



# **Emerging Technologies Summit**

MAKING THE CONNECTION:  
From Energy Efficiency Innovation to Delivery

**April 19 – 21, 2017**

# Getting to Yes: How Integrated Solutions Stakeholders Engage and Make Decisions

ANDREW REILMAN, JOHN ANDARY, SHANTI PLESS, CARLOS SANTAMARIA



# INTEGRAL GROUP

## Revolutionary Engineering

trust | nurture | inspire

John Andary, PE, LEED AP

Principal :: Bioclimatic Design Leader



YES TO ZERO NET ENERGY...ON YOUR PROJECT BUDGET



# ZERO NET ENERGY

## ILFI Certified

945 Front Street, DPR Construction Office, San Francisco, CA  
Packard Foundation Headquarters | LEED Platinum Certified, Los Altos, CA  
IDeAs "Z Squared" Integral Group Office, San Jose, CA

## Completed

### NZE Verified

J. Craig Venter Institute | LEED Platinum Certified, La Jolla, CA  
Tah.Mah.Lah. Residence | LEED Platinum Certified, Northern CA  
UniverCity Childcare Facility | Scale Jumping, Living Building Challenge, Burnaby, BC

### NZE Designed

117 Easy Street, Sunnyvale, CA  
415 Mathilda, Sunnyvale, CA  
435 Indio, Sunnyvale, CA  
Aquarium of the Pacific | LEED Platinum Certified, Long Beach, CA  
Bishop O'Dowd High School, Environmental Science Center, Oakland, CA  
Blackford Elementary School, Campbell, CA  
California Lottery Office, Santa Fe Springs, CA  
California State Polytechnic University, Pomona, Student Center, Pomona, CA  
Castlemont Elementary School, Campbell, CA  
Del Mar High School, Science Education Facility | CHPS Certified, Campbell, CA  
Exploratorium | LEED Platinum Certified, San Francisco, CA  
Hawaii Portable, Oahu, HI  
Kaneda Residence | LEED Platinum Certified, Cupertino, CA  
Leyva Middle School Administration, San Jose, CA  
Lynhaven Elementary School Multi-Purpose, Campbell, CA  
McClellan Ranch, Cupertino, CA  
Millennium Water (Southeast False Creek) | LEED Platinum Certified, Vancouver, BC  
Montenay Office Building | LEED Platinum Certified, Burnaby, BC  
OUSD, Downtown Educational Complex | CHPS Certified Pending, Oakland, CA  
Regent College Library, Vancouver, BC  
San Jose Environmental Innovation Center, San Jose, CA  
Sherman Oaks Elementary School Multi-Use Facility, Campbell, CA  
VanDusen Visitor Centre | Living Building Challenge, Vancouver, BC  
Vernonia K-12 School, Vernonia, OR  
Watsonville Water Resources Center | LEED Platinum Certified, Watsonville, CA  
Westmont High School - Science Education Facility, Campbell, CA

## Completed

### NZE Electric Designed

Clif Bar Headquarters | LEED Platinum Certified, Emeryville, CA

### NZE Ready

2 Bryant, Perkins + Will Office, San Francisco, CA  
Samsung Research Center, Mountain View, CA

## Construction

Confidential Medical Lab, Inland Empire, CA  
LinkedIn Office Renovation, Sunnyvale, CA  
Metalsa Research Building, Mexico  
Xilinx Headquarters Renovation, San Jose, CA  
Yosemite Institute, Yosemite National Park, CA

## In Design

380 Pastoria Office Building Renovation, Sunnyvale, CA  
895 Emerson, Schmidt Family Foundation Offices, Palo Alto, CA  
Boulder Commons, Boulder, CO  
City Place Development, Santa Clara, CA  
Confidential Urban Campus, Los Angeles, CA  
Denver Water, Denver, CO  
Hanover Page Mill, Palo Alto, CA  
Hayward Library, Hayward, CA  
Kaiser Baldwin Hill Medical Office Building, Baldwin Hills, CA  
Kaiser Santa Rosa Medical Office Building, Santa Rosa, CA  
Mark Day School Administration Building, San Raphael, CA  
OUSD Madison High School, Oakland, CA  
Rowland Hall-St. Mark's School, Salt Lake City, UT  
Sacramento Market Co-Op, Sacramento, CA  
San Francisco International Airport, Consolidated Administration Campus, San Francisco, CA  
Stanford University Living Lab, Palo Alto, CA  
UC Davis California Avenue Lecture Hall, Davis, CA  
UC Merced Downtown Campus, Merced, CA  
UC Santa Cruz, Big Creek, Santa Cruz, CA

## Masterplan

Fort Collins Net Zero Energy Eco-District, Ft. Collins, CO  
OUSD Fremont High School Master Plan, Oakland, CA  
Station Pointe Sustainable Master Plan, Edmonton, AB  
UC Berkeley Global Campus, Richmond, CA



INTEGRAL GROUP SAN JOSE OFFICE





OAKLAND DOWNTOWN EDUCATION CENTER



DPR CONSTRUCTION





J. CRAIG VENTER INSTITUTE



EXPLORATORIUM MUSEUM



SMUD EAST CORPORATE CAMPUS

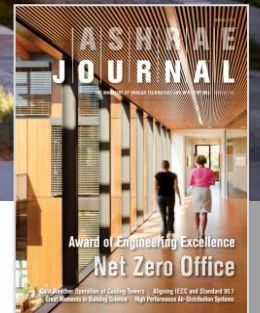


NREL RESEARCH SUPPORT FACILITY





# PACKARD FOUNDATION HEADQUARTERS





1400 PAGE MILL ROAD

COMMERCIAL ZNE CASE STUDY

...SPEC OFFICE BUILDING RENOVATION



## Existing Conditions



- 30,000 SF square one-story office warehouse circa 1970
- Uninsulated concrete walls, wood roof and single pane windows
- DARK, DINGY, DERELICT and UNRENTABLE!







