FEDERAL FACILITIES SYMPOSIUM

Moving toward a Zero Carbon Future

The IDeAs Z2 Design Facility:

Z2 = net Zero energy,

Zero carbon emission

OCTOBER 1, 2008

EHDD | ARCHITECTURE

INTEGRATED DESIGN ASSOCIATES INC

IDeAs ...design facilities

RUMSEY ENGINEERS

Speakers

Scott Shell, AIA, LEED® AP

- Principal
- EHDD Architecture
- Principal-in-Charge

David Kaneda, PE, AIA, LEED® AP

- Principal / building owner
- Integrated Design Associates, Inc.
- Electrical engineer

Presentation Overview

- First decision
- Key concepts:
  Architectural
  Mechanical
  Electrical
- Cost of “Z Squared”
- Q & A

First Decision: LEED® Platinum or Z Squared?

What if….?

…we designed an all electric, super efficient building and then offset all of its power requirements with PV's?

Scott Shell, AIA
conceptual design charrette, September 9, 2005

Architectural / Structural / Landscaping Concepts

- High user comfort
- Reuse the existing building
- Upgraded insulation (R-19 walls, R-30 ceiling)
- Daylight and views
- High performance glass and skylights
- Electro-chromic glass
- Operable windows
- Drought tolerant planting
- Direct reuse of demo materials
- 60% reduction in existing site paving
- Building Integrated PV entrance canopy
- Building Integrated PV cool roof
- Access to public transportation
- 50% Fly ash concrete topping slab

Key concepts: Reuse an existing building

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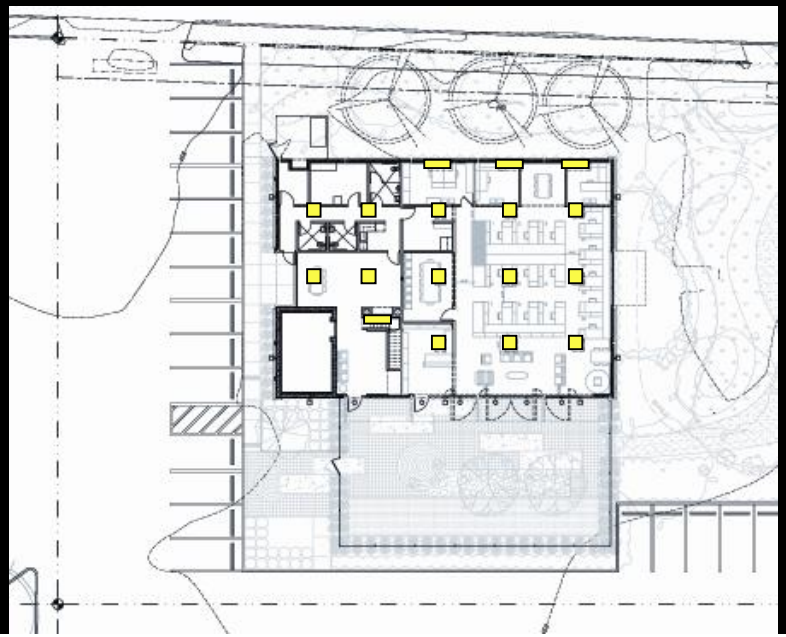
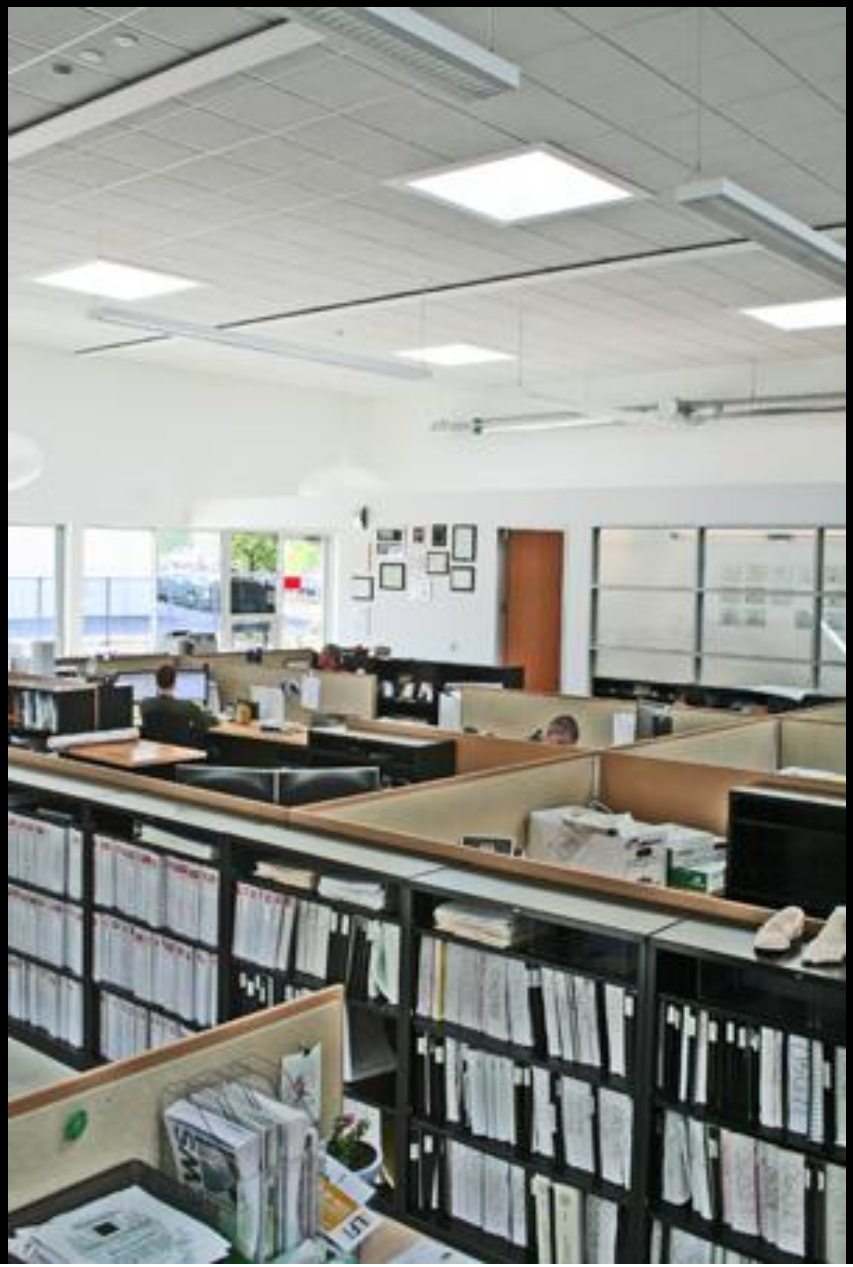
Key concepts: Provide high user comfort

