage except Mech/Elec, Shop and Corridors
 - All regularly occupied spaces (sidelit only)
 - Continuous dimming - OFF controls
- Exterior Lighting Power
 - 1,056 Watts (All LED)
 - Occupancy sensors

- Proposed Equipment

- Air-Cooled VRF w/ ERV @ Office
- Evaporative Cooling w/ Radiant Heating @ Shop
- Mini Split @ Communication Room
- Waste Oil Heater @ Shop

- Proposed Controls

- Nighttime temperature setback
- Expanded occupied deadband (9°F)
- Winter economizing at Communication Room
- Comm Room Temperature (80°F)
- Demand Control Ventilation (Office Only)

DHW

- Low Flow Fixtures
- DHW Heater Efficiency

30% DHW load reduction
96%+ HP DHW

PROCESS EQUIPMENT

- Equipment Purchase Policy
- Vampire Switch
- Occupancy Engagement

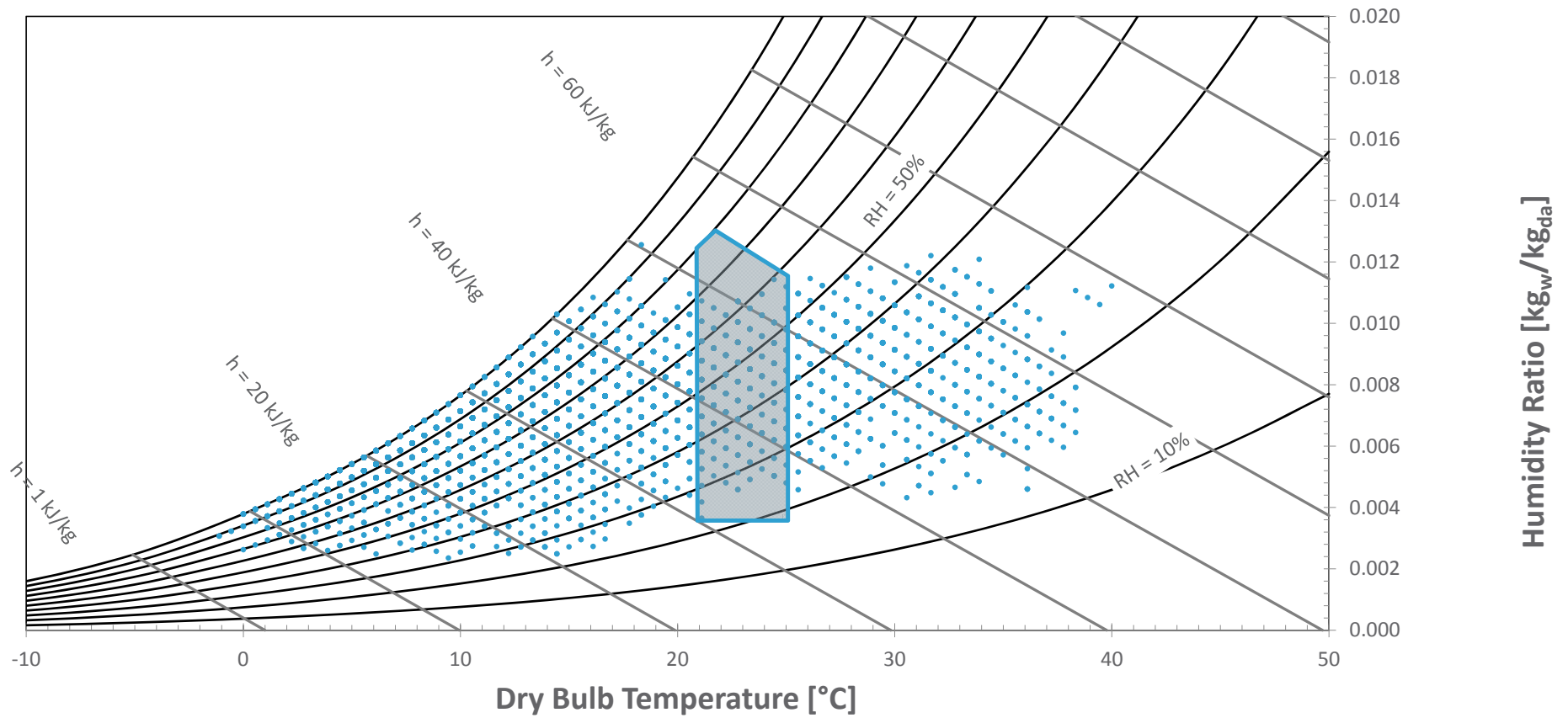
Energy Star Rated Equipment
Disconnects all non essential electric loads at night
InHABIT: Web-based program





