Sustainable Development

NATIONAL BUILDING ENERGY CODES WORKSHOP | AUGUST 2, 2006

OPUS, NORTHWEST, L.L.C.

OPUS ARCHITECTS & ENGINEERS

ZIMMER GUNSUL FRASCA PARTNERSHIP

SHEARS ADKINS ARCHITECTS, L.L.C.

SYSKA HENNESSY

DOYLE ENGINEERING

ARCHITECTURAL ENERGY CORPORATION

PRESENTED BY:

AMY JAVERNICK WILL | OPUS NORTHWEST, L.L.C.

CATHY BERLOW | US ENVIRONMENTAL PROTECTION AGENCY

SHAYNE BRADY | US ENVIRONMENTAL PROTECTION AGENCY

COURTNEY FRANCE | ARCHITECTURAL ENERGY CORPORATION

P R E S E N T A T I O N O V E R V I E W

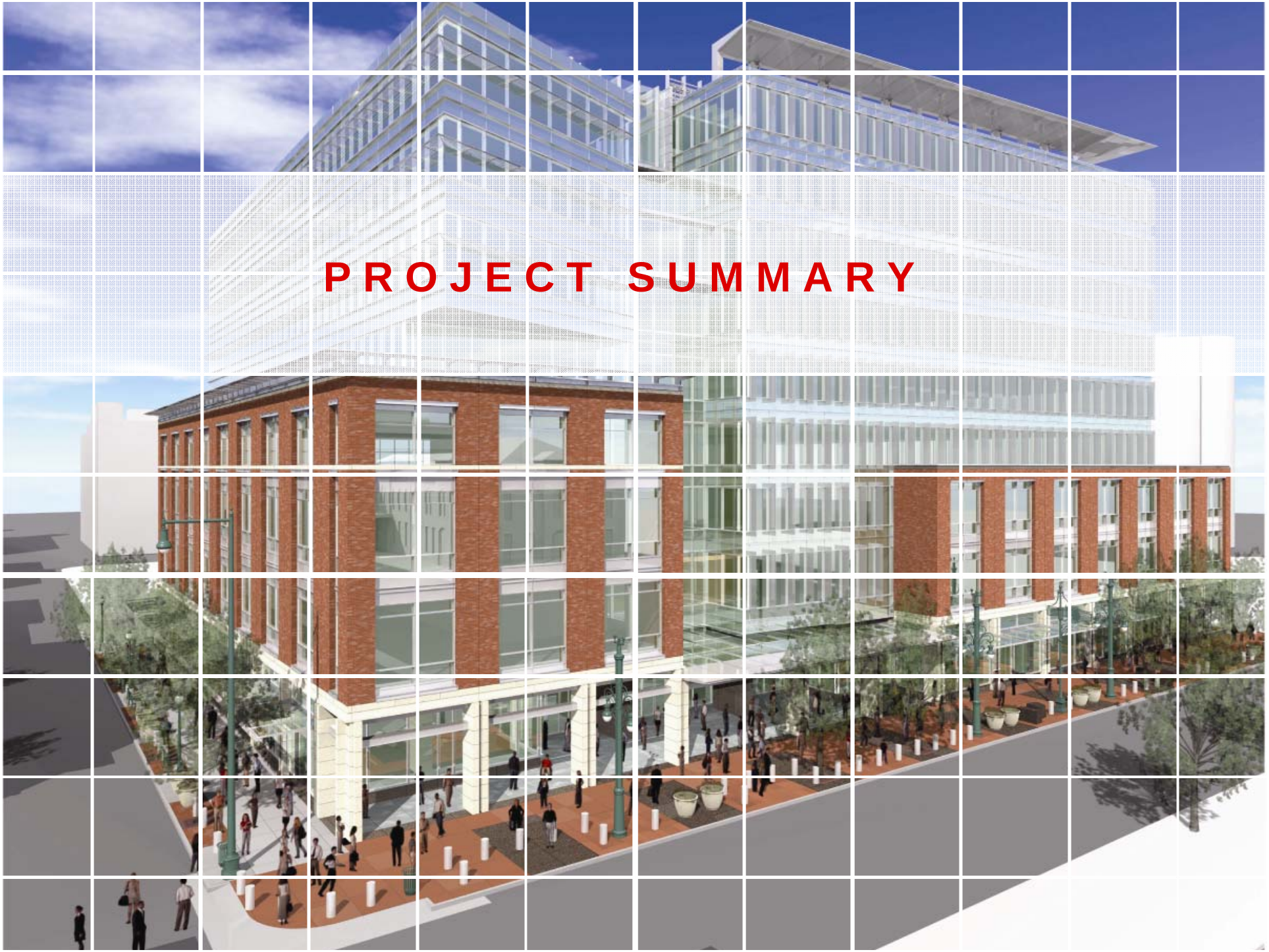
Project Summary

Solicitation for Offer/Public-Private Partnerships

Sustainability Strategies

Partnerships

Best Practices/ Lessons Learned


PROJECT SUMMARY

BUILDING STATISTICS

- 418,300 SF Building
- Ground Level Retail
- 9 Stories of Office Space (Approx. 305,400SF)
- 2 Levels of Below Grade Parking (226)
- 2006 Scheduled Completion
- Leased Facility



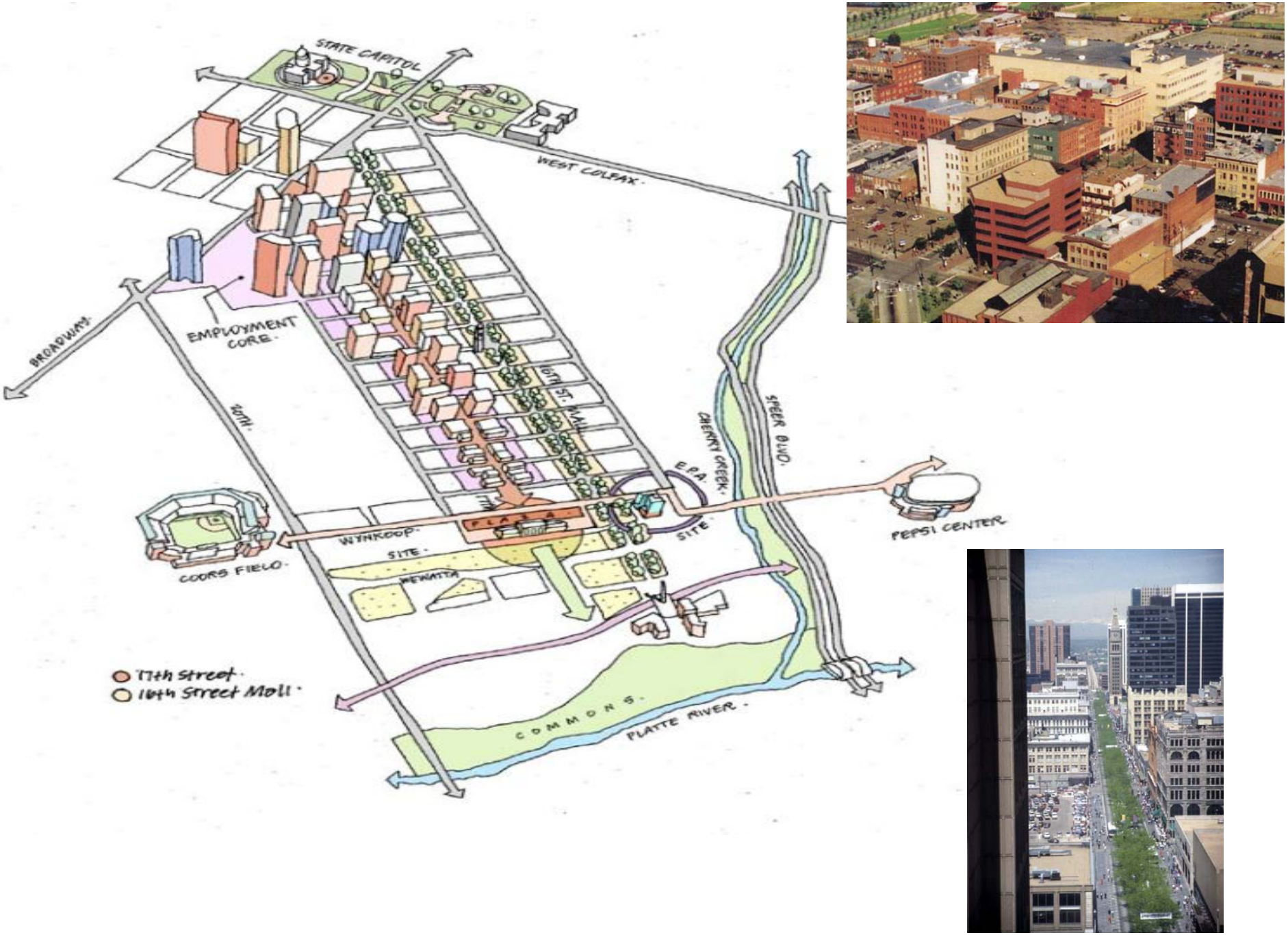


Goals:

