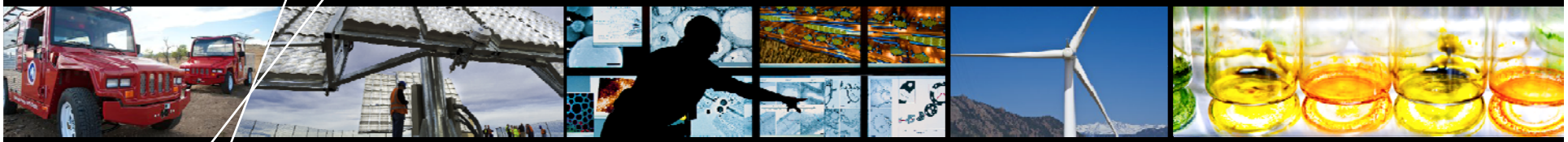
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

FEMP
Federal Energy Management Program

Design Team Commitment:

Contractor Perspective on Cost Control



NASA Net Zero Workshop

Brian Livingston
Haselden Construction

June 5, 2012

The Performance Driven Contract & the Relationship

- Firm, Fixed Price = Full Risk Transfer 'Cost Guarantee'
- Guarantees are shared commitment from both sides
- Commitment from top project execs to project team – keep the dialog open, find the balanced answer
- DB Team – plan and provide for the whole project
- Owner Team – work within the RFP, no changes

- Performance Specifications are the target
  - Performance focused specifications best for innovation & energy outcomes
  - Design Build Team responsible for creating the outcome
  - Requires active, ongoing involvement of owner and representatives
  - Focus: performance, not form/materials
  - **DB Team balances 1st cost, energy, performance**

Problem Definition: RFP Objectives

MISSION CRITICAL

Attain safe work performance/Safe Design Practices

LEED Platinum

Energy Star "Plus"

HIGHLY DESIRABLE

800 staff Capacity

25kBTU/ft^2/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 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

RFP also required maximum use of natural ventilation and 90% of floor space fully daylit

Constructing Zero Energy

- Innovation requires alternative approach
  - Client, Contractor and A/E
  - beyond Platinum best by Design Build Delivery
  - **Innovative intent without contract support can miss energy, budget or schedule targets**