INDIO BUILDING

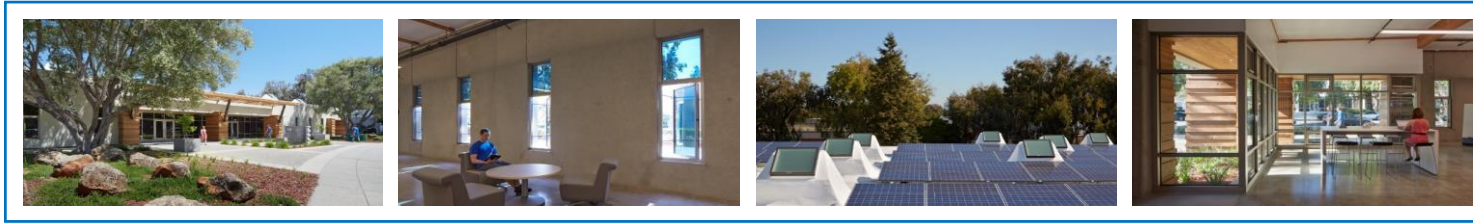
# BUSINESS CASE FOR ZERO NET ENERGY

- ADDITIONAL COST TO RENOVATE SUSTAINABLY VS. LESS EXPENSIVE STANDARD METHOD OF RENOVATING => (\$49.84 / SF)
- ADDITIONAL VALUE CREATED DUE TO A REDUCTION IN OPERATING EXPENSES AND RESERVE REQUIREMENTS => \$52.94 / SF
- ADDITIONAL VALUE DUE TO ACCELERATED LEASE-UP TIME VS. AVERAGE MARKET DOWNTIME => \$22.81 / SF
- ADDITIONAL VALUE DUE TO RECEIVING A PREMIUM IN RENT OVER THE TOP OF THE MARKET RENTS => \$34.47 / SF