Security

Sustainability

Location

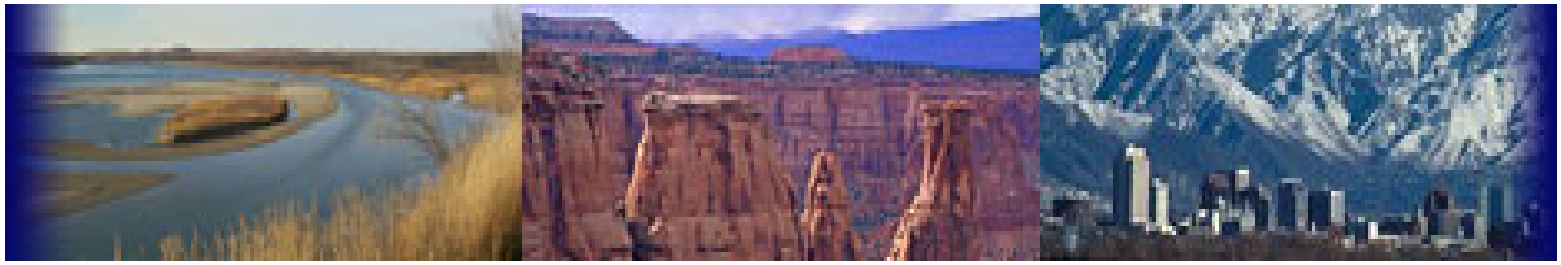

STATE CAPITOL
WEST COLFAX
BROADWAY
EMPLOYMENT CORE
16th ST. MALL
SPEER BLVD.
CHERRY CREEK
EPA
SITE
WYNKOOP
SITE
PEPSI CENTER
COORS FIELD
17th Street
16th Street Mall
COMMONS
PLATTE RIVER


McCORMICK'S
Fish House & Bar
THE OXFORD
USA TODAY


UNION STATION
TRAVEL BY TRAIN
UNION STATION


SOLICITATION FOR OFFER

10 Regions Within the US EPA



Mountain and Plains- Region Eight

6 States- Colorado, Wyoming, Utah,

Montana, North Dakota, South Dakota

27 Tribal Nations

EPA NATIONAL PROJECT GOALS:

- Environmental Stewardship
- LEED Certification
- Energy Star Compliance
- Security
- Executive Orders/Memorandum of Understanding

EPA PROCUREMENT STRATEGIES:

Maximum Sustainability within the Budget

Competitive Design

LEED Scorecard with Designated Point Preferences
(LEED requirement, Preference, Interest)

Specify Minimum EPA Mandatory Requirements for Sustainability and Security While Balancing Cost

Penalties for Not Meeting LEED/Energy Star Requirements

$250,000 Annually If Not Attained/Maintained

Region 8 SFO PROCESS:

- 10 year/GSA Best Value - Not Low Bid
- Three Stage Selection Procurement Strategy
  - Site
  - Team
  - Building

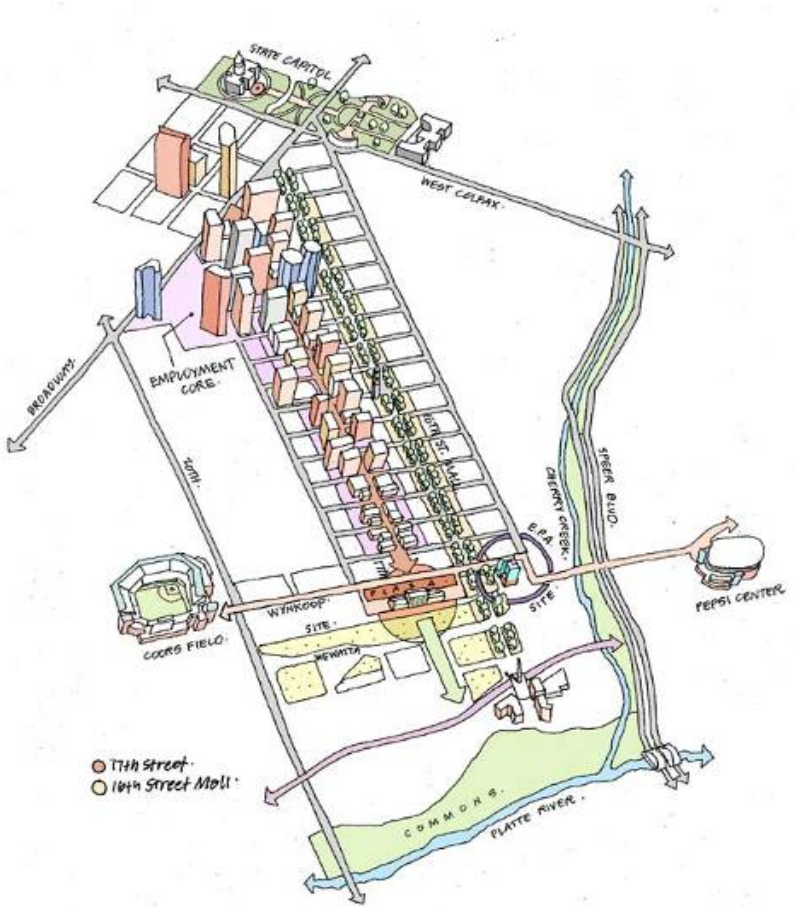




SITE REQUIREMENTS:

50,000 to 100,000 sf

Downtown Location
Near Transit/Lodging
Environmental Suitability/
Brownfield preference
Zoning/Easement for
Density/Security Setbacks
No Public Parking
Cost
Environmental Assessment







Team Requirements:

- Team Qualifications
- Past Performance and References
- Team's Previous Sustainable Projects

Building Design Requirements (Short Listed Teams):

- 231,281 usable sf with minimum 25,000 sf floor plate
- Concept Design
- Design Narratives
- Energy Model/Budget & Use Commitment
- LEED Scorecard
- Operations and Maintenance Plans
- Sustainable Construction Practices
- Material Selection
- Cost

SFO Energy Requirements Highlights:

- Electrical Design Load
- Encourage Energy Savings Performance Contract
- Energy Use 30% Better than ASHRAE
- Energy Star– 75 or Better
- Building Metering
- Independent Commissioning Agent
- Artificial & Natural Lighting
- Ventilation Effectiveness
- Stacked Core Functions
- White/ Reflective Roof/ Green Roof
- Energy Reporting

More information: www.epa.gov/greeningepa


SUSTAINABILITY STRATEGIES

What Is Sustainable or “Green” Development?

Sensitivity to:

Environment

Resource and Energy Conservation

Impact on People (quality of work space)

Financial Impact





Sustainability Requirements in the SFO

Performance Requirements:

- LEED v 2.1 Silver Certification
- EPA Energy Star Program Certification

Prescriptive Requirements (Examples):

- Specific Building Material Emission Levels
- FSC Wood for Particular Products
- CO2 Sensors
- Occupancy Sensors for Lights
- Air-Change Effectiveness of E=0.9 or better (ASHRAE)