Constructing Zero Energy

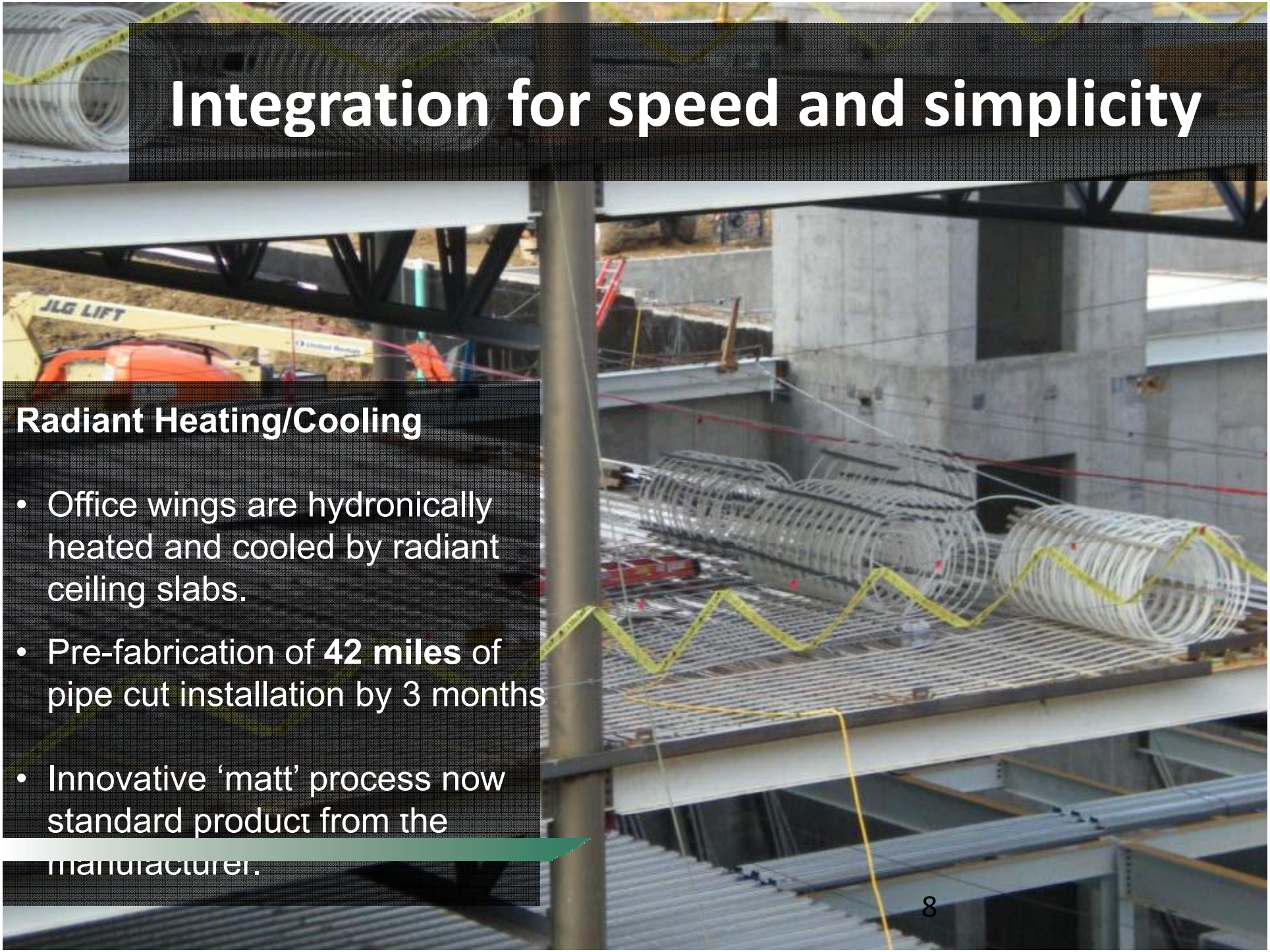
- Full detailed estimate from the beginning
- Estimate updated frequently
- Target budgets become project costs

Description		Sub-System Total	SYSTEM TOTAL
Services			$ 15,830,836
Conveying Systems	SUBTOTAL	$532,975	
Mechanical	SUBTOTAL	$9,201,709	
Fire Protection	SUBTOTAL	$922,774	
Electrical	SUBTOTAL	$5,173,378	
Equipment & Furnishings			$ 4,402,359
Equipment	SUBTOTAL	$117,740	
Furnishings	SUBTOTAL	$4,284,619	
Sitework			$ 330,418
Sitework	SUBTOTAL	$330,418	

SUBTOTAL DIRECT COSTS	$	48,963,526
General Conditions	$	3,332,679
Project Insurances	$	899,495
Design/Build Contingency - 8%	$	3,917,082
Project Bond	$	566,895
SUBTOTAL CONSTRUCTION COSTS	$	57,679,676
Design Fee - Lump Sum	$	5,298,100
Construction Fee - Overhead & Profit - 6.5%	$	4,093,555
TOTAL CONSTRUCTION COST		67,071,332

- The big 5 subcontractors - select early for cost control
  - Structural Steel
  - Mechanical/Plumbing – AHU's, Hydronic, pumps
  - Electrical – lighting, cabling, electrical distribution
  - **Envelope – the single most costly per SF and the most impactful to energy**
    - Glass and Glazing
    - Pre-cast concrete wall system