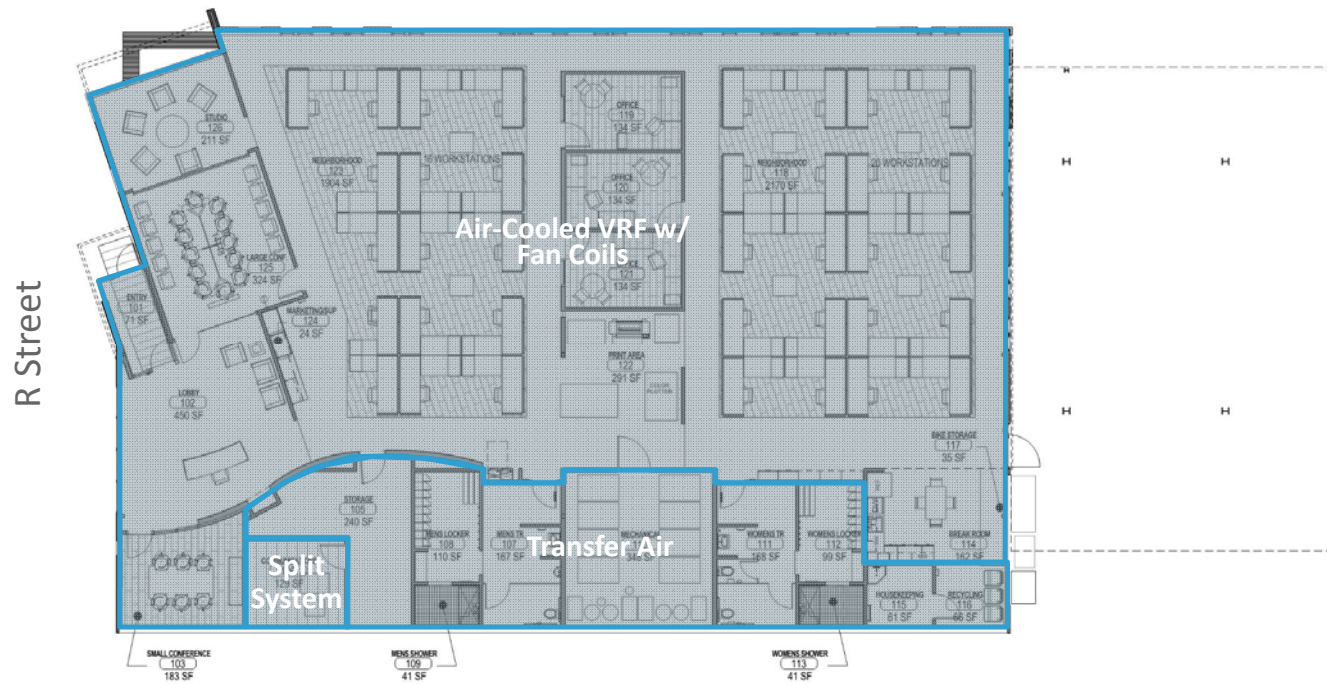


Weather



Floor Plan

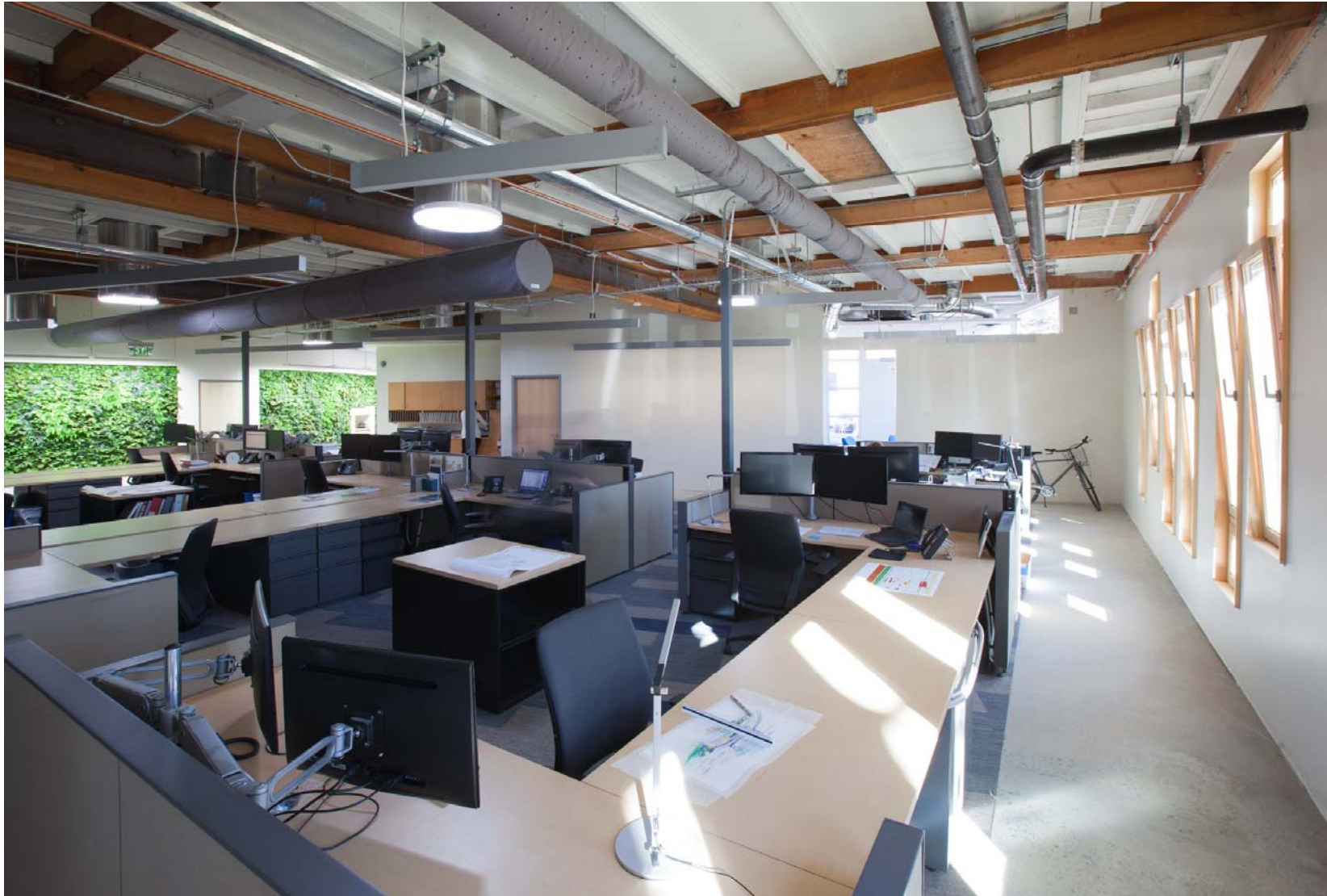
10th Street

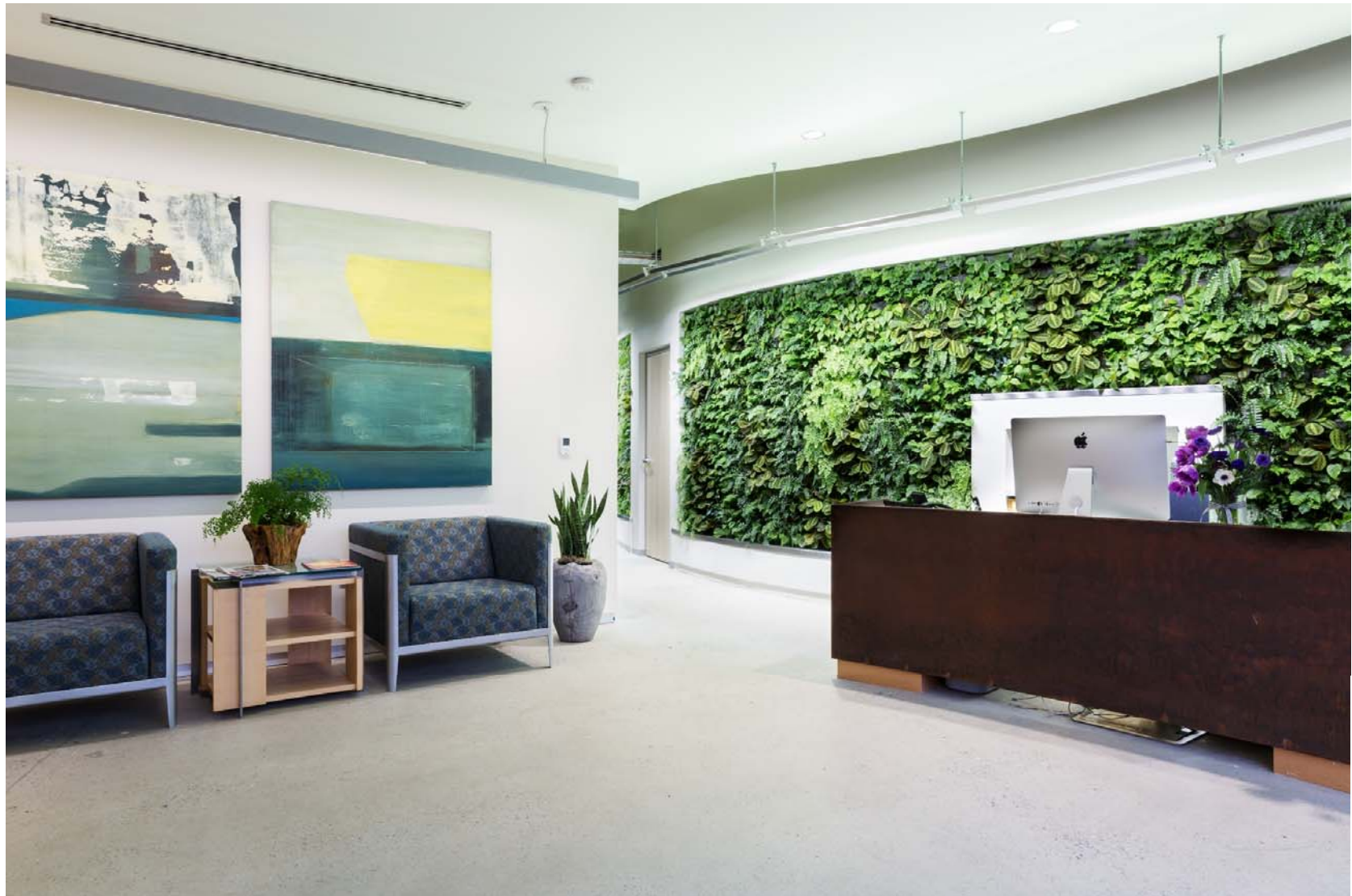


Roof Plan











ENVELOPE

Roof Assembly	-Varies - Maximum U-Value 0.039; 70% Reflective
Exterior Wall Assembly	-N, S, E: U-Value 0.05; 33% Reflective -W: U-Value 0.08; N/A Reflective
Window Assembly	-PPG 70XL on Clear
Storefront:	-Aluminum thermally broken frames
Punched:	-Aluminum clad wood frames
Window-to-Wall Ratio:	-19%
Skylight Assembly	-Operable: U-0.29, SHGC-0.27, VT-0.64, R-10.9 Curb -Solatube: U-0.51, SHGC-0.22, R-10.9 Curb, NFRC Cert. #5006 -Suncatcher: U-0.29, SHGC-0.92, VT-0.65, R-10.9 Curb
External Shading	-Existing Trees -Solar Panel Shading on Roof -Parking Canopy
Slab-on-Grade	-Existing (No Insulation)

LIGHTING

Interior Lighting Power Density	-0.49 W/SF
Occupancy Sensors	-100% coverage in all spaces
Daylight Harvesting Controls	-All regularly occupied spaces (toplit and/or sidelit) -15 footcandles for offices -80/80/35 interior surface reflectance
Exterior Lighting	-103.6 W

HVAC

Proposed Equipment

- 11 Zone Air-Cooled VRF System
- All non-regularly occupied space conditioned via transfer air except Comm Room