# ACCELERATE

Taking Net Zero Energy from Replication to *Production*

INDIO



2014

SILICON VALLEY BUSINESS JOURNAL BEST REUSE PROJECT AWARD 2014 • ACTERRA SUSTAINABLE BUILT ENVIRONMENT AWARD 2015

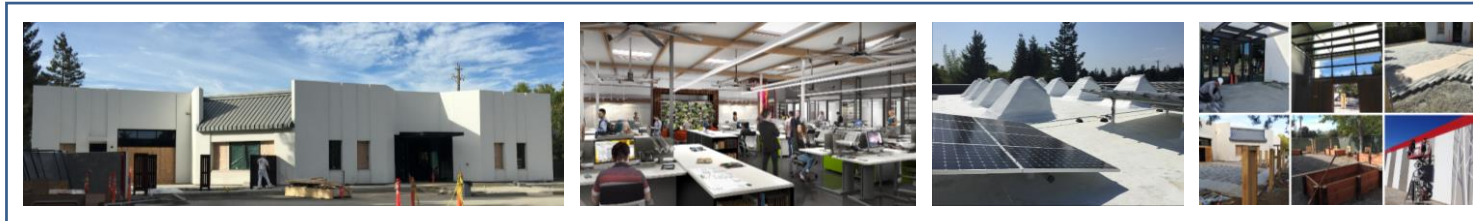
MATHILDA



2015

SILICON VALLEY BUSINESS JOURNAL GREEN PROJECT OF THE YEAR 2015

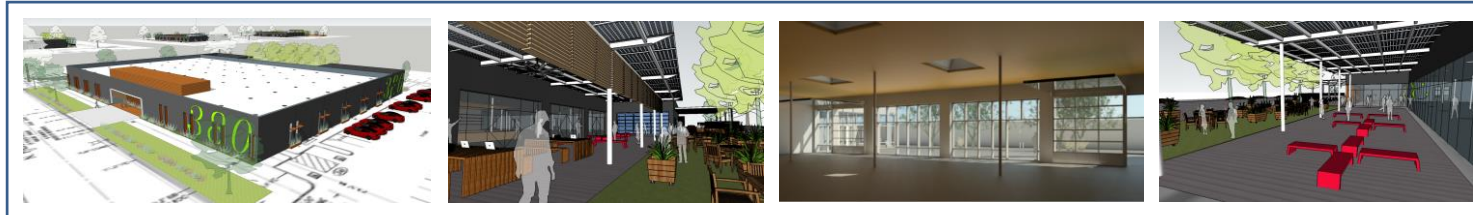
AP + I



2016

SILICON VALLEY BUSINESS JOURNAL GREEN PROJECT OF THE YEAR RUNNER UP 2015

PASTORIA



2017

INSTITUTIONAL ZNE CASE STUDY

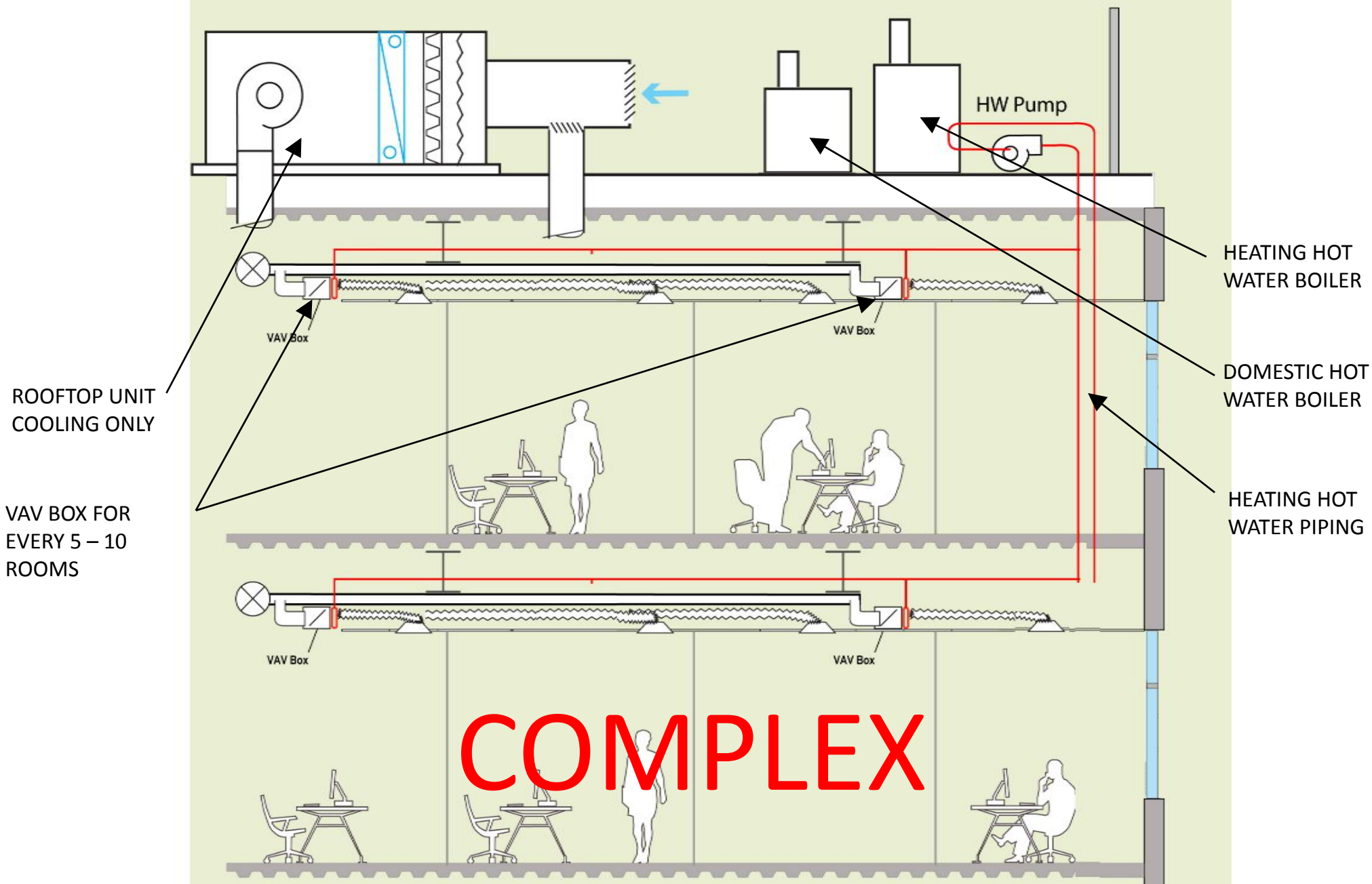
...MEDICAL BUILDING



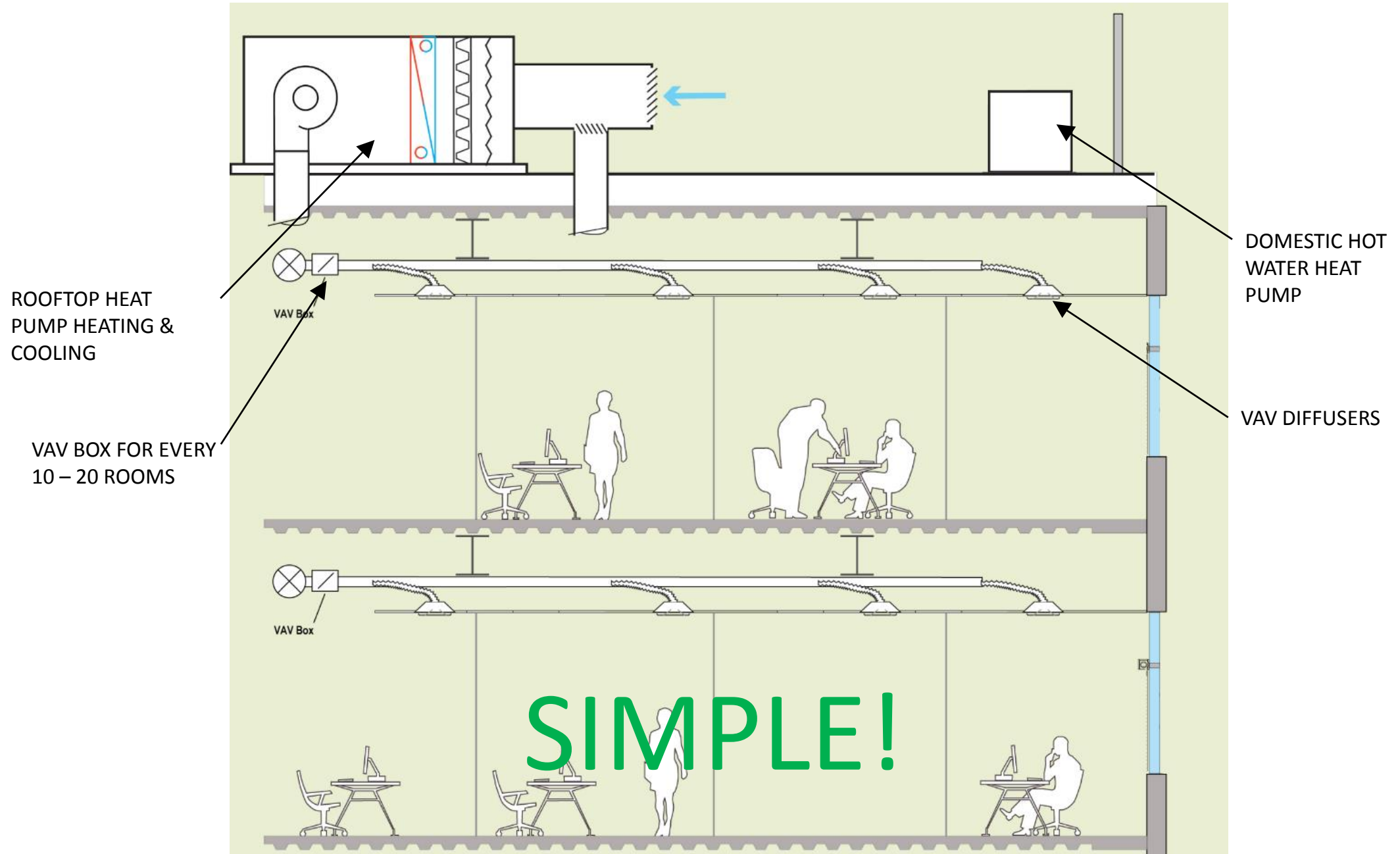


KAISER PERMANENTE MEDICAL OFFICE BUILDING

# Low Cost Baseline Gas-Electric Option : VAV Reheat System



# All-Electric Option : Thermally Zoned Heat Pump System





# Over \$1M First Cost Savings!

Electrical Changes						
<b>Electric VAV Heating</b>						
New 277V Panels	3	EA	12,200	36,600	0.42	
New 100' X 225 A feeders	3		Included above			
Connections for 8 EA Electric VAV - (1st VAV from JB)	8	EA	3,014	24,112	0.28	
Connections for 16 EA Electric VAV (Added VAV from JB)	16	EA	1,208	19,328	0.22	
Connections for remaining 36 VAVs - Assumed NR - No Reheat	36	EA	-	-	-	
Adds to Building Service, Distribution Boards	Not required per IG					
	S/T			80,040		
<b>Changes to potential VA options</b>						
VA to reduce future capacity no longer available - More capacity used						
NEW RISK ITEM - Potential to add 1 EA 600 A Board	Not required per IG					
	S/T			43,750	0.50	
<b>Electrical Water Heating</b>						
NEW RISK ITEM - Add 1200A Board for Electric Water Heating	Not required per IG					
NEW RISK ITEM - POTENTIAL INCREASE TO SERVICE SIZE	Not required per IG					
	S/T			-		
				<b>ELECTRIC VAV</b>	<b>123,790</b>	<b>1.41</b>
				<b>ELECTRIC WATER</b>	<b>-</b>	<b>-</b>
Assuming Electric VAV approved						