Integration for speed and simplicity



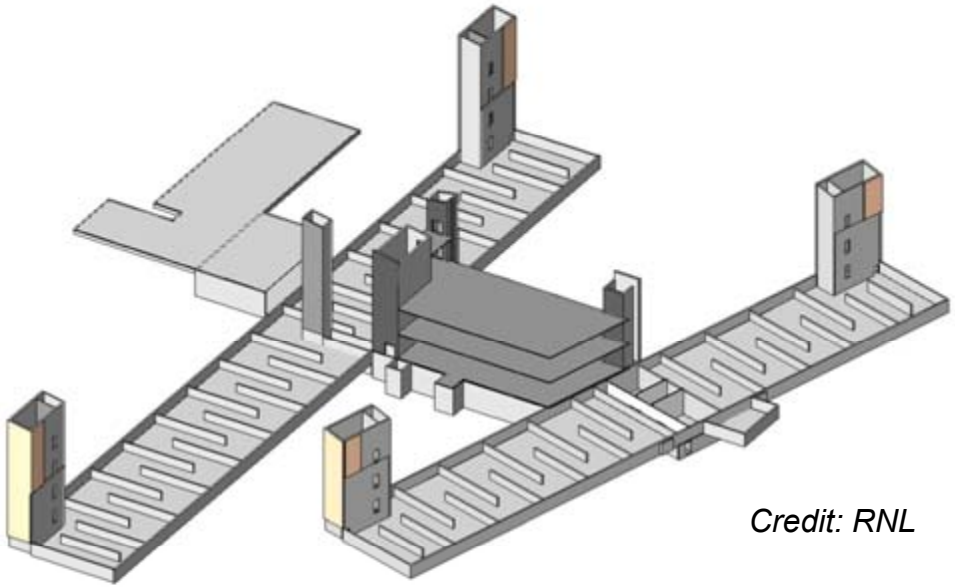
Radiant Heating/Cooling

- Office wings are hydronically heated and cooled by radiant ceiling slabs.
- Pre-fabrication of **42 miles** of pipe cut installation by 3 months
- Innovative ‘matt’ process now standard product from the manufacturer.