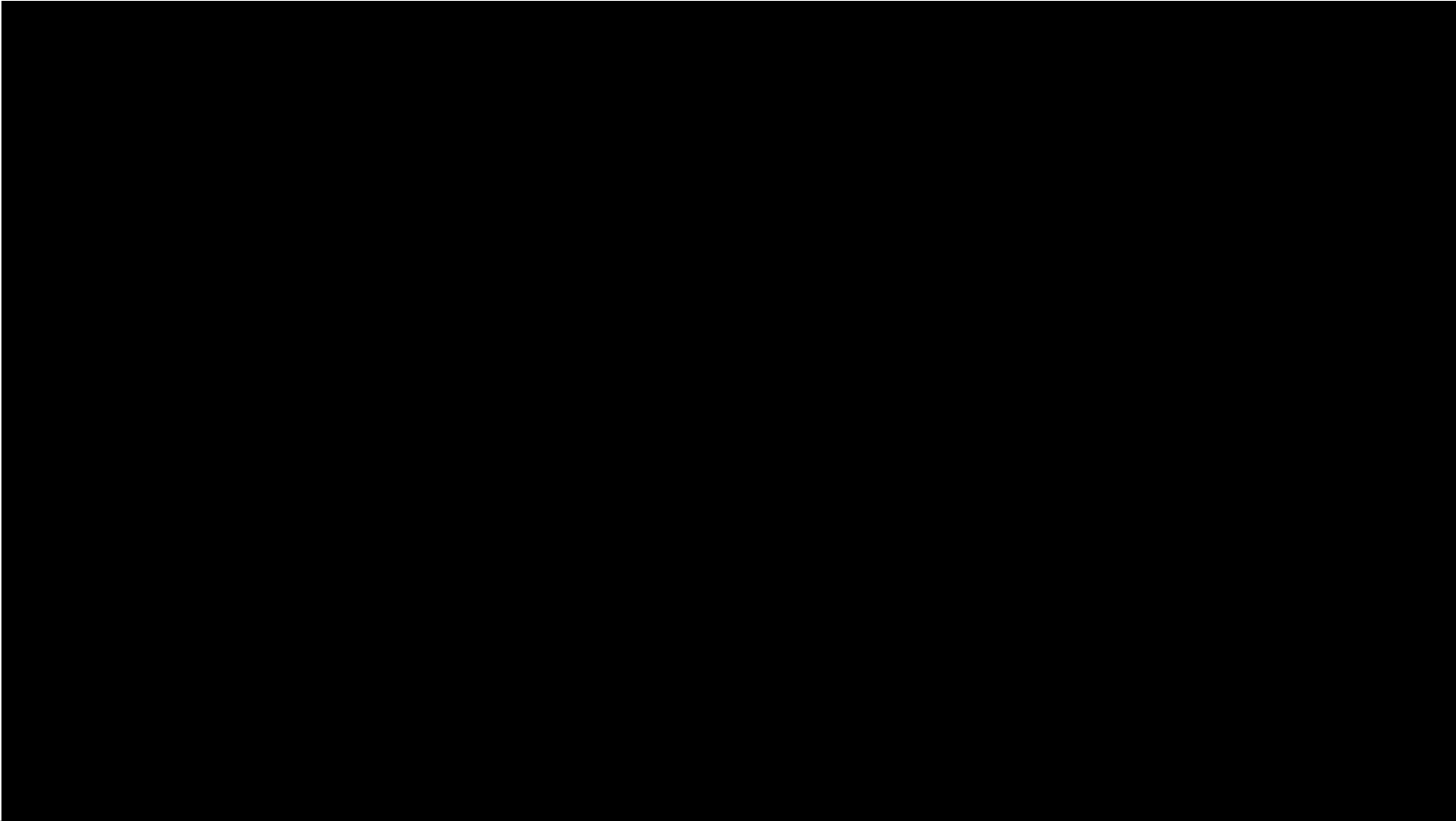
Proposed Controls

- Expanded occupied deadband (9°F)
- Nighttime temperature setback
- Natural Ventilation
- Comm Room Temperature (80°F)