LEED Scorecard: Sustainable Sites

LEED
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

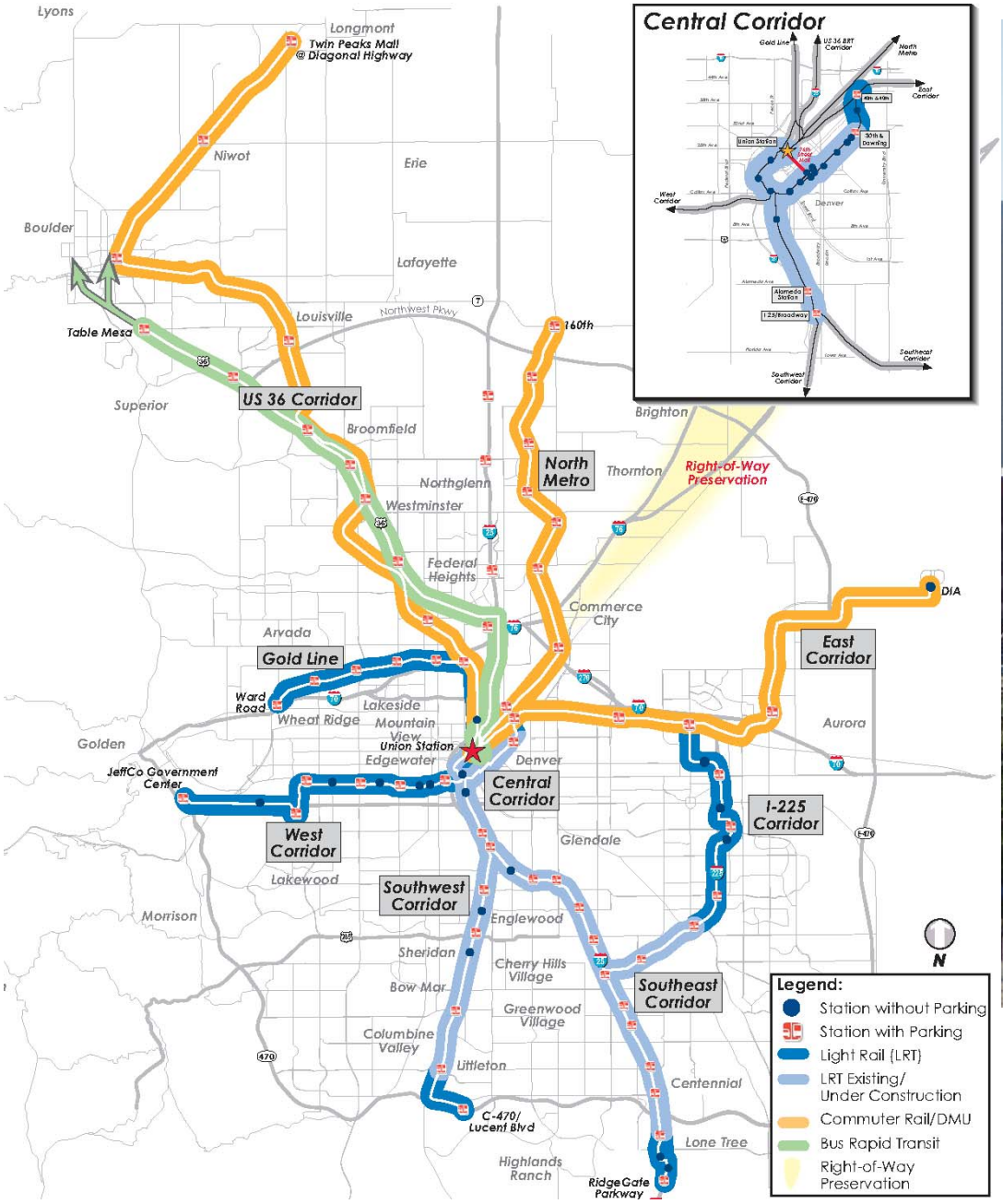
EPA Region 8 Headquarters

Version 2.1 Registered Project

Y	M	N	Sustainable Sites - 14 Points	
Y			Prereq 1	**Erosion & Sedimentation Control**
	X		Credit 1	**Site Selection**
X			Credit 2	**Urban Redevelopment**
X			Credit 3	**Brownfield Redevelopment**
X			Credit 4.1	**Alternative Transportation**, Public Transportation Access
X			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms
X			Credit 4.3	**Alternative Transportation**, Alternative Fuel Vehicles
X			Credit 4.4	**Alternative Transportation**, Parking Capacity and Carpooling
		X	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space
		X	Credit 5.2	**Reduced Site Disturbance**, Development Footprint
		X	Credit 6.1	**Stormwater Management**, Rate and Quantity
	X		Credit 6.2	**Stormwater Management**, Treatment
X			Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands**, Non-Roof
X			Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands**, Roof
		X	Credit 8	**Light Pollution Reduction**
8	2	4	***14 Possible***	






Central Corridor
Lyons
Longmont
Twin Peaks Mall
@ Diagonal Highway
Niwot
Erie
Boulder
Lafayette
Louisville
Northwest Pkwy
Table Mesa
US 36 Corridor
Superior
Broomfield
160th
Brighton
North Metro
Thornton
Right-of-Way Preservation
Northglenn
Westminster
Federal Heights
Commerce City
DIA
Arvada
Gold Line
East Corridor
Ward Road
Lakeside
Wheat Ridge
Mountain View
Aurora
Golden
Union Station
Edgewater
Denver
JeffCo Government Center
Central Corridor
I-225 Corridor
West Corridor
Glendale
Lakewood
Southwest Corridor
Morrison
Englewood
Sheridan
Cherry Hills Village
Bow Mar
Southeast Corridor
Greenwood Village
Columbine Valley
Littleton
Centennial
C-470/ Lucent Blvd
Lone Tree
Highlands Ranch
RidgeGate Parkway
N
Legend:
Station without Parking
Station with Parking
Light Rail (LRT)
LRT Existing/ Under Construction
Commuter Rail/DMU
Bus Rapid Transit
Right-of-Way Preservation

garden roof system

high albedo (reducing heat island effect)

habitat creation

CO2 absorption

WQCV – stormwater treatment

Occupant amenity

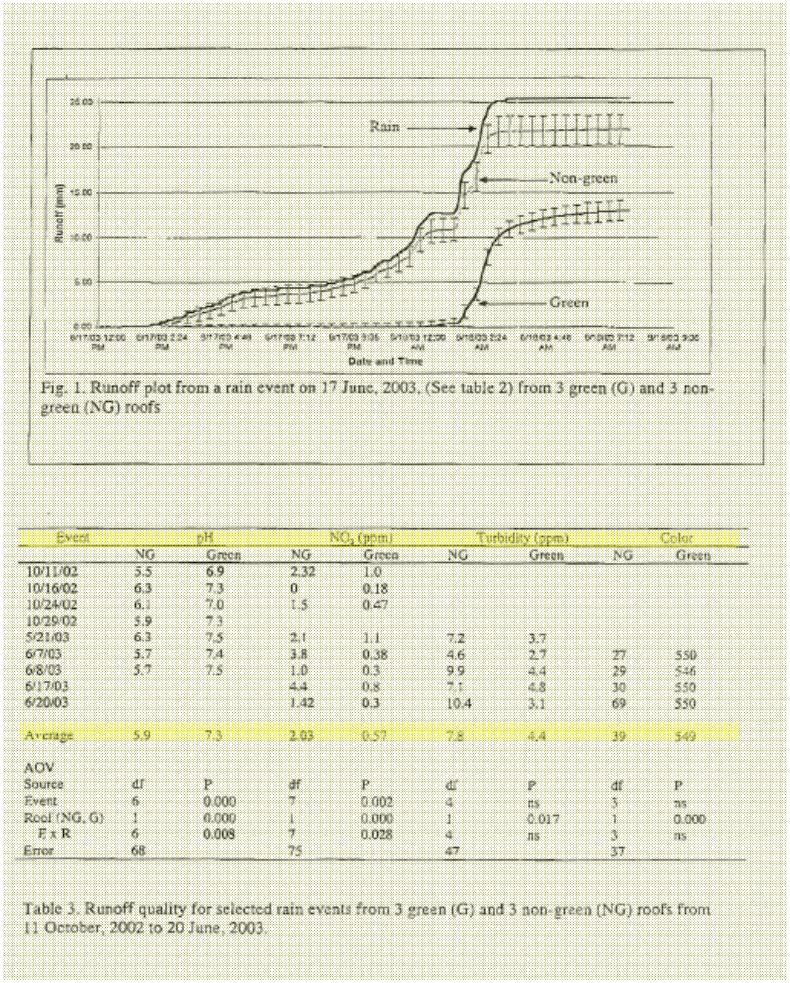


Fig. 1. Runoff plot from a rain event on 17 June, 2003. (See table 2) from 3 green (G) and 3 non-green (NG) roofs

Event	pH		NO_3 (ppm)		Turbidity (ppm)		Color	
	NG	Green	NG	Green	NG	Green	NG	Green
10/11/02	5.5	6.9	2.32	1.0				
10/16/02	6.3	7.3	0	0.18				
10/24/02	6.1	7.0	1.5	0.47				
10/29/02	5.9	7.3						
5/21/03	6.3	7.5	2.1	1.1	7.2	3.7		
6/7/03	5.7	7.4	3.8	0.38	4.6	2.7	27	550
6/8/03	5.7	7.5	1.0	0.3	9.9	4.4	29	546
6/17/03			4.4	0.8	7.1	4.8	30	550
6/20/03			1.42	0.3	10.4	3.1	69	550
Average	5.9	7.3	2.03	0.57	7.8	4.4	39	549
AOV								
Source	df	P	df	P	df	P	df	P
Event	6	0.000	7	0.002	4	ns	3	ns
Roof (NG, G)	1	0.000	1	0.000	1	0.017	1	0.000
E x R	6	0.008	7	0.028	4	ns	3	ns
Error	68		75		47		37	

Table 3. Runoff quality for selected rain events from 3 green (G) and 3 non-green (NG) roofs from 11 October, 2002 to 20 June, 2003.

water quality performance data

LEED Scorecard: Water Efficiency

LEED
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

EPA Region 8 Headquarters

Version 2.1 Registered Project

Y	M	N	Water Efficiency - 5 Points	
X			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%
		X	Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation
		X	Credit 2	**Innovative Wastewater Technologies**
X			Credit 3.1	**Water Use Reduction**, 20% Reduction
X			Credit 3.2	**Water Use Reduction**, 30% Reduction
3	0	2	*5 Possible*	





Water Free Urinals:

*Potential savings = 360,000 gallons per year**

Not currently approved for use in Denver

Dual Flush Toilets:

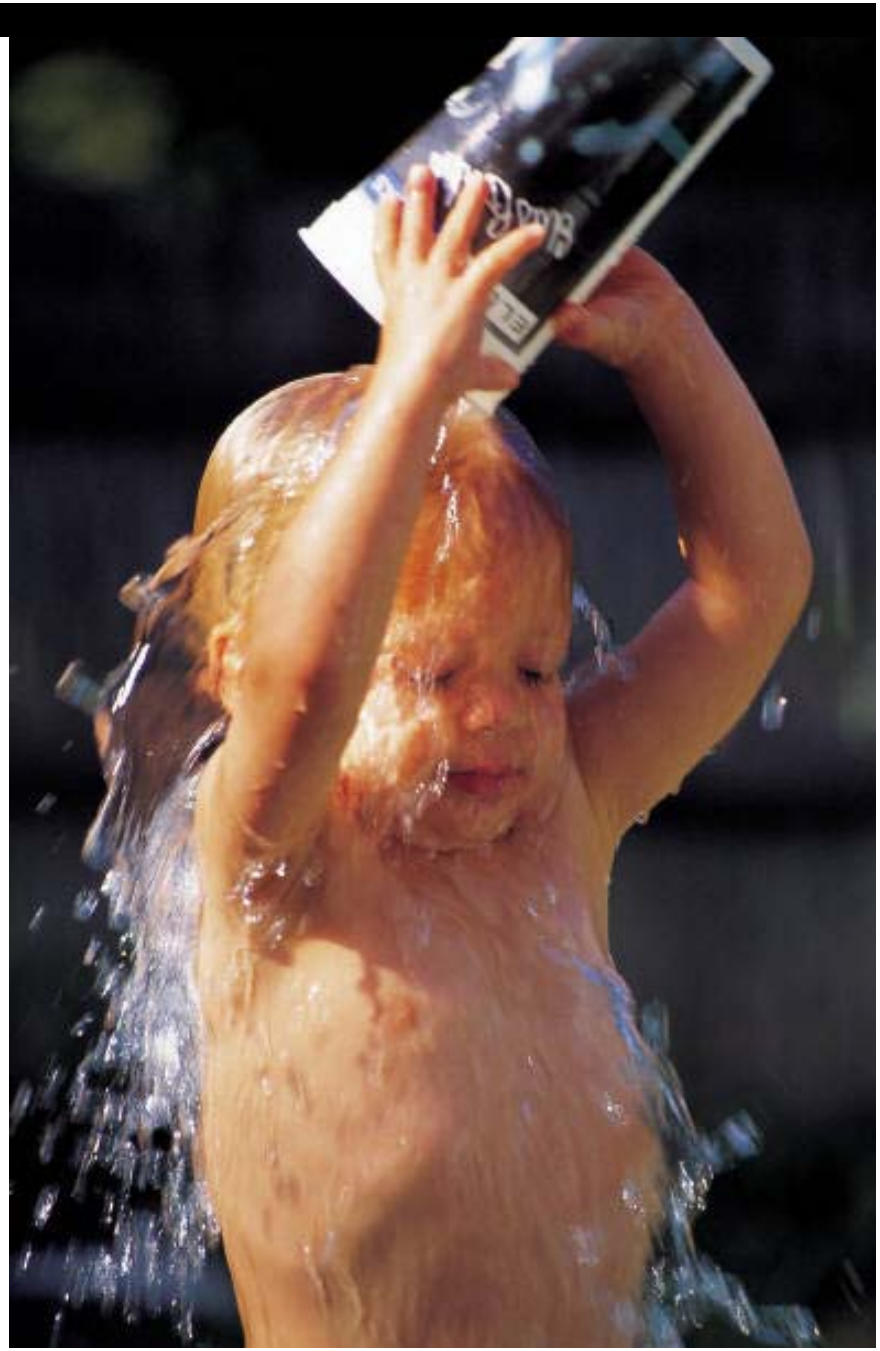
*Potential savings = 270,000 gallons per year***