Site / Offsite Changes						
<b>Electric VAV Heating</b>						
No changes anticipated						
<b>Electrical Water Heating</b>						
Not required per IG						
Increase Electrical Service Size						
PG&E Connection / Meter Fees						
Remove Gas Service - Site & Offsite Costs	1	LS	(50,000)	(50,000)		
	S/T			(50,000)		
				<b>ELECTRIC VAV</b>	<b>-</b>	<b>-</b>
				<b>ELECTRIC WATER</b>	<b>(50,000)</b>	<b>(0.57)</b>
Assuming Electric VAV approved						

DIRECT COSTS		ELECTRIC VAV	(780,305)	(8.92)
<b>TOTAL INCLUDING MARKUPS</b>		<b>ELECTRIC VAV</b>	<b>(844,221)</b>	<b>(9.65)</b>
DIRECT COSTS		ELECTRIC WATER	(166,393)	(1.90)
<b>TOTAL INCLUDING MARKUPS</b>		<b>ELECTRIC WATER</b>	<b>(180,023)</b>	<b>(2.06)</b>

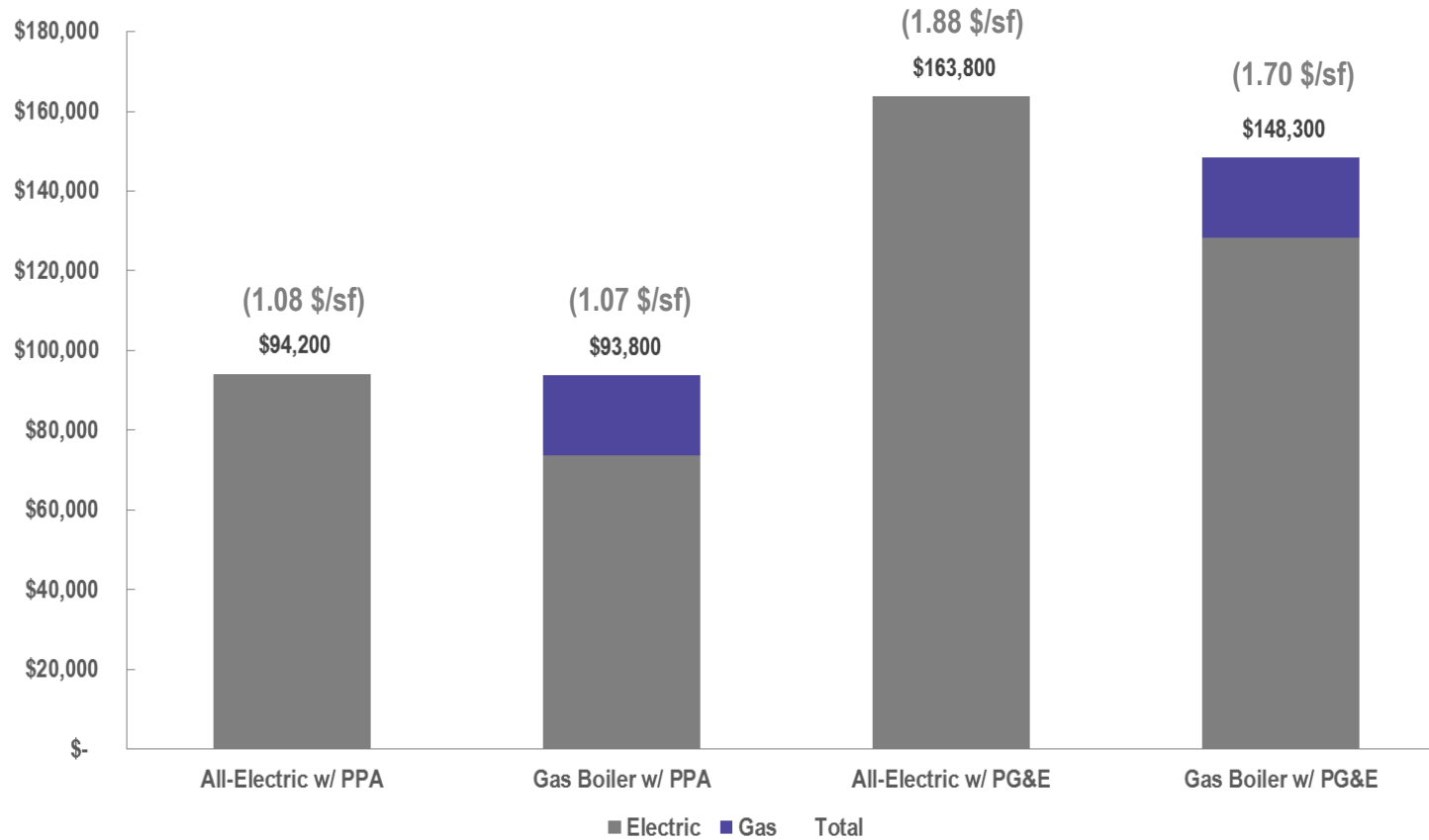
Assuming Electric VAV approved

Summary		
First Cost Savings	Total [\$]	[\$/SF]
All-Electric HVAC	(844,221)	(9.65)
All-Electric Plumbing	(180,023)	(2.06)
<b>Total:</b>	<b>(1,024,244)</b>	<b>(11.71)</b>