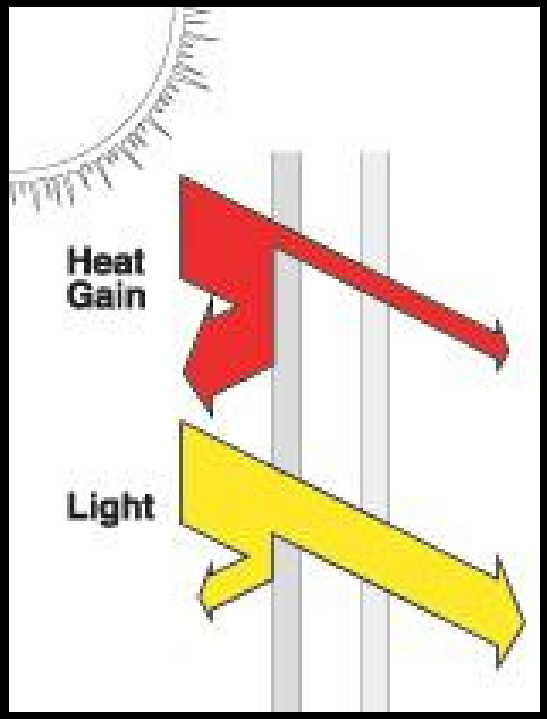
Key concepts: Natural ventilation

Key concepts: Maximize daylight and views





Key concepts: Spectrally selective glass



- Visible transmittance = 63%
- Solar Heat Gain Coefficient = 0.31
- U-value = 0.29 winter night / 0.27 summer day
- Light to solar heat gain ratio = 2.33