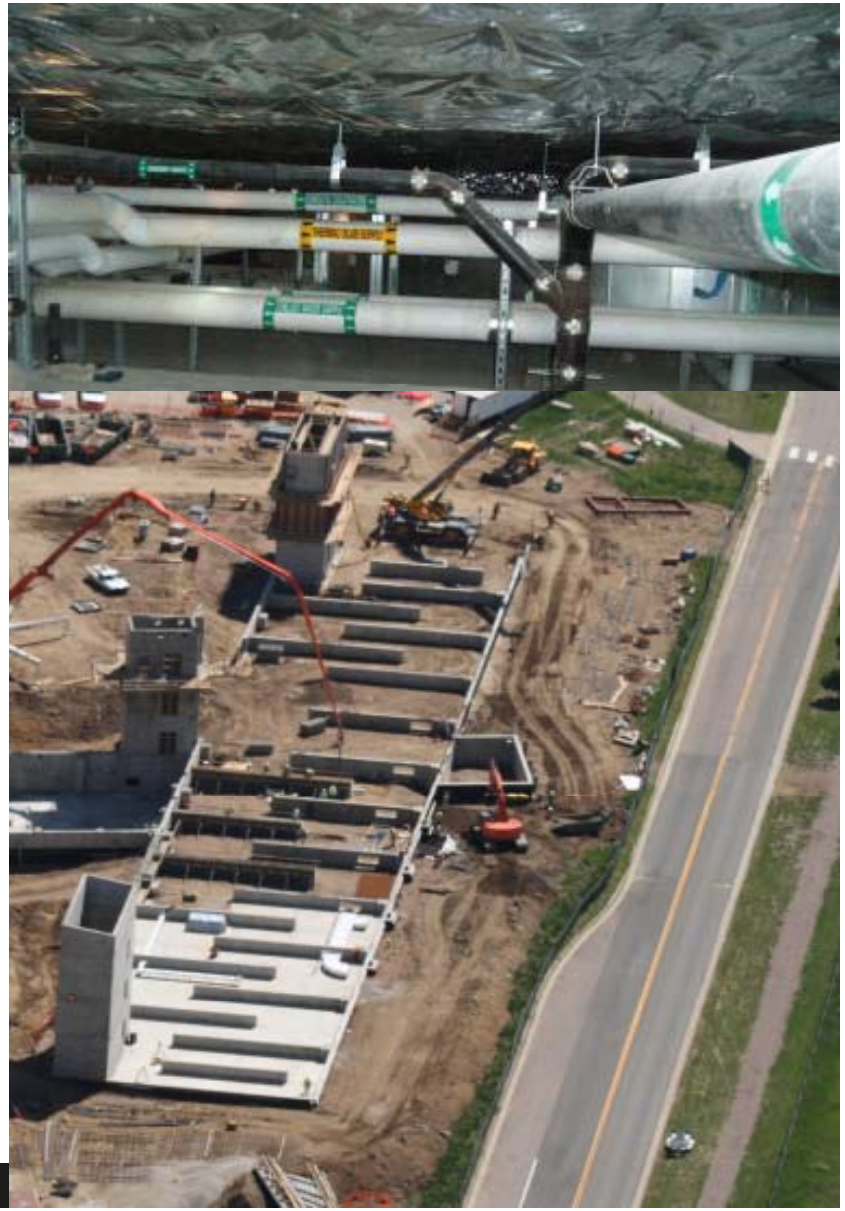
Building Structural Elements Efficiency

Thermal Storage Labyrinth

- Staggered concrete basement structure stores thermal energy
- Offset cost of export of expansive clay
- Provides passive heating and cooling of the building.



Credit: RNL



Substantiation – backing up the promise

- **All performance requirements substantiated per design package**
- **Created verifiable, incremental demonstration of solutions**
- **Tracked progress on 16 Division Performance Specifications**