# Annual Energy Costs

## HVAC Electric and Gas Systems

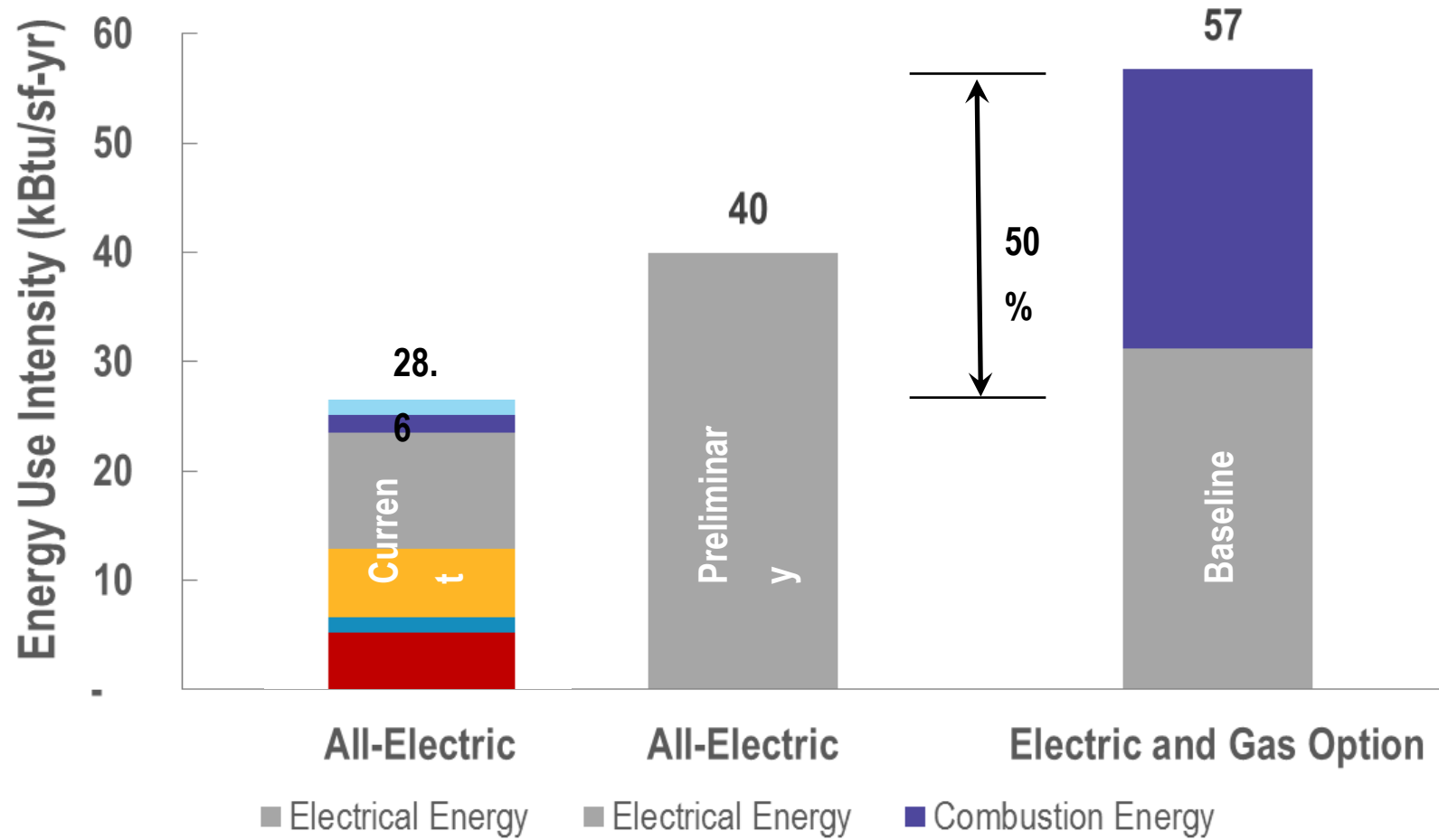


- All-Electric using PPA results in lowest annual energy costs
- All-Electric under PG&E rates results in high energy costs
- PG&E Electric and gas rates will escalate

PPA Electric Rate	0.092	\$/kWh
PG&E Effective Electric Rate (est)	0.16	\$/kWh
PG&E NG Rate	0.9	\$/therm



# Annual Energy Use Intensity (EUI)



# 620 KW PV System to achieve Zero Net Energy



# THANK YOU

[jandary@integralgroup.com](mailto:jandary@integralgroup.com)

*Check out our book.*

INTÉGRAL

Revolutionary  
Engineering



MOLLY MILLER



# Integrating Energy Efficiency Requirements into Project Requirements = yes

**Shanti Pless**  
Senior Research Engineer  
National Renewable Energy  
Laboratory  
April 2017



# THE NREL RSF STORY



# NREL: 2008



NREL PIX



# Historical Context

## Pre-2008

- Design-bid-build
- Specifications of “exactly” what we wanted
- Always struggling to balance the budget with program and architecture and energy



# NREL/DOE Research Support Facility

**Location:** Golden, CO

**Primary Use:** Office

**Size:** 360,000 ft<sup>2</sup>

**Occupants:** Approximately 1,325

**LEED Rating:** Platinum

**Construction Cost:** \$254/ft<sup>2</sup>

**Energy Budget:** 35 kBtu/ft<sup>2</sup>/yr

**Phase 1:** 2010

**Phase 2:** 2012

**Source Net Zero Energy Goal:**  
Offices, datacenter, and parking  
with on-site PV

**Utilize warranty and incentive  
program to ensure energy  
targets are met**



# NREL: Today





**CONTRACTS DRIVE BEHAVIOR**

# Owner Defines Desires

**Mission Critical:**  
Project cannot succeed  
without this element

**Highly Desirable:**  
What the owner wants

**If Possible:**  
The wish list

**Utilize design competition  
for firm fixed price**

## **Tier 1: Mission Critical Goals**

- Attain safe work/design
- LEED Platinum
- ENERGY STAR® “Plus”

## **Tier 2: Highly Desirable Goals**

- 800 staff capacity
- 35 kBtu/ft<sup>2</sup>-yr
- Architectural integrity
- Honor future staff needs
- Measurable ASHRAE 90.1
- Support culture and amenities
- Expandable building
- Ergonomics
- Flexible workspace
- Support future technologies
- Documentation to produce “how to” manual
- Allow secure collaboration with visitors
- Completion by 2010

## **Tier 3: If Possible Goals**

- Net-zero energy
- Most energy-efficient building in the world
- LEED Platinum Plus
- 50% better than ASHRAE 90.1
- Visual displays of current energy efficiency
- Support public tours
- Achieve national and global recognition and awards

# Acquisition Strategy Results (From DOE)

- Created Value Beyond the Budget at Lower Cost and Risk to All Parties
  - No Claims or Controversy
  - No Contractor Change Orders
  - Virtually No Contingency Use for Unknowns or Omissions
  - Sixteen Months from Shovel to Move-In
    - **Over a year of delivery time saved!**
  - Large Scale Net Zero Energy without increase in first cost
- Defined a New National Building Energy Standard
  - Replicable Acquisition Strategy for Use by Others to Create Their Own Successes!