PROCESS & PLUG

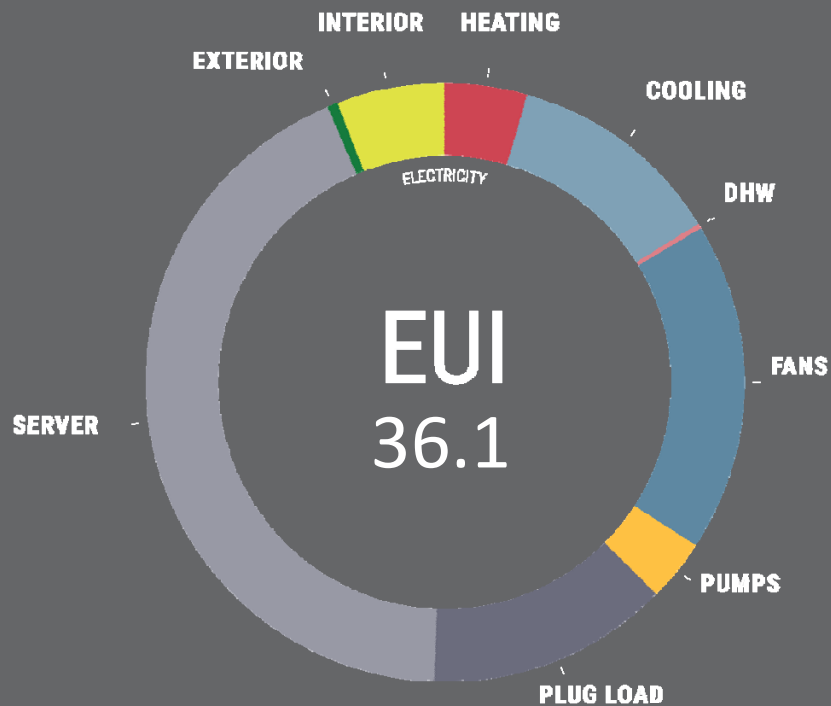
Equipment Purchase Policy
Virtual Desktop
Vampire Switch
Occupancy Engagement Program

Energy Star Rated equipment only
Workstation Load (100 W Maximum)
Disconnects all non essential electric loads at night
InHabit: Web-based program