Section:	**Facility Performance**
Category:	**Ease of Operation**
Item #:	**F.4.c.2.**
Prepared by:	**TEAM**
Submittal for Review:	**3/17/09**
Returned:	
Resubmission:	
Final Submission:	
Assoc. Design Package:	**Design Package 3**

- ☐ 100% Preliminary Design Substantiation
- ☐ Design Package 1
- ☐ Design Package 2
- ☒ Design Package 3
- ☐ 100% Construction Administration Substantiation

[Appendix A, Conceptual Documents]

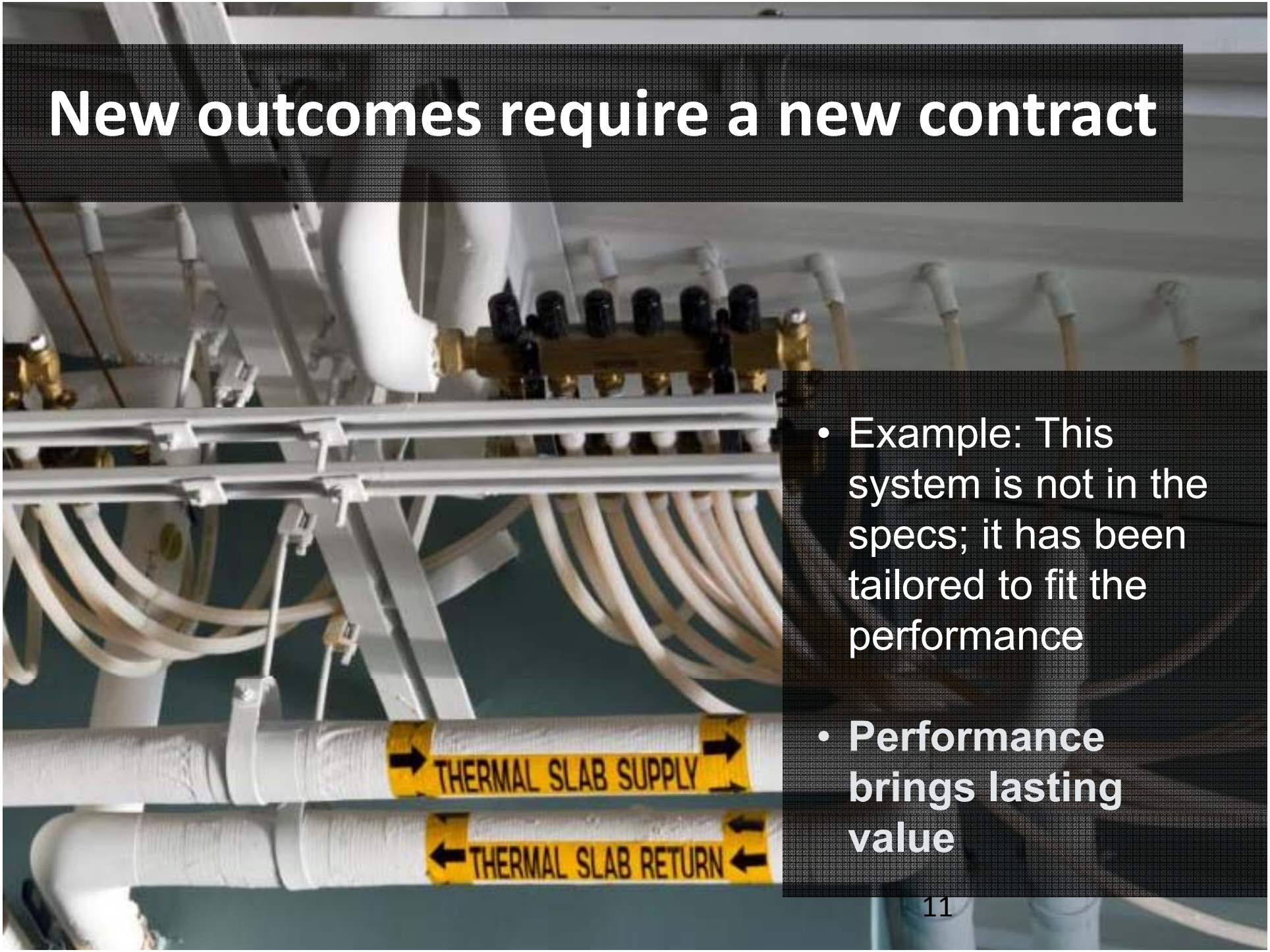
F. Operation and Maintenance:

4. Ease of Operation: Provide facility, equipment, and systems that are easily operated by personnel with a reasonable level of training for similar activities.

c. Substantiation:

2) Design Development: Operating impact analysis, including identification of type and quantity of staff, tools, and supplies required; estimate of impact that aging materials will have on operating requirements; no cost calculations required; identify source of data.

New outcomes require a new contract



- Example: This system is not in the specs; it has been tailored to fit the performance
- **Performance brings lasting value**

Constructing Zero Energy

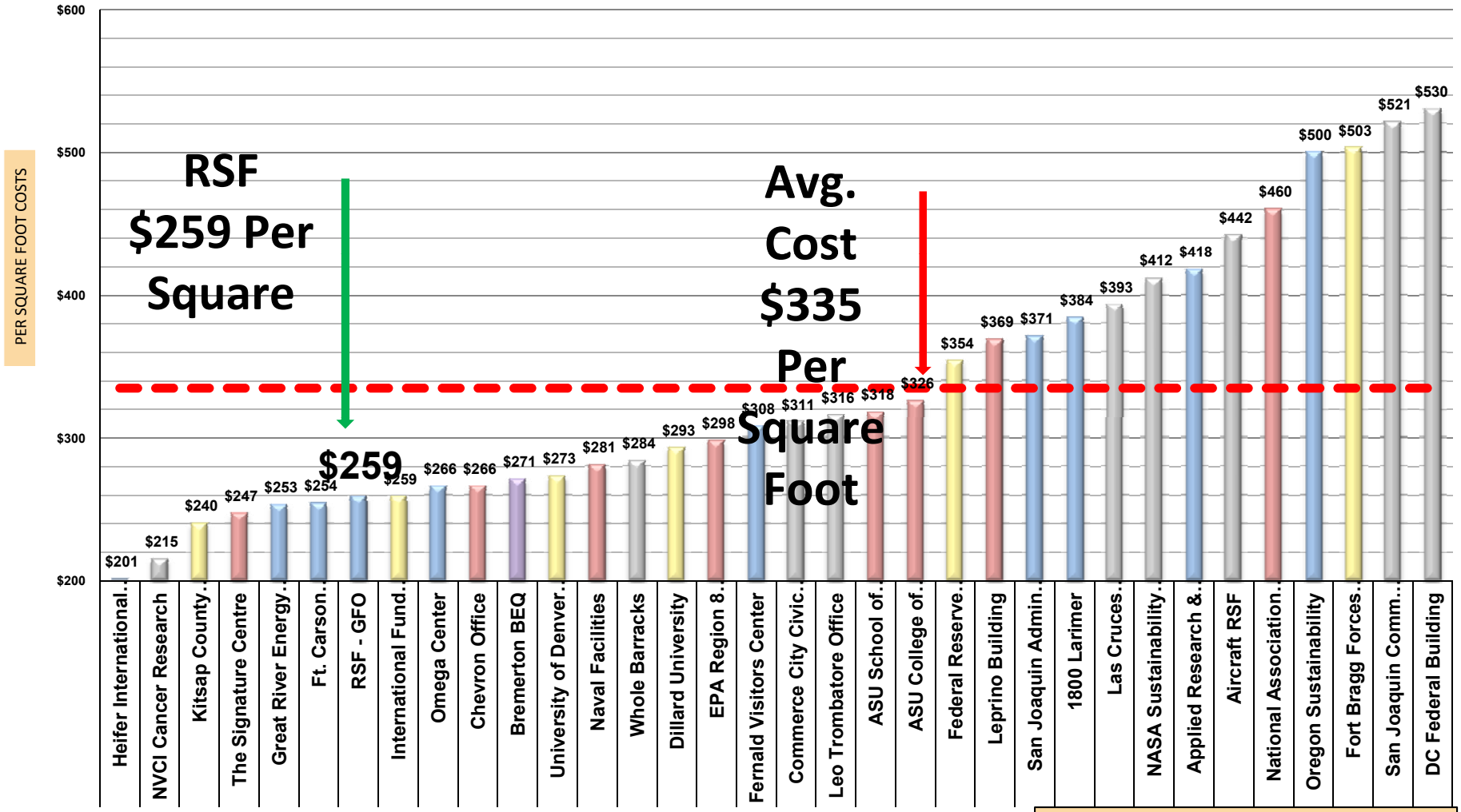
- Low and Zero Performance is a participation sport

•Willingness to accept change (in many things) to achieve new outcomes

- •Office standards do effect energy
- •AV equipment does effect energy
- •Your behavior effects energy