# How Much Did It Cost?

- \$259/ft<sup>2</sup> construction costs for site work, infrastructure, and building
  - Includes interiors, furniture, and cabling
  - Does not include PV, land, or design costs
- Third-party-owned power purchase agreement for PV
  - \$29/ft<sup>2</sup> or 11% additional cost if NREL had purchased all PV without tax breaks or subsidies (at \$5/Watt)

# Replicable – Cost Control Review

- Firm fixed price with required energy goals in design-build contract
- Integrated architecture and envelope as efficiency measures
- Simple and commercially viable
- No unique technologies required
- Modular precast wall panels with minimal finishes
- Optimized glazing area
- Repeatable office floorplate
- Takes a coordinated effort with the owner (and all user groups), architect, builder, and engineers



# How-to Guides for Cost Control



## Guide:

- <https://buildingdata.energy.gov/cbrd/resource/1655>
- Discusses the recommended strategies
- Pairs strategies with industry examples of success in ZEBs and other high-performance buildings where possible
- Describes how to balance key decision-making factors
- Provides quick reference tables to help building owners and project teams apply the recommended strategies to their projects.

## • Fact sheet:

- <https://buildingdata.energy.gov/cbrd/resource/1654>
- Highlights key ideas from the guide
- Directs readers to the guide for more details.



# How-To Guide for Energy-Performance-Based Procurement

An Integrated Approach for Whole Building High  
Performance Specifications in  
Commercial Buildings



# Energy-Performance-Based Acquisition for Commercial Buildings

Energy-performance-based acquisition is the process of considering well-defined energy performance goals and incentives for the entire building lifecycle, including planning, design, construction, and operation. Learn more about a typical energy-performance-based project using the steps and resources below.

## Explore the Steps for an Energy-Performance-Based Project

Keeping a focus on energy efficiency, these steps outline five time-phased efforts central to setting and attaining energy goals for new commercial buildings.

1 2 3 4 5

## Download the Detailed How-To Guide

The how-to guide describes in detail the actions that owners, designers, contractors, and other project team members can take to help ensure aggressive energy savings are achieved in design and construction and maintained over time.

Download

## See Energy-Performance-Based Case Studies

Aggressive energy savings of 50% over code are possible using the energy-focused acquisition approach shown in these examples.

Skip to case studies

## See Annotated RFP Examples

The National Renewable Energy Laboratory (NREL) has annotated example request for proposals (RFPs) to highlight the energy-performance-based acquisition process.

Skip to annotated RFPs

[https://buildingdata.energy.gov/cbrd/energy\\_based\\_acquisition/](https://buildingdata.energy.gov/cbrd/energy_based_acquisition/)



| **ACCELERATE PERFORMANCE**

**100** buildings  
**three** years

---

Scale performance-based procurement



This material is based upon work supported by the Department of Energy, Office of Energy Efficiency and Renewable Energy (EERE), under Award Number DE-EE0007068.

## TEAM

Seventhwave

National Renewable Energy  
Laboratory

Institute for Sustainable Energy

## UTILITY PARTNERS

ComEd

Eversource

United Illuminating

## OWNER PARTNERS

University of Chicago

Lend Lease



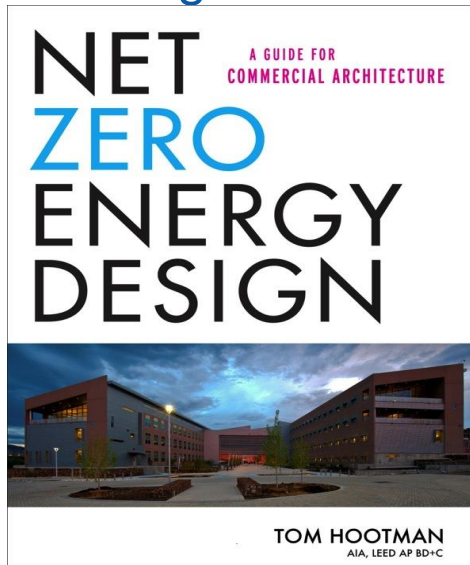
Photos courtesy of University of Chicago

# Thanks and Questions

Shanti Pless

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[www.nrel.gov](http://www.nrel.gov)





Factors That Influence Decision Makers  
Case Study of a Deep Energy Retrofit Project  
The Aventine Office Building – La Jolla California

**Presented by: Carlos Santamaria, RPA, LEED AP**  
**Principal, CEES-Advisors & BOMA California Energy Chair**

**Aventine Office**  
**La Jolla, California**



# The Aventine Office Building Overview

- **All Electric Building**
- **2 - 300 Ton Centrifugal Chillers – 18 Years Old Equipment**
- **Allerton Energy Mgt. System**
- **Direct Digital VAV Control**
- **High Percentage of Dollars were Recover Capital <4 Years**
- **High Profile Building, Tenants**

**Aventine Office Building  
La Jolla, California  
252,957 sf / Built 1990  
22 Year Old Building**





# “The Challenge”

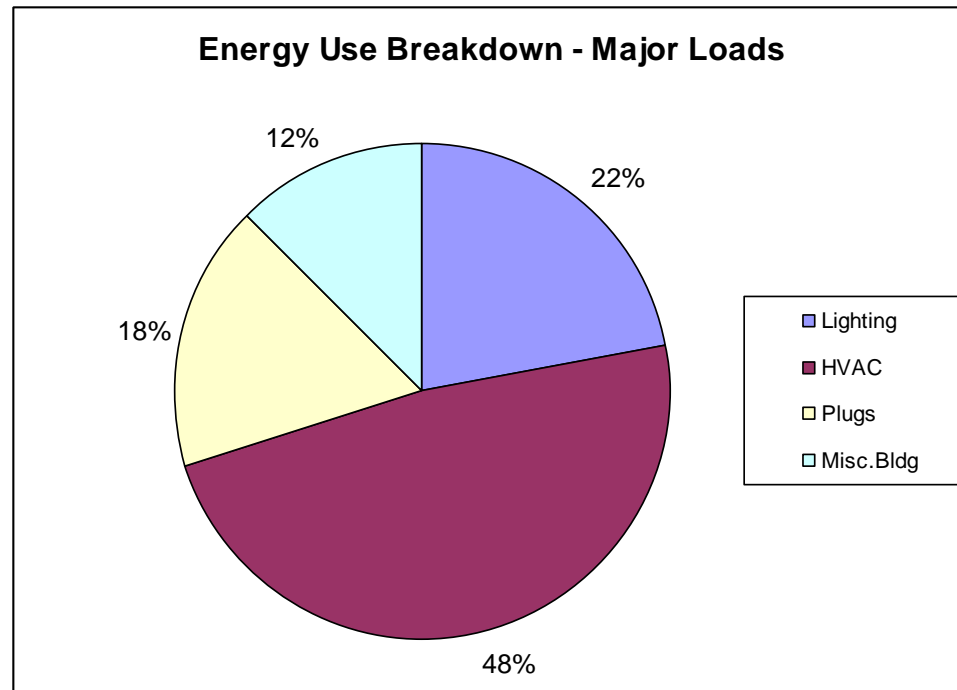
## Factors That Influence CRE Decision Makers