Key concepts: Control solar heat gain

Key concepts: Increased wall and ceiling insulation

- R-19 walls
- R-30 ceilings

Key concepts: Drought tolerant landscaping

Key concepts: Mechanical / Plumbing Concepts

- Radiant heating
- Radiant cooling
- Ground source heat pump
- Natural ventilation
- Dedicated OA air handler
- CO_2 sensors - demand ventilation
- Displacement ventilation
- Night time purge
- Photocell powered sensor low flow faucets
- Low flow dual flush toilets
- Waterless urinals
- Heat pump waste heat capture for warm water

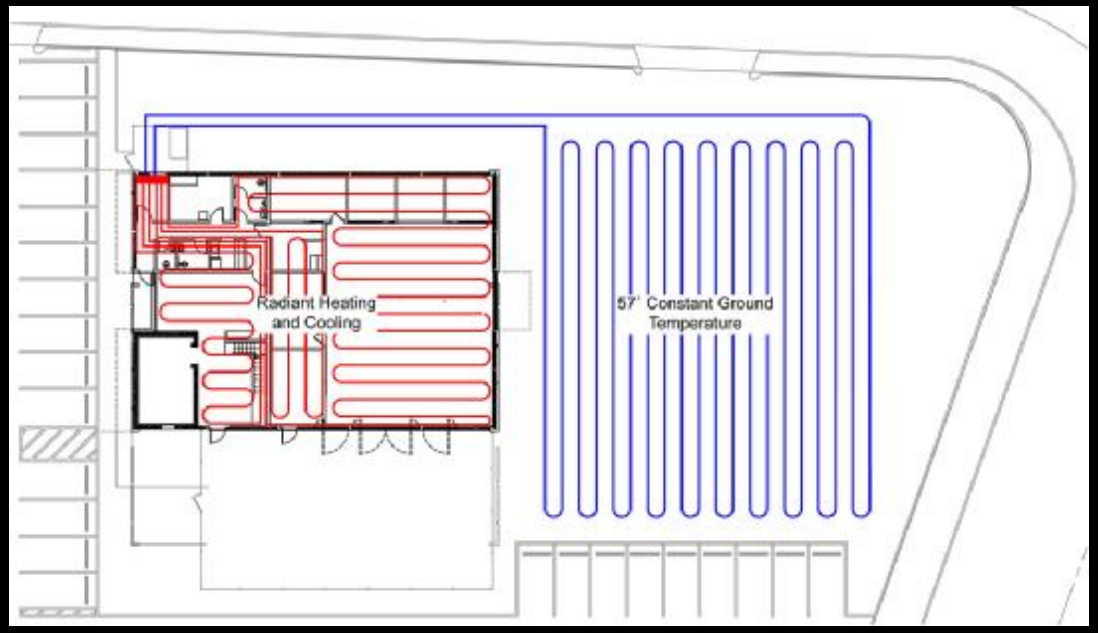
Key concepts: Radiant floor heating and cooling

Occupant comfort is:

- 50% radiation
- 30% air movement / air temperature
- 20% evaporation

Key concepts: Ground source heat pump

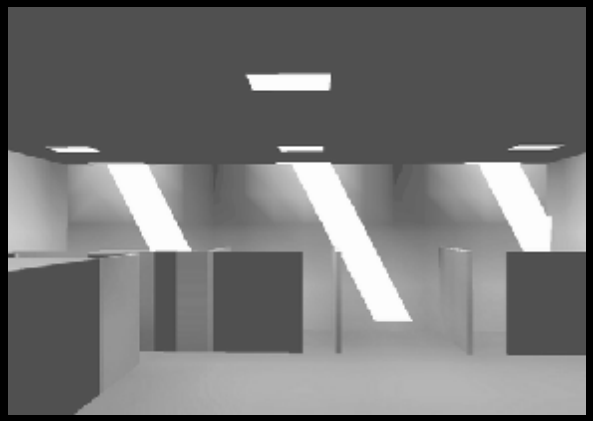
- earth stays constant at about 57°F
- pulls heat from the earth in winter
- puts heat into the earth in summer



Key concepts: Reduced water usage

Key concepts: Electrical / Lighting Concepts

- High efficiency light sources
- Astronomic time clock
- Task/ambient lighting
- Individual occupancy sensor task lighting controls
- Occupancy sensor ambient lighting controls
- Mesopic lighting concepts
- Light pollution reduction
- Daylight switching photosensors
- Daylight dimming photosensors
- Photovoltaic system
- Upsized wiring
- High efficiency transformer
- Energy star equipment
- Occupancy sensor based plug load control
- Wireless data
- VOIP

