The RFP and Selection Process

506 page RFP
3 very tough teams/2+ months
2 1-on-1 Meetings
1 Interview
FFP for $64MM/4 months
The Problem Statement – The Program

• 218,000 GSF
• $64,000,000 FFP
• 800 Staff Capacity
• Start July 2009 - Occupy 6/2010
The Problem Statement – Performance

• LEED Platinum required
• Natural Ventilation required
• LEED Daylight Credit required
• 50% better than LEED Platinum energy use - required
Today’s Office Building

Range View I

Program

• 55,000 GSF, 4 floors
• $4.7 MM core/shell (2002)
• Design/const +/- 18
Today’s Office Building

Range View I

Performance

• LEED Silver Equivalent
• Rooftop Package Units
• Daylight Credit
ZERO ENERGY BUILD
ZEB Goal

Passive design
Massing, orientation and roof area
Very Efficient MEP and IT
Integrated Workplace Design

$\text{\$\$\$} \quad \text{\$}$
Integrated Design

Systems
- Thermal
- Lighting
- Comfort

Passive
- Thermal
- Lighting
- Comfort

Fundamentals
- Orientation
- Build depth
- Window to wall ratio

Environmental Context Assessment
- Site
- Climate
- Resources
- Systems

Optimize Energy Performance
(Optimization Wedges)
Integrated Design

Cost Transfer

CONVENTIONAL BUILDING

GREEN BUILDING

TOTAL BUILDING COSTS

MECHANICAL

ARCHITECTURE

ELECTRICAL

STRUCTURAL

COST TRANSFER
Integrated Design

Design Simulations

• Energy modeling
• Daylight modeling
• Natural ventilation modeling
• Thermal mass modeling

• And all must meet the Cost Model
Energy and Architecture
WINDOW SUNSHADE

PRE-CAST SANDWICH PANEL:
- 3" CONCRETE
- 2" RIGID INSULATION
- 6" CONCRETE

LIGHTLOUVER
BOUNCES LIGHT DIRECTLY INTO ROOM

SUMMER SUN

WINTER SUN

DOUBLE PANE LOW-E GLASS

COOL AIR

PRE-CAST SANDWICH PANEL:
- 3" CONCRETE
- 2" RIGID INSULATION
- 6" CONCRETE

TRANSPIRED COLLECTOR

FIGURE #1
NREL
The Section
The Section

60'

PV System

Natural Ventilation

Thermal Mass

Transpired Collectors

Daylighting

Radiant Cooling

Radiant Heating

Workplace

UFAD

Labyrinth
Zero Energy Strategies

DL - Daylight
SD - Shading
NV - Natural Ventilation
TC - Transpired Collector
UF - Underfloor Air
LL - Low Energy Lighting
RS - Radiant Slabs
EV - Evaporative Cooling
TM - Thermal Mass
NP - Night Purge
WP - Wind Protection
GI - Green IT

Bio-fuel
Solar Electric
Wind
The Section - Daylighting
Natural Ventilation - Summer Day

50 F to 75 F
Natural Ventilation - Summer Night

> 70 F
The Section – Thermal Mass

Crawl space / Labyrinth
Is it replicable?
How to Design and Build a ZEB
Cost / Construction – Envelope

Energy driven form: 145,000 SF

Conventional form: 65,000 SF
Integrated Design

Cost Transfer

![Diagram showing cost transfer between conventional and green building concepts](image-url)
Cost / Construction – Modularity
Replicable - Cost

- $54.5 Million construction cost
- Excludes site work
- Includes interiors including furniture
- 218,000 SF
- $250 / SF
The Moves – changing the Core/Shell

- Use low energy HVAC
  - Hydronic heat and cool
  - Displacement ventilation/UFAD
- Use climate & exposure conscious glazing
- Use thermal mass to heat and cool
The Moves – changing the Core/Shell – even more

- Operable windows (!) to support night cooling.
- Low energy Data Centers
- Bias toward south/north exposure
The Moves – changing the interior

• More open interior design – design for daylighting and natural ventilation
• In-board offices & modest panel heights
• Minimize the use of ceilings
• Material selections to enhance daylighting
What we’re hoping for

- Higher performing and lower cost photo-voltaic panels
- Cost neutral electro-chromic glass
- A building envelope as good as a leaf (!)
MISSION CRITICAL
Attain safe work performance/Safe Design Practices
LEED Platinum
Energy Star first “Plus”

HIGHLY DESIRABLE
800 staff Capacity
25kBTU/sf/year
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 a “How to” manual
“PR” campaign implemented in real-time
Allow secure collaboration with outsiders
Building information modeling
Substantial Completion by 2010