- Asking for \$800,000 during the Economic Downturn of 2008/2009 – **Large Capital Expense**
- Making the Case – The Value Proposition
- Getting Senior Mgt. Support
- Communicating the Quantitative as well as Qualitative Benefits
- Planning, Executing & Showing Results
- \*Key- “A Trained Workforce”

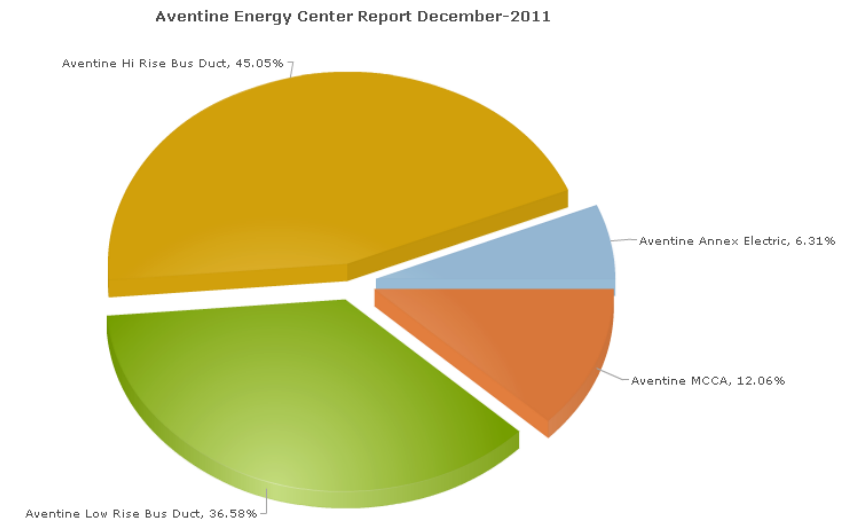
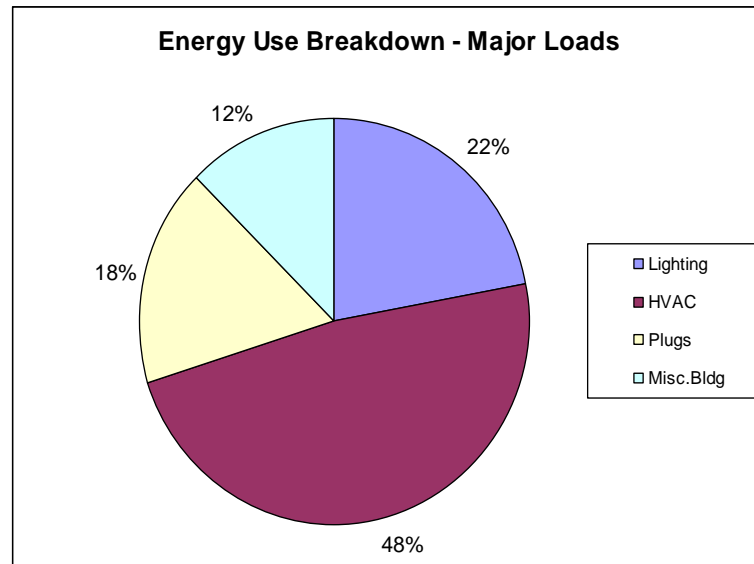
Cost Saving Opportunity (CSO) Measure	Update Project Costs	NC=NoCost LC=Low Cost MC= Medium Cost HC=High Cost Pjt(s)	Estimated Project Rebates	Projected Yrly KWH Savings	Current Cost Per KWH or Savings	(Est) Annual Dollars Saved	(Est) Tons of CO2 Saved	Estimated Payback in Years
Replaced CFC Compressors with Turbocor R134a Units and Installed OptimumLOOP Energy Mgt & MVM System.	\$465,000	HC	\$116,000	501,500	\$0.18	\$90,270	4514	3.51
Install Sensors for Stairwell Lighting to reduce 24/7 Operation. <i>Utility Incentive</i>	\$0	NC	\$0	23,827	\$0.18	\$4,232	214	0.00
Install (4) CO2 Sensors for IAQ Readings	\$8,800	LC	\$0	na	na	na	na	na
Install CT Meter's on Bleed & Make-up lines. Will apply for Wtr Dept. Credit.	\$6,500	LC	\$0	na	na	na	na	na
Replace Hi/Wattage fixtures with Lower wattage fixtures	\$34,750	LC	\$5,213	60,970	\$0.18	\$10,828	549	2.73
Same as above	\$7,720	LC	\$1,158	15,724	\$0.18	\$2,793	142	2.35
Same as above	\$3,650	LC	\$548	23,512	\$0.18	\$4,176	212	0.74
Same as above	\$2,450	LC	\$368	5,887	\$0.18	\$1,046	53	1.99
Same as above	\$1,700	LC	\$255	2,540	\$0.18	\$451	23	3.20
Repipe and install supply line that can provide 100% Reclaimed water to Cooling Tower.	\$15,000	MC	\$0	0	na	\$4,700	0	3.19
Replace approximately 26 MRR & LRR Toilets to HE Fixtures to Save Water	\$46,000	MC	\$8,500	0	na	\$8,575	0	4.37
Replace approximately 25 MRR Waterless Urinals to Save Water	\$95,000	HC	\$3,300	0	na	\$7,200	0	12.74
Install Green "Cool" Roof to Save Energy & Extend Roof Life.	\$115,000	HC	\$0	42,555	\$0.18	\$7,558	383	15.22
	<b>\$801,570</b>		<b>\$135,341</b>	<b>676,515</b>	<b>\$0.18</b>	<b>\$141,828</b>	<b>6089</b>	<b>4.70</b>