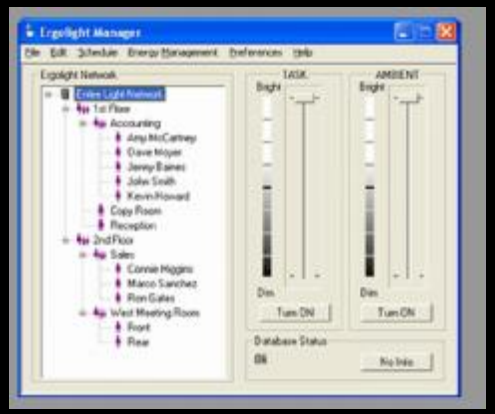


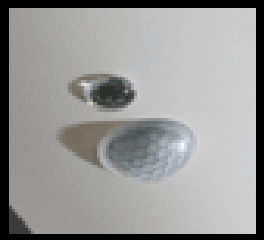
computer model

actual photograph

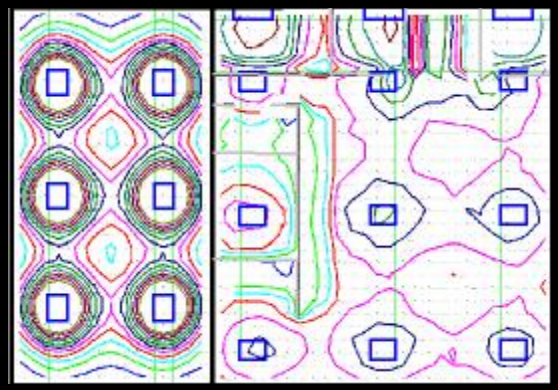
Key concepts: High efficiency light sources

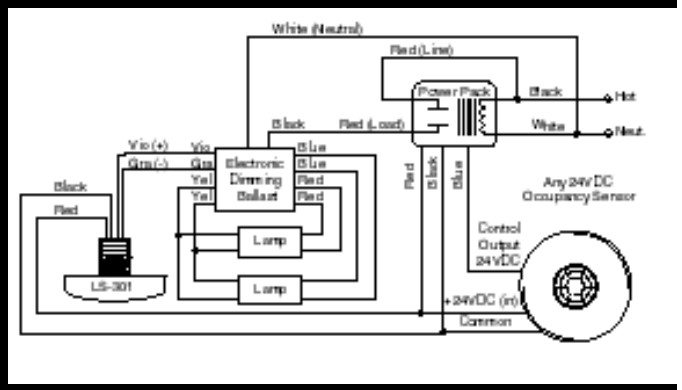
Key concepts: Automatic lighting controls