49% SAVINGS

Ultra Low-Flow Lavatory

Low-Flow Showers

Low-Flow Sinks



LEED Scorecard: Materials & Resources

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LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

EPA Region 8 Headquarters

Version 2.1 Registered Project

Y	M	N	Materials & Resources - 13 Points	
Y			Prereq 1	**Storage & Collection of Recyclables**
		X	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Shell
		X	Credit 1.2	**Building Reuse**, Maintain 100% of Shell
		X	Credit 1.3	**Building Reuse**, Maintain 100% Shell & 50% Non-Shell
X			Credit 2.1	**Construction Waste Management**, Divert 50%
X			Credit 2.2	**Construction Waste Management**, Divert 75%
		X	Credit 3.1	**Resource Reuse**, Specify 5%
		X	Credit 3.2	**Resource Reuse**, Specify 10%
X			Credit 4.1	**Recycled Content**, Specify 5% (post-consumer + ½ post-industrial)
X			Credit 4.2	**Recycled Content**, Specify 10% (post-consumer + ½ post-industrial)
X			Credit 5.1	**Local/Regional Materials**, 20% Manufactured Locally
X			Credit 5.2	**Local/Regional Materials**, of 20% Above, 50% Harvested Locally
		X	Credit 6	**Rapidly Renewable Materials**
	X		Credit 7	**Certified Wood**
6	1	6		***13 Possible***

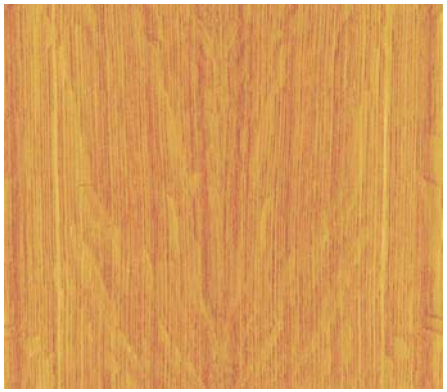




rapidly renewable

Timber Bamboo Flooring and Plywood

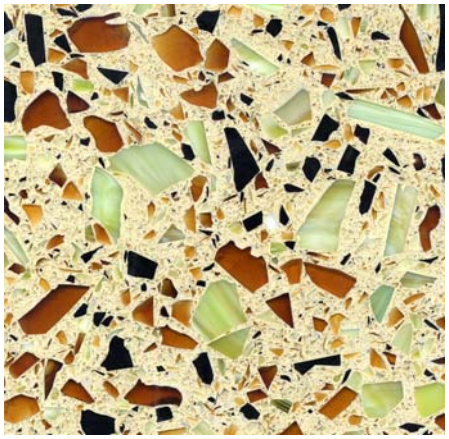
Linoleum Floor Covering



certified wood products

Maple

Curly maple



recycled content

Acoustical Ceiling Tiles

Glass Tile

Ceramic Tile

Recycled Glass and Light Weight Concrete Counter

Modular Carpet.

Furniture.

Structural Metal Framing/Metal Fabrications/Ornamental Metals

Concrete with Fly Ash (byproduct of coal combustion)

LEED Scorecard: Indoor Environmental Quality

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EPA Region 8 Headquarters

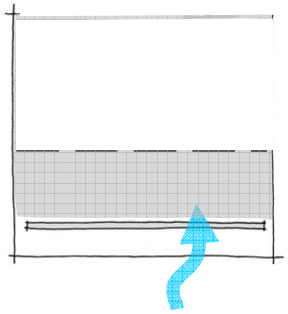
Version 2.1 Registered Project

Y	M	N	Indoor Environmental Quality - 15 Points	
Y			Prereq 1	**Minimum IAQ Performance**
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**
X			Credit 1	**Carbon Dioxide** (CO_2) **Monitoring**
X			Credit 2	**Ventilation Effectiveness**
X			Credit 3.1	**Construction IAQ Management Plan**, During Construction
X			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy
X			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants
X			Credit 4.2	**Low-Emitting Materials**, Paints
X			Credit 4.3	**Low-Emitting Materials**, Carpet
X			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber
X			Credit 5	**Indoor Chemical & Pollutant Source Control**
		X	Credit 6.1	**Controllability of Systems**, Perimeter
X			Credit 6.2	**Controllability of Systems**, Non-Perimeter
X			Credit 7.1	**Thermal Comfort**, Comply with ASHRAE 55-1992
X			Credit 7.2	**Thermal Comfort**, Permanent Monitoring System
X			Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces
X			Credit 8.2	**Daylight & Views**, Views for 90% of Spaces
14	0	1	***15 Possible***	





