Design team commitment:

An Architect’s Perspective

NASA Net Zero Workshop

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DOE/NREL Research Support Facility

Federal Office Building
Golden, CO
RNL/Haselden DB

222,000 sf
Project Overview

- 800 staff
- 222,000 Square Feet
- 2 long, narrow wings
- 4-story north, 3-story south
- Third wing in second phase
- Energy driven design
Project Overview Continued

- **LEED® Platinum Certified:**
  - 58 LEED credits submitted

- **Energy Goal: 35kBtu/sf/year**
  - Incl. high performance data center
  - 50% better than ASHRAE 90.1 2004

- **Designed to net zero energy**

- **2 years: design and construction**

- **RSF 2 performs 17% better at 10% less cost**
Setting the Stage

▶ Nature of contract
  • Performance based design-build
  • Firm fixed price contract

▶ Two-part Contract
  • Firm fixed price contract
  • An initial concept design phase to prove that the DB team could do what they said they could do—50% of fee at risk in this 6 month period
  • Award of a FFP contract following acceptance of the conceptual design—remaining 50% of concept design fee paid

▶ Performance Incentive Program
  • Incentive for "superior performance"
Unusual Project Requirements

- 26 proposal objectives
  - LEED Platinum and ZEB design
- 600+ substantiation items
- Performance specs vs. bridging docs
- Firm Fixed Price risk transfer design build contract
  - Design-build on steroids!
$2 Million Owner Incentive Value Offered

- Managing owner risks
- Mitigating owner risks
- Mgmt reserve vs. incentives
- NREL optimized scope
- Focused Owner involvement
RSF Incentive Program Structure

- 6 evaluation periods
  - Preliminary Design: $400,000
  - Design Development: $300,000
  - Contract Documents: $300,000
  - Construction: $500,000
  - Closeout: $400,000
  - Commissioning/Warranty: $100,000

- Incentives rollover
Public Award Fee Program Continued

- Develop written incentive plan
- Describe how process will be administered; consistency
- Assign board to conduct evaluations
- Develop evaluation criteria, publish to D-B team
- D-B team conducts self evaluation
Designing Before You Win -

This is a new world for architects

- **Architects dislike competitive design-build**
  - proposal costs extreme, risks are very high
  - undesirable relationship with GC
  - insulation from owner — difficult to understand their needs
  - Program and requirements may not be clear

- **Keep end in mind**
  - back end incentive
  - Once project awarded, DB team can execute effectively and efficiently
  - incentivize designer’s up front investment with stipend
  - Performance incentive is a critical ingredient to make the risk worthwhile
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What is different about creating a NET 0 energy building?

ENERGY DRIVEN ARCHITECTURE
Energy Driven Architecture

A collaborative/integrative design process

► Every discipline drives the design for optimum performance
  • Energy modeling at every stage
  • Sustainable strategies drive the architectural solutions
  • Design Build team must balance design and cost at each step

► Ego is put aside—ideas can be generated by any member of the team

► Energy Driven design is a contribution of architecture, electrical, mechanical, structure, site civil and landscape
Energy Driven Architecture

The first design must be the right design

- Decisions made early determine solutions in detail later on
  - Solutions cannot depend on complicated systems
  - Rather the architecture must achieve passive performance
  - The key is optimization of design, energy performance, and cost
  - Commitments made early have to stick later on.
  - Risk must be minimized by lack of change—decisions must be made and adhered to throughout the detailed design process
  - This requires more detailed performance analysis in every step of design.
Energy driven design optimizes where the dollars are spent to achieve results.
Any building can be Net 0 if you simply buy enough renewable energy!
The RSF design was driven on the first day by the most effective cross section for natural day-lighting.
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Natural ventilation provides optimal reflection of the Colorado Climate
Operable windows offer occupants the choice to naturally ventilate
Night purge of space removes heat and prepares space for the next day
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The “lazy H” floor plan reflects the orientation of the site to optimize daylight
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The interior design reflects the energy strategy of daylight and ventilation
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Light louvers reflect daylight deep into the space
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Closed offices are designed without “lid” to allow daylight and ventilation
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Transpired Solar Collectors capture heat for tempering ventilation air
A “labyrinth” below the building captures and stores air from the collectors.
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Ventilation is in raised floor plenums that distribute air to individual work space
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All heating is hot water hydrotherm located in the ceiling space
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The Data Center captures heat and adds to heat storage in the labrinth
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A net 0 strategy requires a paradigm shift in the way the user lives with the building day in and day out.
The building still consumes 35Kbtu/sq ft per year—thus the difference is made up from renewable energy—PV, wind, and biomass
The building is already operating Net 0 without all of the PV fully operational.

First day of Net zero – June 23, 2011
Awards and Articles

- Over 29 awards won as of June 2012
- Over 100 articles published about the project worldwide
- Over 3000 visitors tour the building
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Questions?