RESULTS

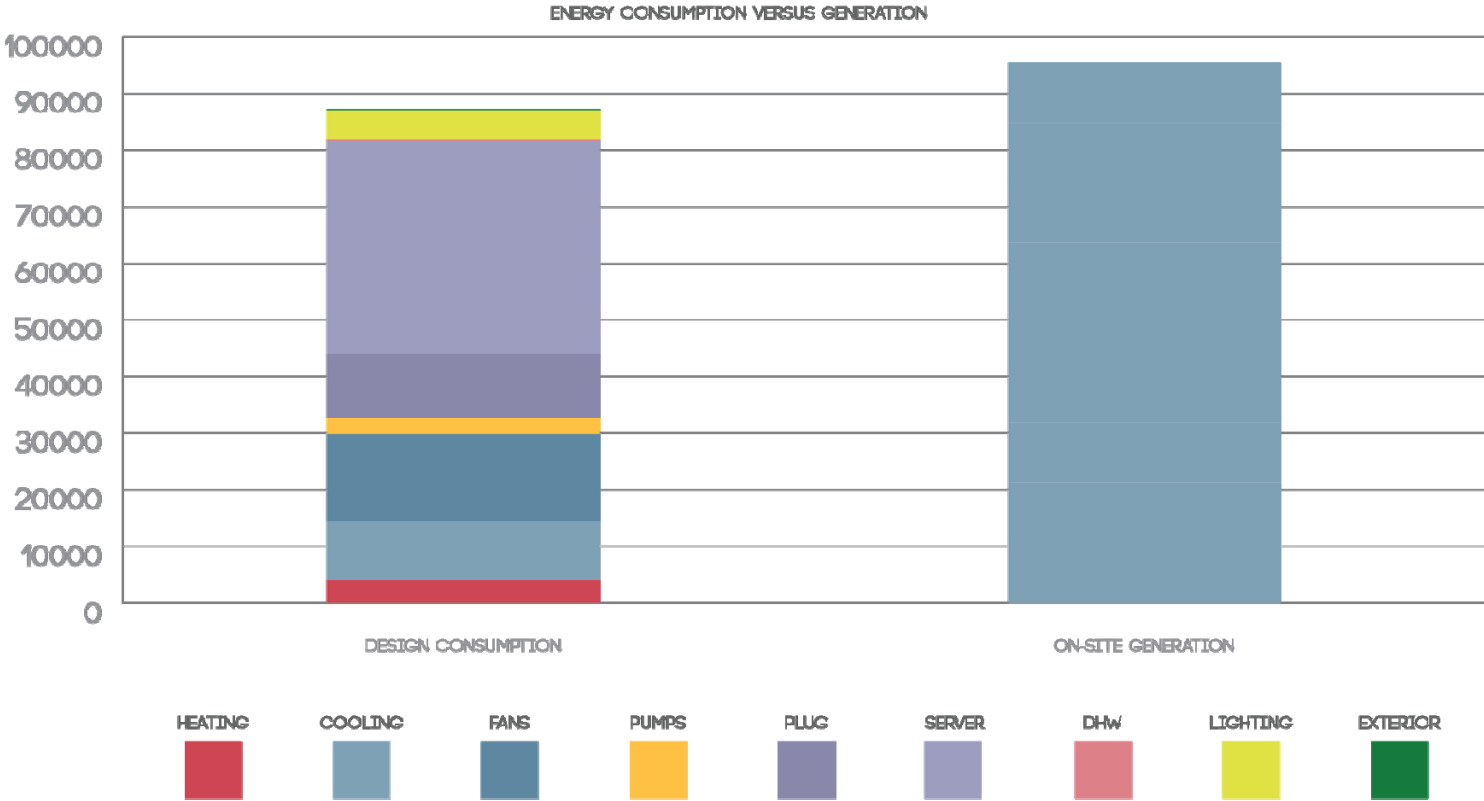
DESIGN



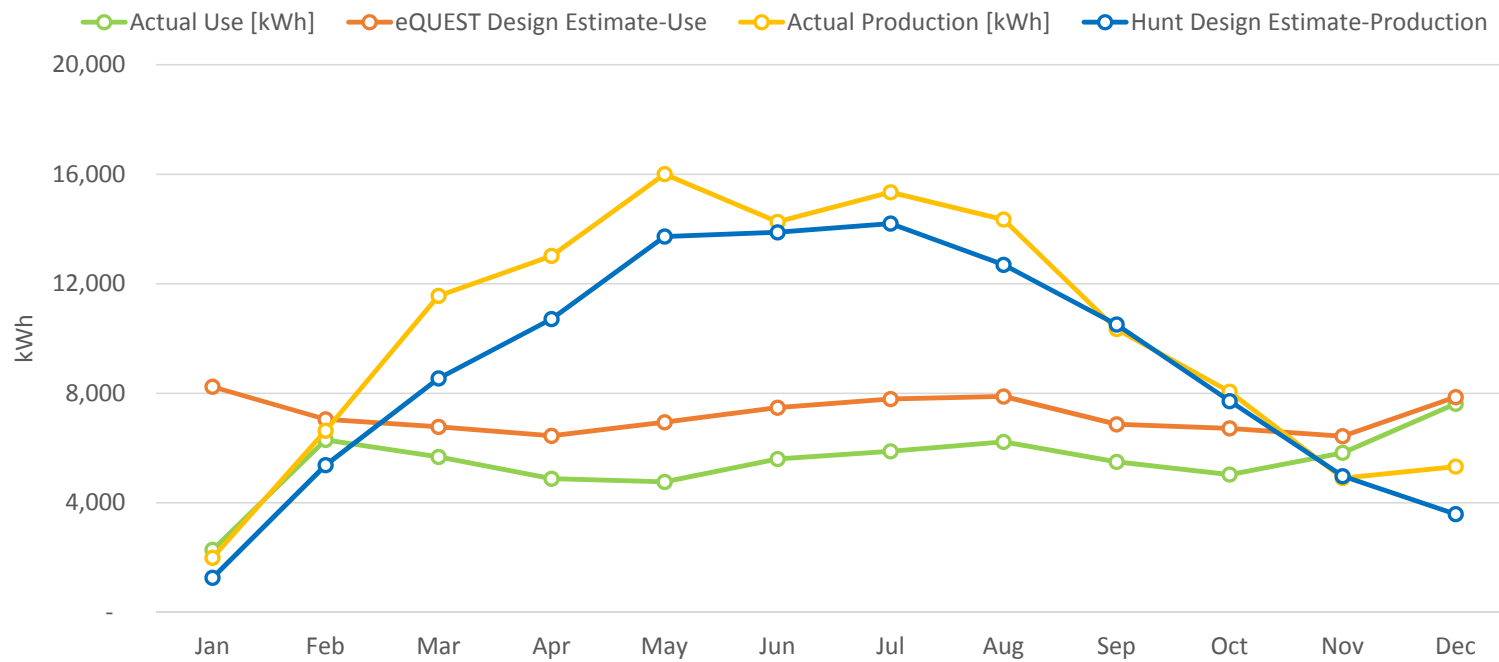
“Building reuse is the highest form of sustainability, yet the design constraints that come with reuse are very limiting in terms of energy use reduction...”

-Kenner Kingston

DESIGN RESULTS_kWh



ACTUAL RESULTS_kWh





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