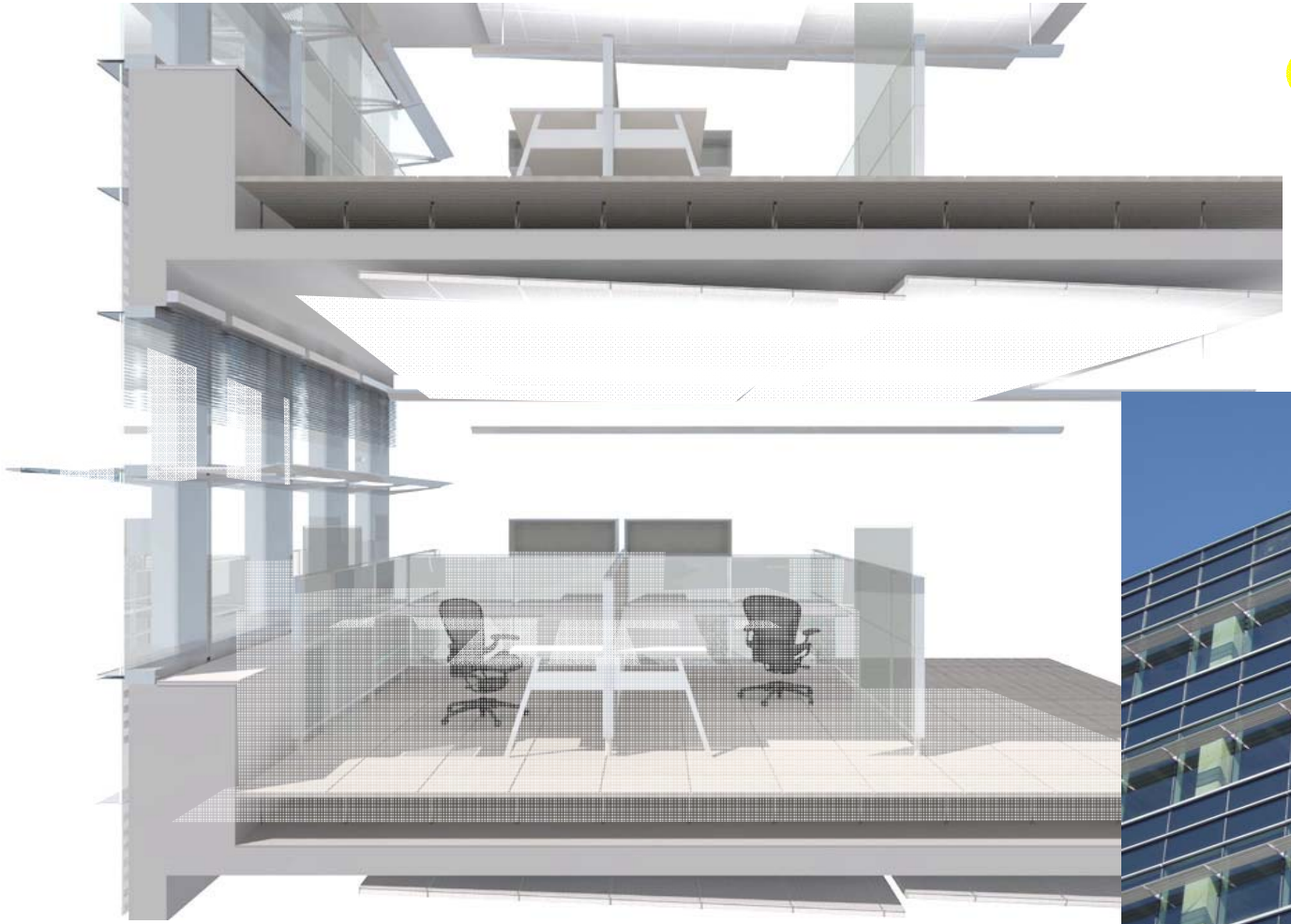
underfloor air distribution

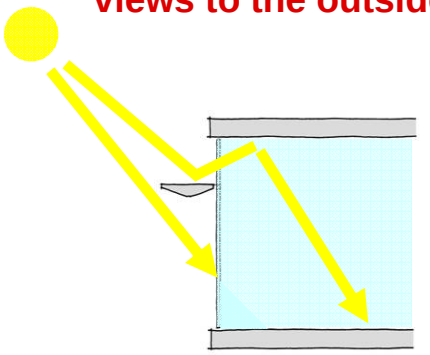


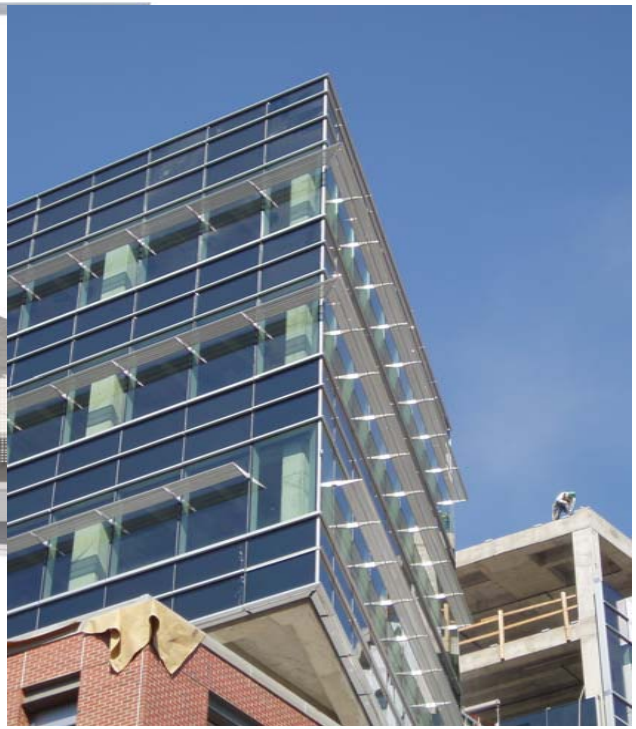
section

penetration of light

views to the outside







LEED Scorecard: Innovation & Design Process

LEED
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

EPA Region 8 Headquarters
Version 2.1 Registered Project

Y	M	N			
			Innovation & Design Process - 5 Points		
X			Credit 1.1	**Innovation in Design**	SSc7.1 Covered Parking Exceedance
X			Credit 1.2	**Innovation in Design**	Eco-Pass Bus Passes for All Employees
X			Credit 1.3	**Innovation in Design**	Green Housekeeping
X			Credit 1.4	**Innovation in Design**	100% Green Power
				Innovation in Design	Green Housekeeping
				Innovation in Design	Energy Star Equipment Purchase Program
				Innovation in Design	Green Guard Furniture
				Innovation in Design	Educational Outreach
				Innovation in Design	Jurisdictional Adjustment
1			Credit 2	**LEED™ Accredited Professional**	
5	0	0	***5 Possible***		





LEED Scorecard: Energy & Atmosphere

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LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

EPA Region 8 Headquarters

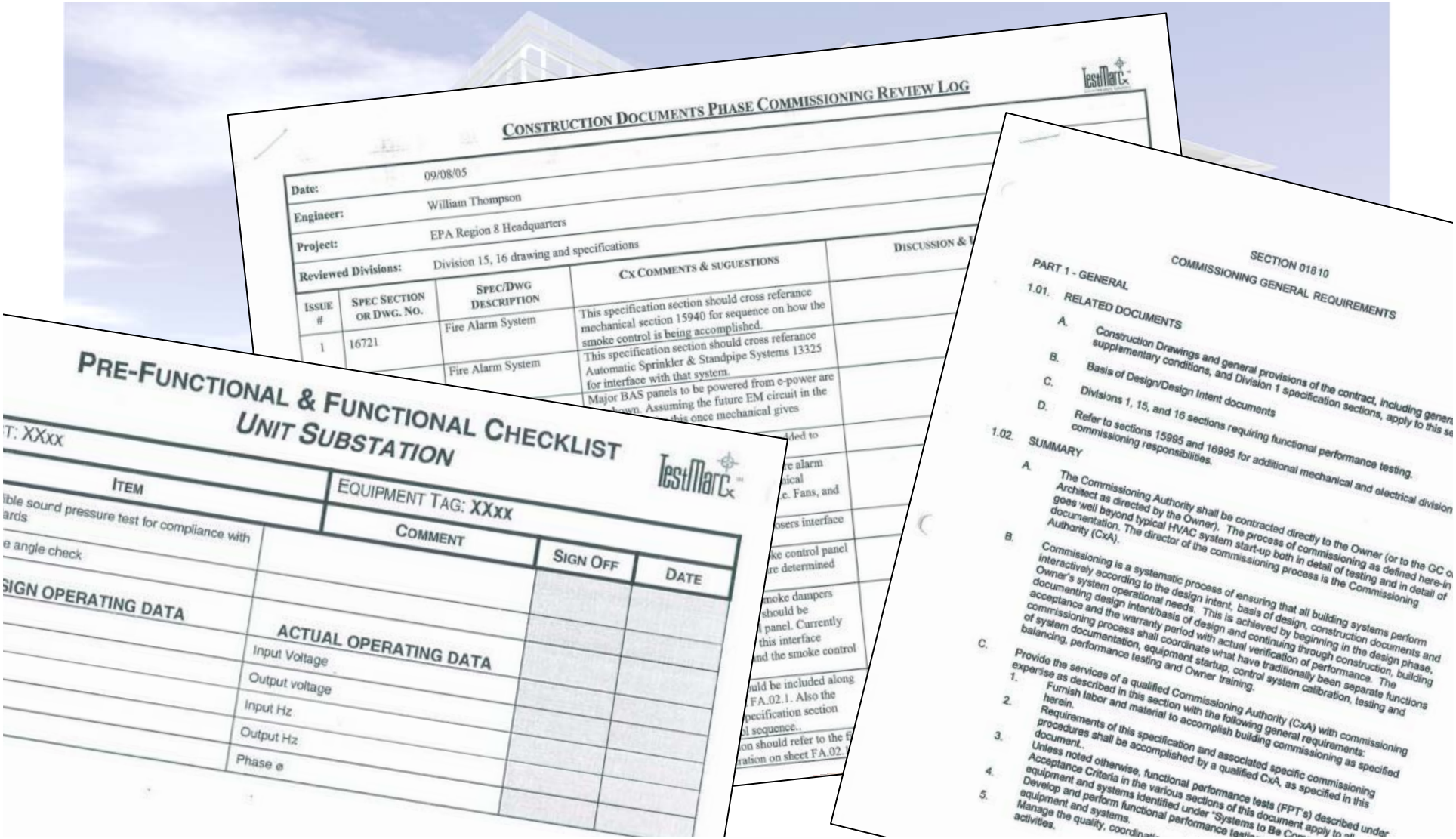
Version 2.1 Registered Project

Y	M	N	Energy & Atmosphere - 17 Points	
Y			Prereq 1	Fundamental Building Systems Commissioning
Y			Prereq 2	Minimum Energy Performance
Y			Prereq 3	CFC Reduction in HVAC&R Equipment
5		5	Credit 1	Optimize Energy Performance
		X	Credit 2.1	Renewable Energy, 5%
		X	Credit 2.2	Renewable Energy, 10%
		X	Credit 2.3	Renewable Energy, 20%
X			Credit 3	Additional Commissioning
X			Credit 4	Ozone Depletion
X			Credit 5	Measurement & Verification
X			Credit 6	Green Power
9	0	8	*17 Possible*	





EAp1, EAc3 – Commissioning Activities



CONSTRUCTION DOCUMENTS PHASE COMMISSIONING REVIEW LOG

Date: 09/08/05
Engineer: William Thompson
Project: EPA Region 8 Headquarters
Reviewed Divisions: Division 15, 16 drawing and specifications

ISSUE #	SPEC SECTION OR DWG. NO.	SPEC/DWG DESCRIPTION	CX COMMENTS & SUGUESTIONS	DISCUSSION &
1	16721	Fire Alarm System	This specification section should cross referance mechanical section 15940 for sequence on how the smoke control is being accomplished.	
		Fire Alarm System	This specification section should cross referance Automatic Sprinkler & Standpipe Systems 13325 for interface with that system.	
			Major BAS panels to be powered from e-power are [illegible]. Assuming the future EM circuit in the [illegible] once mechanical gives	

PRE-FUNCTIONAL & FUNCTIONAL CHECKLIST
UNIT SUBSTATION

T: XXxx

ITEM	EQUIPMENT TAG: XXxx COMMENT	SIGN OFF	DATE
ible sourd pressure test for compliance with ards			
e angle check			
SIGN OPERATING DATA			
	ACTUAL OPERATING DATA		
	Input Voltage		
	Output voltage		
	Input Hz		
	Output Hz		
	Phase ø		

SECTION 01810
COMMISSIONING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01. RELATED DOCUMENTS

A. Construction Drawings and general provisions of the contract, including gener supplementary conditions, and Division 1 specification sections, apply to this se