# The Aventine Office Building Assessing Opportunities

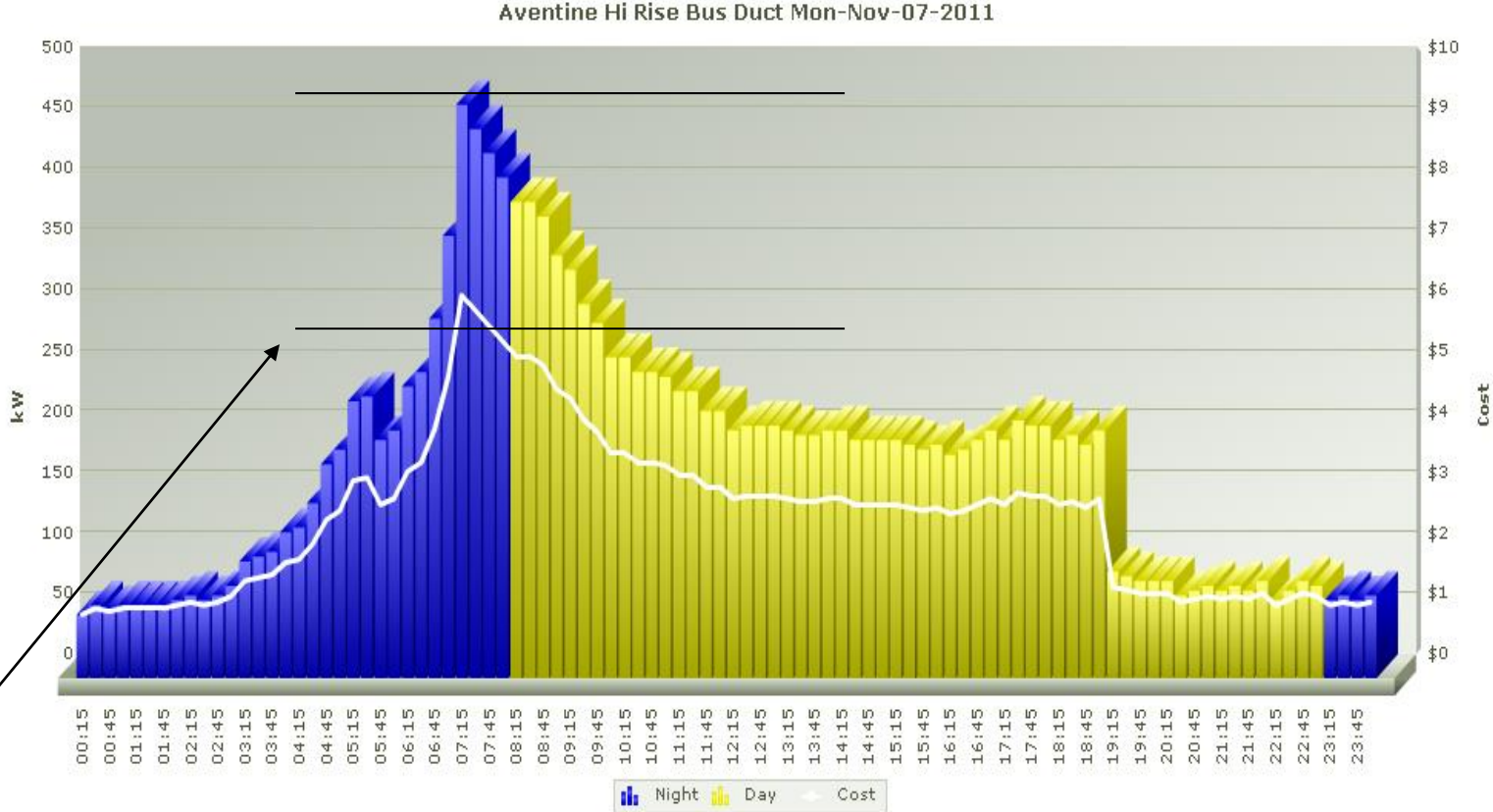
Largest Areas of Energy Consumption Identified  
& Upgraded. HVAC Systems -



# Challenges & Opportunities Verification – Estimating Versus New Energy Analytics

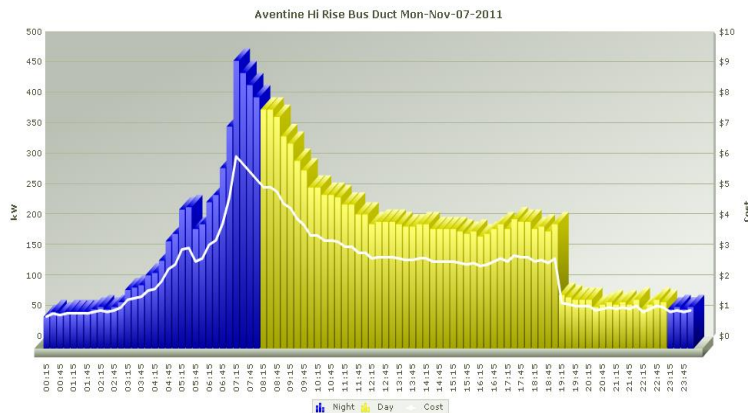


# A Picture is Worth a Thousand Words Showing Energy Analytics



**Ability to Show Savings Potential – Reduction of Peak Usage.**

# The Aventine Office Building High Performance Results



One of the 1<sup>st</sup> LEED Platinum  
20 Year Old, Multi-Tenant  
Existing Office Buildings in  
the “WORLD”



**ENERGY STAR Rating  
of “100” for over 5  
Years Straight!**

**Sustained Performance!**

**23 kBtu/SF, (SEU) Site  
Energy Use Intensity**



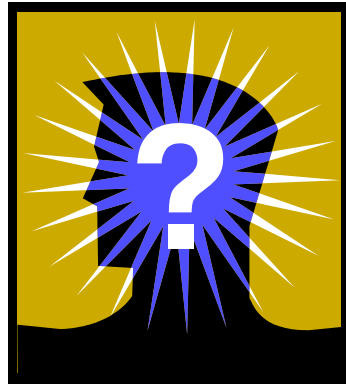
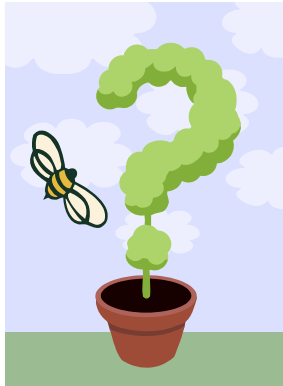
# The Aventine Office Building Stakeholder Talking Points

## **Year 1 RESULTS**

- Increased EPA ENERGY STAR score to from “84” to “**100**” – 5 Plus Years
- GHG Emission Reduction From Baseline  
–234 MtCO<sub>2</sub>e
- Pre-Retrofit Electrical Cost at \$2.90 \$per/Sq.Ft.
- Post-Retrofit Electrical Cost at \$2.20 \$per/Sq.Ft.
- **2011 Year End Electrical Cost at <\$1.90\$per/Sq.Ft**
- **Increased Asset Value by over \$2.5M**
- **Became Company Example of High Performance Building Transformed**
- **Received Numerous Awards and Company Publicity- Great Marketing**



# Questions



If you would like to contact us, please feel free to send an email to  
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Or call 650-642-4516 c#