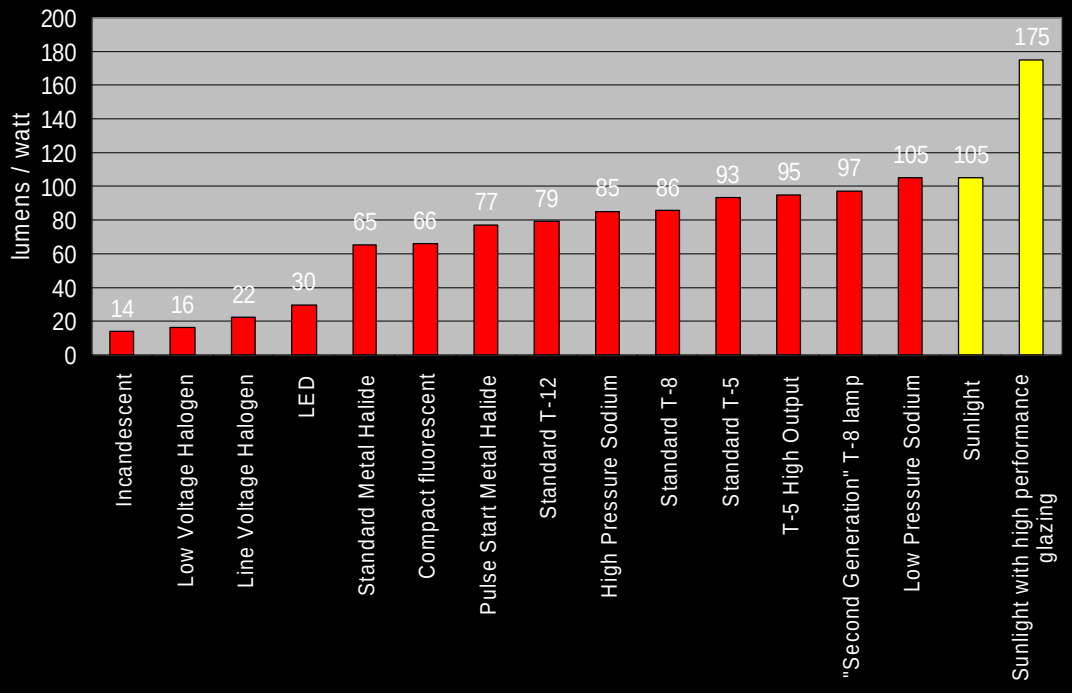




Key concepts: Daylight harvesting





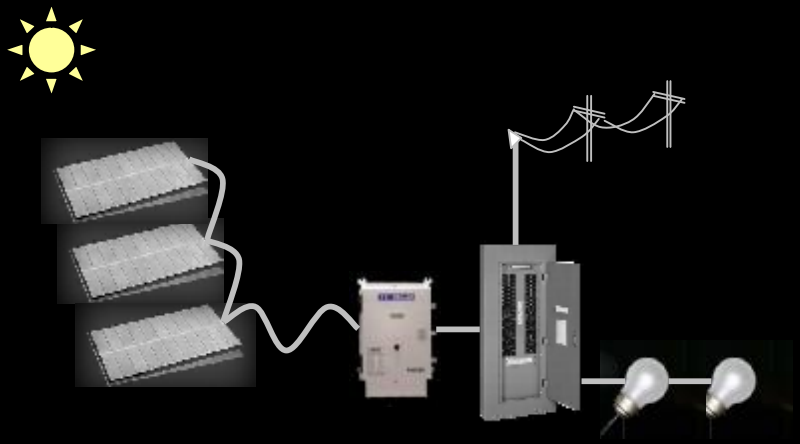


Key concepts: Minimize plug loads

- High efficiency equipment
- Software based shut off
- Occupancy based controls
- Security system based shutdown

Key concepts: BIPV for net 100% of energy consumption

- All electric building
- Net zero energy
- Zero carbon emissions



Analysis: PV system incentives

- PV Capacity 30 kW DC/ 28kW AC
- 42,707 kWh / year

- Estimated PV Cost:

$255,000	installed cost ($8.50/watt)
-72,602	CEC rebate BIPV ($0.34/kWh x 42,707 kWh/yr x 5yrs)
31,858	tax on CEC rebate (35% fed tax, 8.854% state tax)
-76,500	30% federal tax credit
-89,250	accelerated depreciation* (35% federal corp tax)
$48,506	cost of system after 5 years

* calculation does not include the time cost of capital

- the cost after rebates, tax credits and depreciation is about 19% of the installed cost.
- Energy savings at $ 0.16 / kWh = $6,833/year
- Payback is about 7.1 years

Analysis: Estimated additional cost for “Z Squared”

Key differences from a conventional building:

$20,000	cost of upgraded glass
97,500	cost of radiant mechanical system over traditional system.
38,000	cost of concrete for radiant floor
48,500	cost of PV systems (after rebates and tax incentives)
$204,000	total
244,800	total with soft costs
$4,100,000	total cost of building
6.3%	premium to build a net zero energy building

How we did it

- Have a client who is committed to sustainability and willing to take risks.
- Hire a team who is experienced in sustainable design.
- Bring together the entire team during conceptual design. Minimize energy consumption first, size PV's second.
- Focus on daylight harvesting.
- Use radiant floors.
- Look for LEED points after the design is completed. (The building will probably be Gold or Silver.)

Project team

for more information: www.z2building.com
David and Stephania Kaneda, Owner

EHDD Architecture, Architects
www.ehdd.com

Rumsey Engineers Inc., Mechanical and Plumbing Engineers
www.rumseyengineers.com

Integrated Design Associates, Inc., Electrical Engineers and Lighting Design
www.ideasi.com

Tipping and Mar + Associates, Structural Engineers
www.tippingandmar.com

Carroll Engineering , *Civil Engineer*
www.carrollengineering.com

MPA Design, Landscape Architects
www.mpadesign.com

Hillhouse Construction, General Contractor
www.hillhouseconstruction.com