B. Basis of Design/Design Intent documents

C. Divisions 1, 15, and 16 sections requiring functional performance testing.

D. Refer to sections 15995 and 16995 for additional mechanical and electrical division commissioning responsibilities.

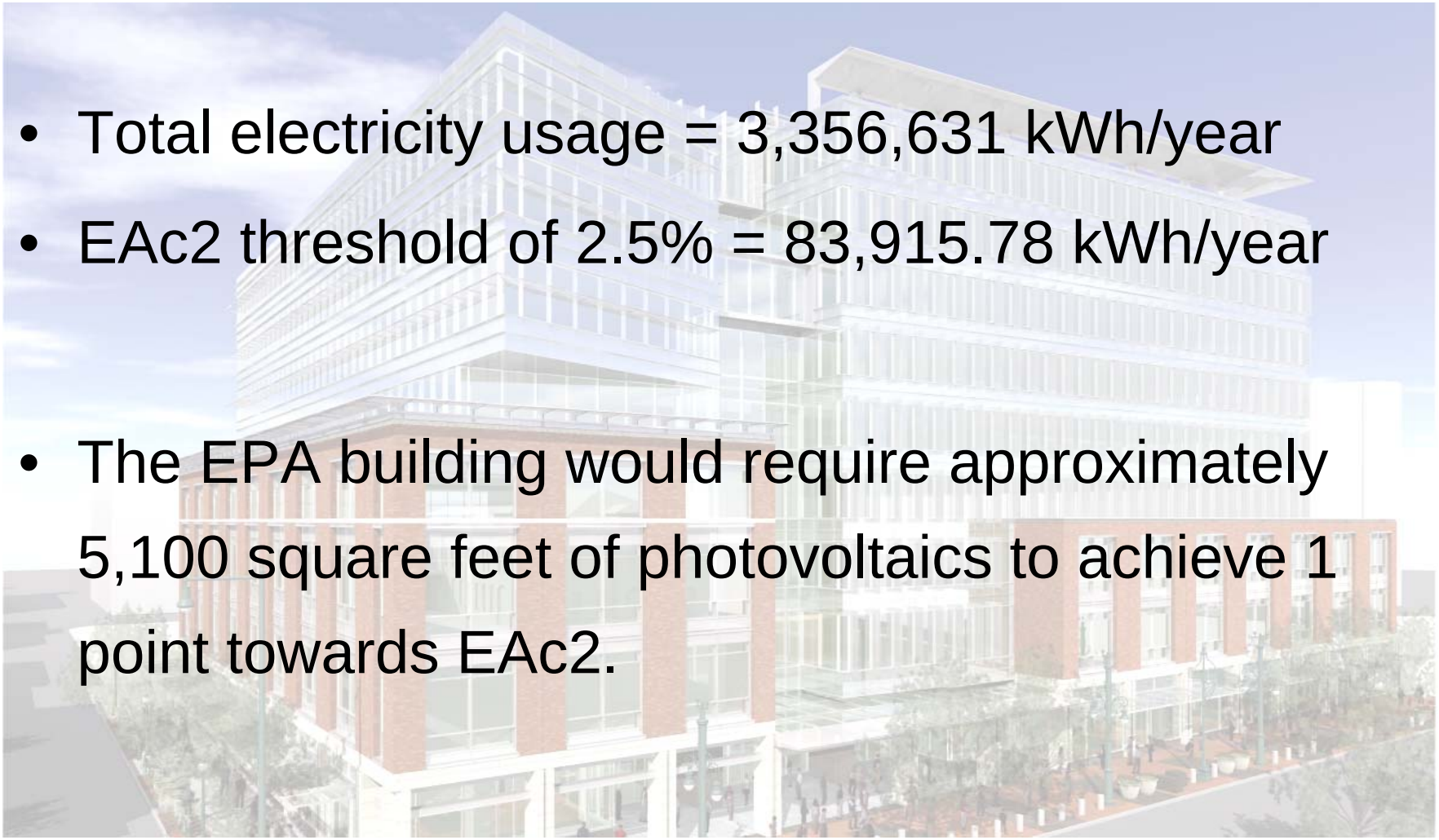
1.02. SUMMARY

A. The Commissioning Authority shall be contracted directly to the Owner (or to the GC o Architect as directed by the Owner). The process of commissioning as defined here-in goes well beyond typical HVAC system start-up both in detail of testing and in detail of documentation. The director of the commissioning process is the Commissioning Authority (CxA).

B. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent, basis of design, construction documents and Owner's system operational needs. This is achieved by beginning in the design phase, documenting design intent/basis of design and continuing through construction, building acceptance and the warranty period with actual verification of performance. The commissioning process shall coordinate what have traditionally been separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and Owner training.

C. Provide the services of a qualified Commissioning Authority (CxA) with commissioning expertise as described in this section with the following general requirements:
1. Furnish labor and material to accomplish building commissioning as specified herein.
2. Requirements of this specification and associated specific commissioning procedures shall be accomplished by a qualified CxA, as specified in this document..
3. Unless noted otherwise, functional performance tests (FPT's) described under Acceptance Criteria in the various sections of this document apply to all equipment and systems identified under "Systems to Be Co
4. Develop and perform functional performance testi equipment and systems.
5. Manage the quality, coordinat activities.

EAc2 – Renewable Energy



- Total electricity usage = 3,356,631 kWh/year
- EAc2 threshold of 2.5% = 83,915.78 kWh/year
- The EPA building would require approximately 5,100 square feet of photovoltaics to achieve 1 point towards EAc2.

EAc5 – Measurement and Verification

The following systems will be metered for energy usage as part of the M&V Plan, following FEMP 2000 version 2.2, consistent with Option D:

- Lighting systems and controls
- Constant and variable motor loads
- Variable frequency drive operation
- Chiller efficiency at variable loads
- Cooling load
- Air and water economizer and heat recovery cycles
- Air distribution static pressures and ventilation air volumes
- Indoor water risers and outdoor irrigation systems

EAc6 – Green Power

The EPA project will be purchasing 100% of their energy from Renewable Energy sources for a minimum of 2 years.

- The purchase contributes to reducing 6,138,720 pounds of CO_2 production per year.
- This is equivalent to removing 536 cars from the road or removing the burden of 837 acres of trees from soaking up that much CO_2.

Whole Building Design

Efficient design alternatives

- Building envelope
- Glazing
- Day lighting
- Lighting & Lighting Controls
- HVAC Equipment & Systems
- Energy Efficient Tenant Equipment





- Analysis: Various Energy Simulations

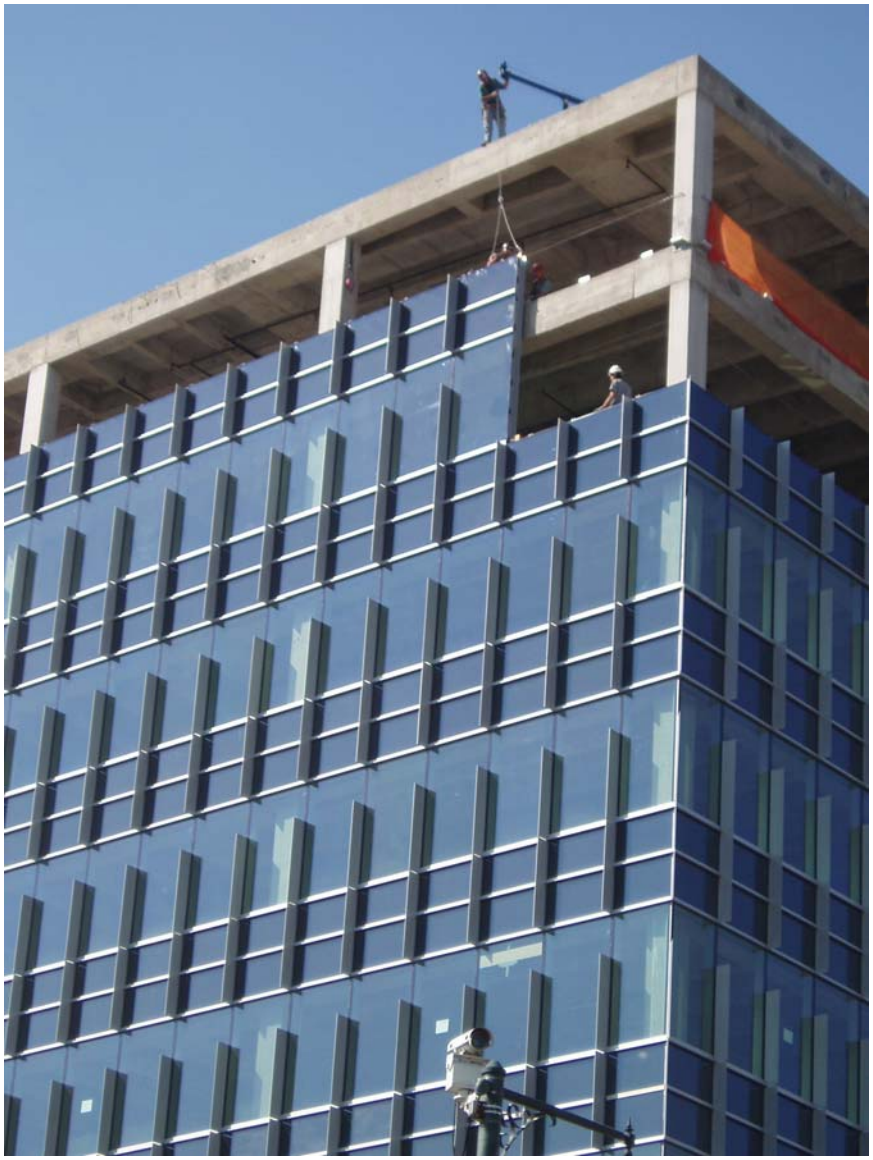
  Factors: Weather
  Solar Path
  Wind Direction & Speed