IF POSSIBLE
Net Zero/design approach
Most energy efficient building in the world
LEED Platinum Plus
ASHRAE 90.1 + 50%
Visual displays of current energy efficiency
Support public tours
Achieve national and global recognition and awards
Support personnel turnover
NREL Building Delivery & Real Estate

- Build to own
- DB Delivery
- Bldg. Orientation/Glazing Area
- Power Purchase Agreement
ZEB Definitions

Net Zero **Site Energy** Building

Net Zero **Source Energy** Building

Net Zero **Energy Cost** Building

Net Zero **Energy Emissions** Building
Zero Energy Buildings: A Critical Look at the Definition
Preprint
P. Torcellini, S. Pless, and M. Deru
National Renewable Energy Laboratory
D. Crawley
U.S. Department of Energy
To be presented at ACEEE Summer Study
Pacific Grove, California
August 14–16, 2006
The Design-Build Team

Builder

Haselden Construction, LLC

Daylighting + LEED

Structural

K L&A, Inc.

Civil

MEP + Energy

Stantec
Beauty in the Numbers

Zero
Natural Ventilation

South

Auto

Manual

North

Auto

Manual

4 FT
Photovoltaic System

787 KW

332 KW
Power Purchase Agreement (PPA)

Building Owner
- Gets clean, renewable energy
- Gets a competitive long term power contract
- Provides roof or site area for PV

Solar Developer
- Gets 30% Federal tax credit
- Gets Solar RECS from Utility
- Gets 20 year contract for power
- Installs and maintains equipment

Utility Company
- Gets to claim renewable energy toward renewable portfolio standard
- Provides net metering
ZEB – RENEWABLE ENERGY

HEATING PLANT (WOOD CHIP) 1768 MBTU/YR

GREEN POWER (GRID) 4525

RSF ROOF 787 KW 3537 MBTU/YR

RSF PARKING 332 KW 1490
<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Off-grid</td>
</tr>
<tr>
<td>A+</td>
<td>Low-energy building, 100% RE within building footprint</td>
</tr>
<tr>
<td>A</td>
<td>Low-energy building, &gt;50% RE within building footprint, remainder RE within site</td>
</tr>
<tr>
<td>A-</td>
<td>Low-energy building, &lt;50% RE within building footprint, remainder RE within site and campus</td>
</tr>
<tr>
<td>B+</td>
<td>Low-energy building, &gt;50% RE within building footprint, site or campus, remainder RE off site</td>
</tr>
</tbody>
</table>
# ZEB - CLASSIFICATIONS

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B</strong></td>
<td>Low-energy building, &lt;50% RE within building footprint and site, remainder RE off site</td>
</tr>
<tr>
<td><strong>B-</strong></td>
<td>Low-energy building, 100% RE off site</td>
</tr>
<tr>
<td><strong>C+</strong></td>
<td>Low-energy building, &gt;50% RE within building footprint, site or campus, remainder green power</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Low-energy building, &lt;50% RE within building footprint, site or campus, remainder green power</td>
</tr>
<tr>
<td><strong>C-</strong></td>
<td>Purchase green power</td>
</tr>
</tbody>
</table>
SITE ZEB/B+ -503 MBTU/yr

HEATING PLANT (WOOD CHIP) 1768 MBTU/YR

RSF ROOF 787 KW 3537 MBTU/YR

RSF PARKING 332 KW 1490
SOURCE ZEB/A 493

RSF ROOF 787 KW
3537 MBTU/YR

RSF PARKING 332 KW
1490 MBTU/YR
EMISSIONS ZEB/A
383 Tons CO$_2$/yr

RSF ROOF
787 KW
3537 MBTU/YR

RSF PARKING
332 KW
1490
COST ZEB/A - 11,381 $/yr

RSF ROOF
787 KW
3537 MBTU/YR

RSF PARKING
332 KW
1490
Sunscreen

Transpired collector
Integrated Design

The Traditional Model is Fragmented!

• Separate disciples act in silos – over the wall approach
• Hierarchal organization
• Team is separated over time
• True cost identified late
Integrated Design

The Integrated Model is Multidisciplinary!

- Collaboration among disciplines
- Flat networks and alliances
- Team begins together
- Cost identified early and often
Integrated Design

An Integrated Start

• Set project and sustainability goals and performance targets
• Eco-charrette – integrate energy/form/site/program
• Brainstorming – think: big, elegant, simple; follow nature
• Research – take the time to identify the issues and opportunities
Daylighting

Glare Control + View Window
Daylight Control + Daylight Window
Daylight Enhancement

Light Louver Unit
Daylight Window 70% Tvis
View Window 36% Tvis

Structural Design
Ceiling Reflectance 85%
Wall Reflectance 70%
Floor Reflectance 70%