•Active and ongoing client participation = cost, performance & schedule success

COMMERCIAL CONSTRUCTION BUILDING COSTS – By Cost Per Square Foot



NOT RATED
LEED CERTIFIED
LEED GOLD
LEED SILVER
LEED PLATINUM

PROJECTS AND LEED CERTIFICATION

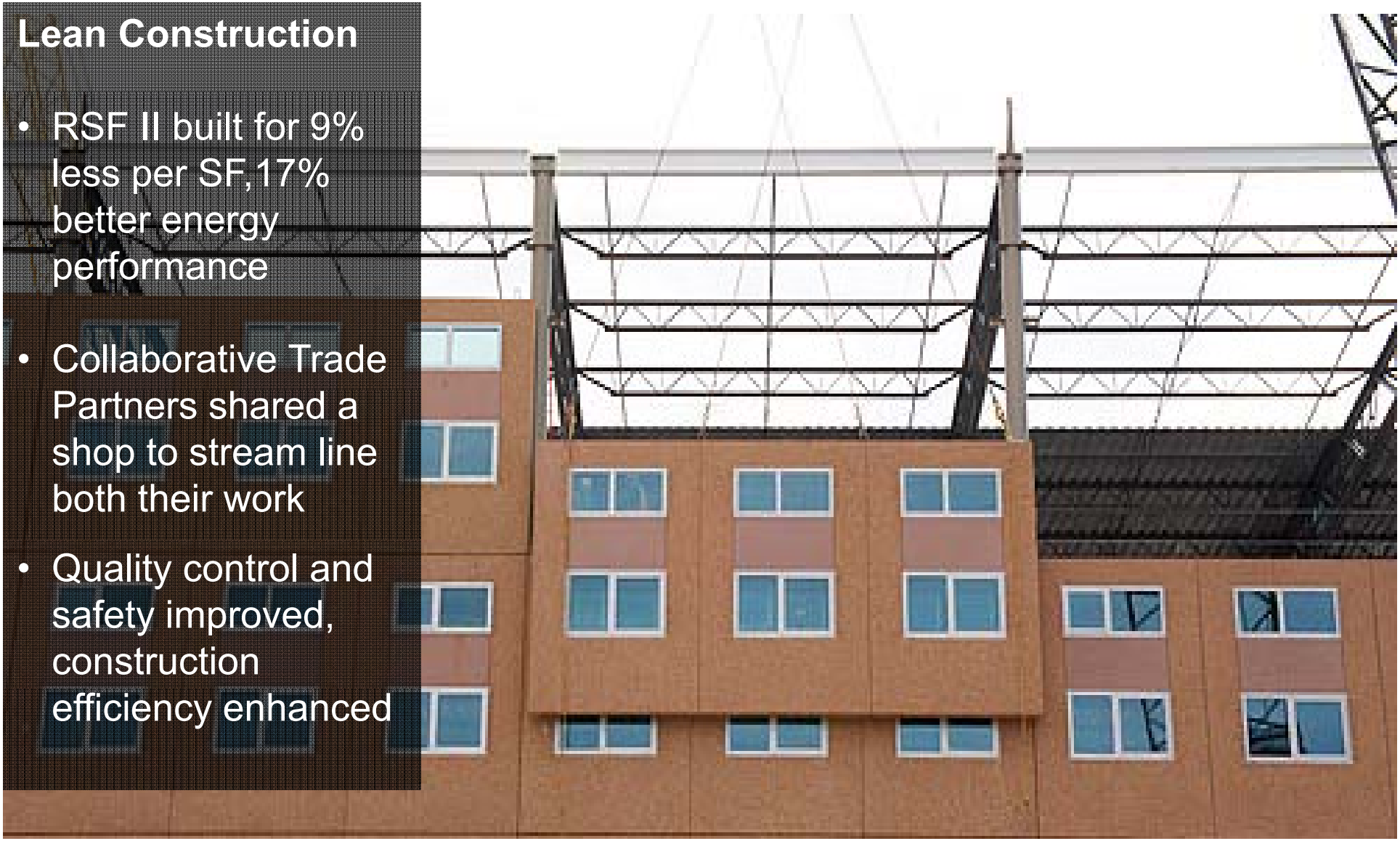
SOURCES:

www.fayobserver.com
www.dbia.com
www.nasa.gov
www.eomega.org
www.oregonsustainabilitycenter.org
www.americas.rlb.com
http://greensource.construction.com
www.1800larimer.com
www.usgbc.org
www.smithgroup.com
www.cronkite.asu.edu

Off-Site Glazed Wall Panels

Lean Construction

- RSF II built for 9% less per SF,17% better energy performance
- Collaborative Trade Partners shared a shop to stream line both their work
- Quality control and safety improved, construction efficiency enhanced



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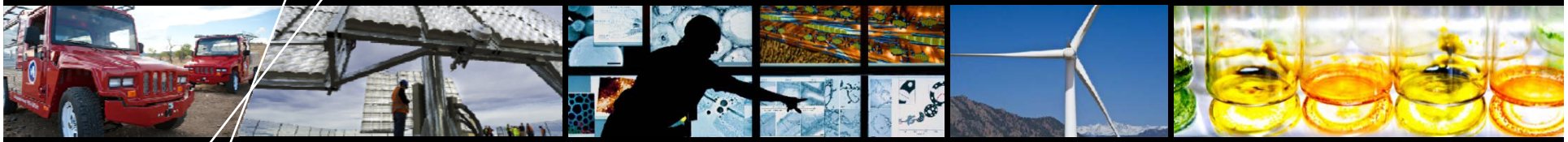

Questions?