Compared-Energy Consumption Over One Year
(12 hours daily/ 5 days per week or 8760 hours)

Seven-Bldg Design Alternatives
Five-HVAC Design Alternatives

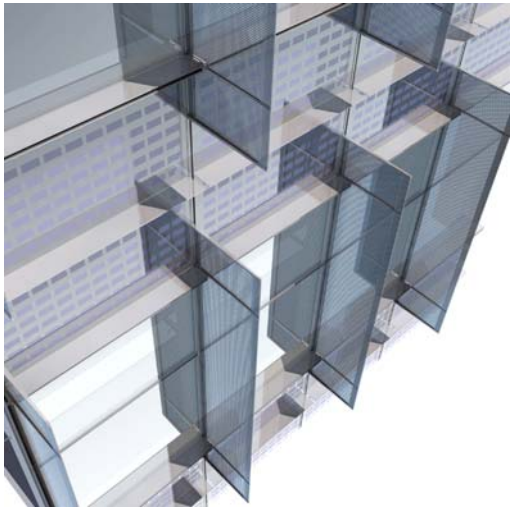






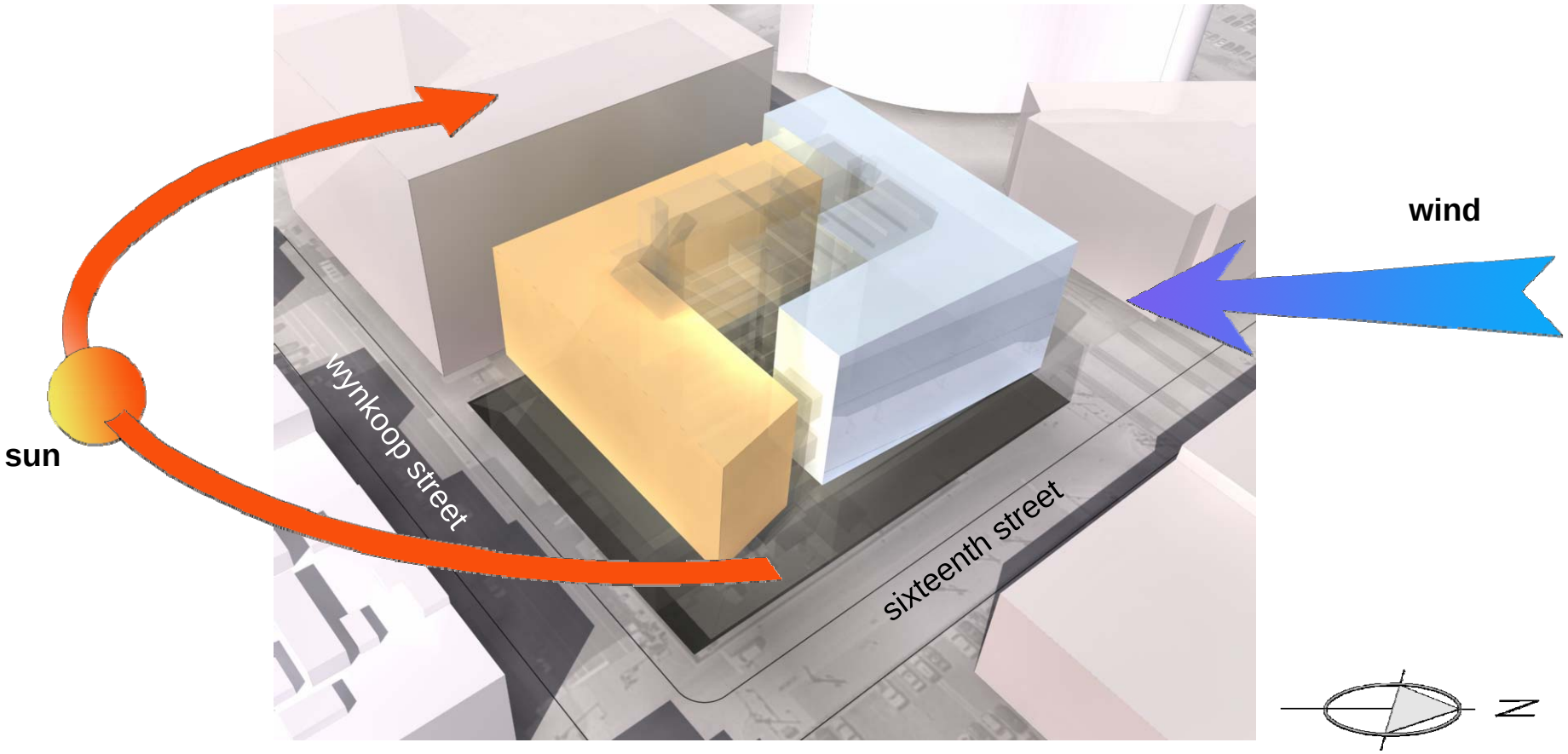
heat loads from low summer sun angles

northwest elevation

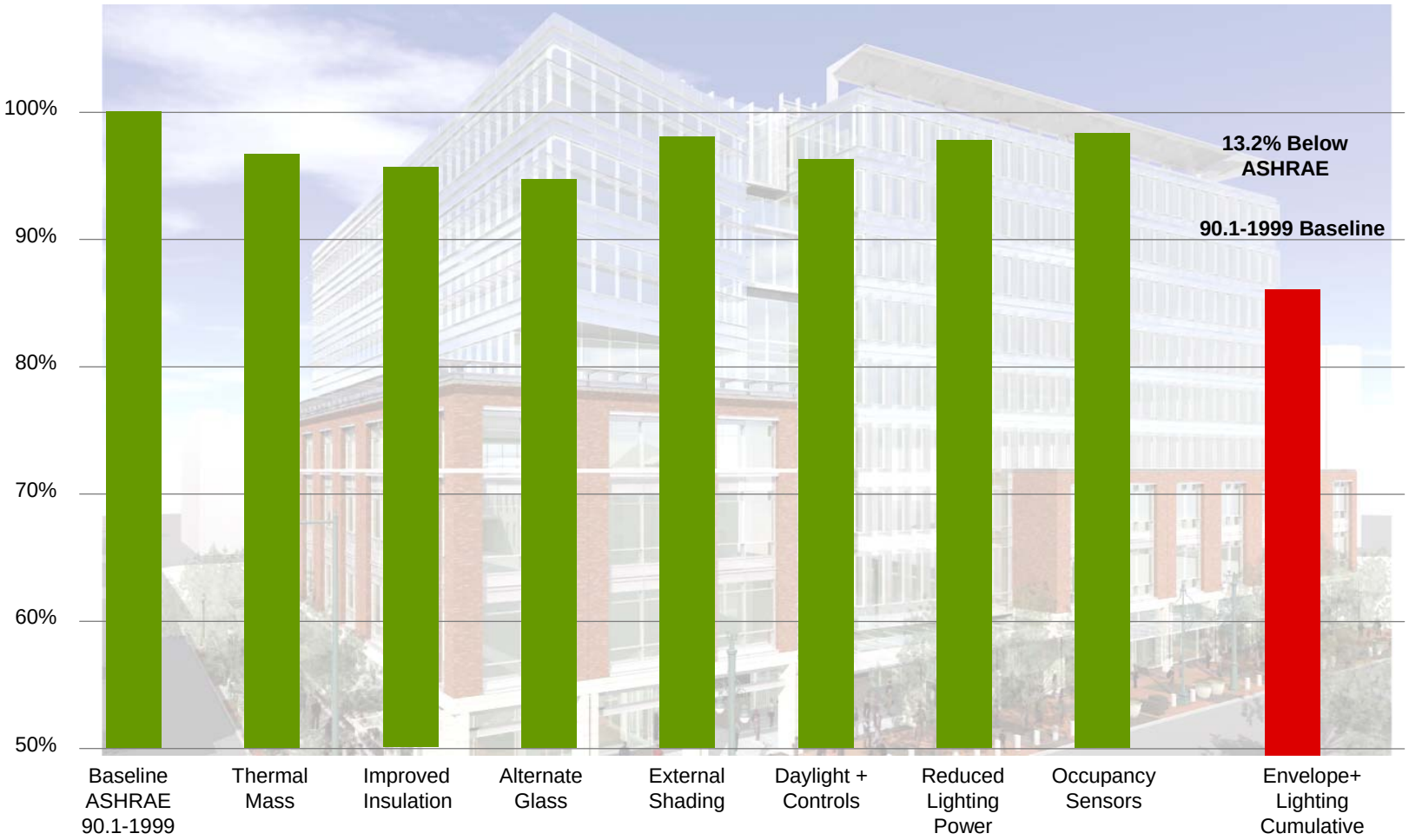


double L scheme

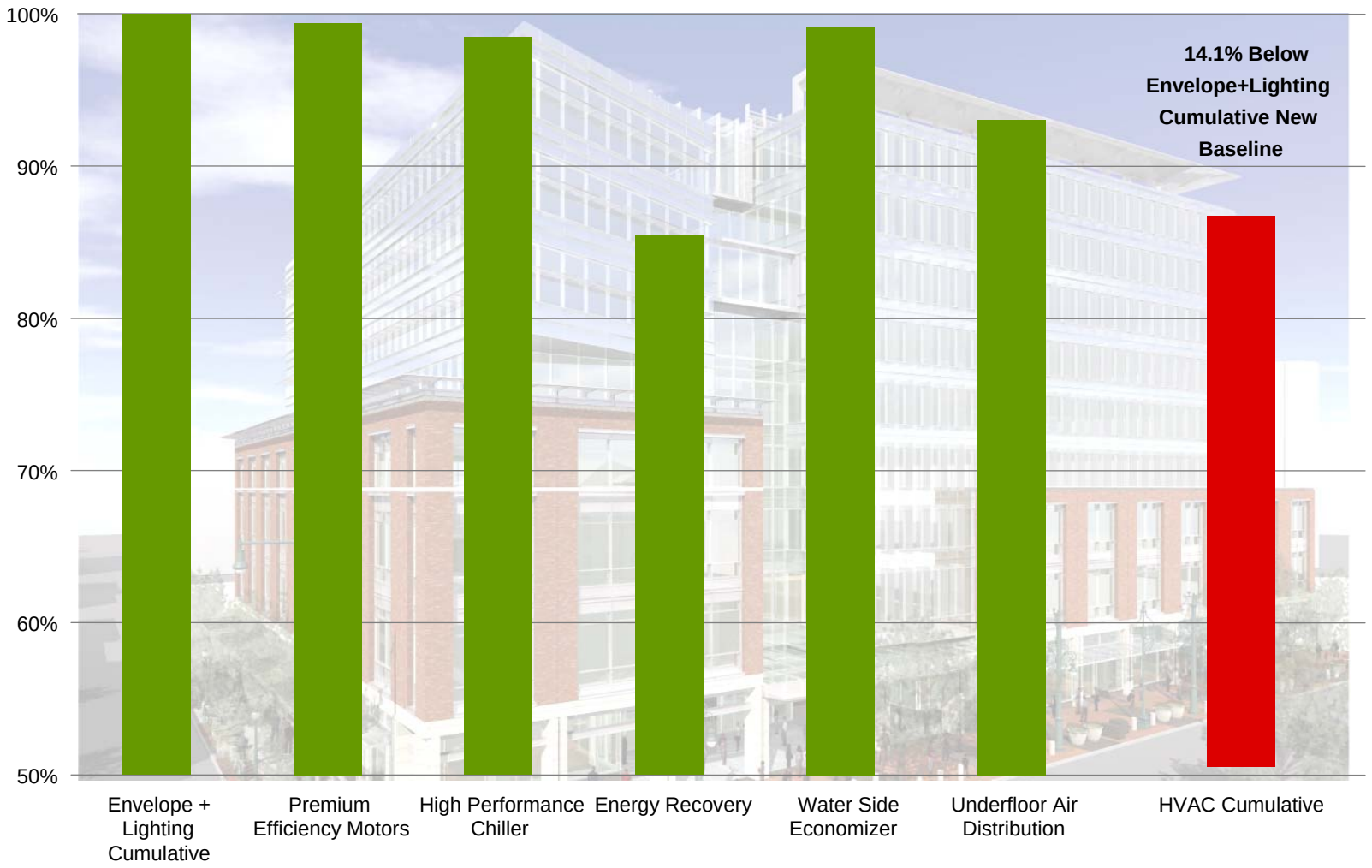
environmental and urban influence



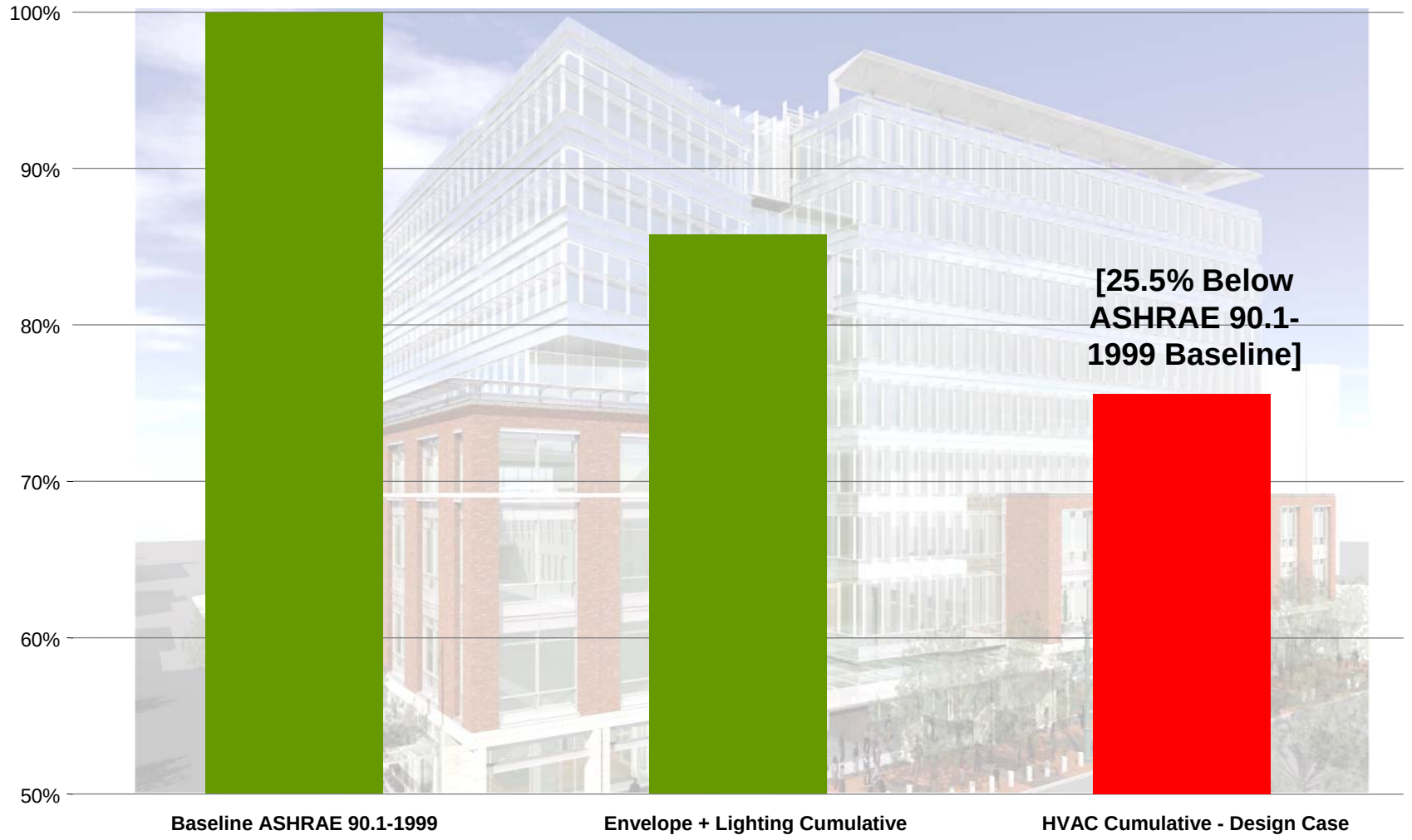
preliminary energy performance of envelope and lighting/daylighting strategies



preliminary energy performance of HVAC strategies



energy performance summary



Energy Performance Outcomes

- Annual Energy Consumption Reduced 25.5%
  Below ASHRAE Standard 90.1

- Annual Energy Costs Savings of 35.7%
  Compared to Equivalent ASHRAE 90.1
  Baseline Building





Federal Goal Est 2006:

- 30% better energy performance than ASHRAE 90.1-2004 requirements






PARTNERSHIPS

Private/ Public Partnership Similarities of Project

- Both desire a State of the Art Building
  - 'Represent Leadership in Energy & Environmental Building Design'
- Both have Limited Resources
- Both have a Mandate:
  Finish on Time and Within Budget






USEPA Headquarters
US General Services Administration
U S Department of Homeland Security
Real-estate Developer and Owner
Architect and Engineering Designers and Constructors
USEPA Region 8 Senior Management
USEPA Region 8's Architect
Building Development Team
USEPA Region 8's Environment and Building Design Team
Other Partners:
Urban Drainage and Flood Control District
Denver Botanic Gardens
US Department of Energy National Renewable Energy Laboratory
Denver Water
Colorado State University
Partnerships Enable Results

Team Approach Benefits

- Offered Different Kinds of Expertise
- Offered Better Decision-making
- Saved Time & Costs in Project Support
- Aids in Reducing Unexpected Resulting in Delays or Financial Costs





Message on Collaboration

Collaboration of Ideas Can Result in Greater/ Higher Outcomes


BEST PRACTICES/LESSONS LEARNED

Working with Building Codes

- Explain why the technology (or material) is important
- Identify where it's been used successfully (inside & outside the US)
- Identify Code Jurisdictions where allowed
- Provide reliable supporting documentation to the technology
- Offer lists of knowledgeable national experts

Tenant Perspective of Leased Competition SFO:

Do Again:

Competition – Need time and commitment but potential to get added value.

One Site – Keeps level playing field for the building design and is one less factor in the building selection process.

Team Qualifications Review/Short List for Design- Saves cost for bidders and reviewers. Get teams with understanding of project goals and better integration of trades.

Penalties For Not Meeting LEED/Energy Star- Yet to be seen if they are not met.

Do Differently:

LEED scorecard Listing Preferences – Put in a few more mandatory points since LEED points are not weighted by difficulty or expense to achieve.

Future Considerations:

Green Globes
LEED CI, EB

Owner's Perspective of Leased Competition Phase for EPA Region 8

*Site Selection Separate: Good Approach for both parties

*Finalists:
- Recommendation for stipends to "losing" teams
- Narrow Finalists further (i.e. 3 instead of 5)
  - ~Better Product
  - ~Absorbed into "winner's" budget

*Design-Build vs. Design-Bid-Build
- Performance vs. Prescriptive
- Know which approach is wanted at the beginning
- Difference between concept & engineered process

*Increased Staff Size- Documentation

*Option Selections

Sustainability Lessons Learned EPA Region 8

*Working with Neighborhood / Government Entities:

- Flexibility with Lighting Requirements

- Flexibility with Tree/Irrigation Requirements


QUESTION AND ANSWER