Energy 2004
U.S. Department of Energy

"Doing it Right from the Start"
August 11, 2004

Mary Ann Lazarus, AIA, LEED AP
HOK

- HOK Guidebook to Sustainable Design
- 3 LEED Certified Projects
- 200 Current "green" projects
- 20 LEED Registered
- 170+ LEED AP

How important is an Integrated Design Approach?

or

Is sustainable design simply a collection of best practices that reduce environmental burden, or is it fundamental to the process of design?

LEED IFICATION of the Process

LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

Project Name
Project Location

LEED 2.1 Project Checklist

Sustainable Sites			14 Possible Points	Points Earned
Y	Prereq 1	**Erosion & Sedimentation Control**	Required	
Y ? N	Credit 1	**Site Selection**	1	
Y ? N	Credit 2	**Development Density**	1	
Y ? N	Credit 3	**Brownfield Redevelopment**	1	
Y ? N	Credit 4.1	**Alternative Transportation,** Public Transportation Access	1	
Y ? N	Credit 4.2	**Alternative Transportation,** Bicycle Storage & Changing Rooms	1	
Y ? N	Credit 4.3	**Alternative Transportation,** Alternative Fuel Vehicles	1	
Y ? N	Credit 4.4	**Alternative Transportation,** Parking Capacity	1	
Y ? N	Credit 5.1	**Reduced Site Disturbance,** Protect or Restore Open Space	1	
Y ? N	Credit 5.2	**Reduced Site Disturbance,** Development Footprint	1	
Y ? N	Credit 6.1	**Stormwater Management,** Rate and Quantity	1	
Y ? N	Credit 6.2	**Stormwater Management,** Treatment	1	
Y ? N	Credit 7.1	**Heat Island Effect,** NonRoof	1	
Y ? N	Credit 7.2	**Heat Island Effect,** Roof	1	
Y ? N	Credit 8	**Light Pollution Reduction**	1	
	Total		14	**0**
Water Efficiency			5 Possible Points	Points Earned
Y ? N	Credit 1.1	**Water Efficient Landscaping,** Reduce by 50%	1	
Y ? N	Credit 1.2	**Water Efficient Landscaping,** No Potable Use or No Irrigation	1	
Y ? N	Credit 2	**Innovative Wastewater Technologies**	1	
Y ? N	Credit 3.1	**Water Use Reduction,** 20% Reduction	1	
Y ? N	Credit 3.2	**Water Use Reduction,** 30% Reduction	1	
	Total		5	**0**
Energy & Atmosphere			17 Possible Points	Points Earned
Y	Prereq 1	**Fundamental Building Systems Commissioning**	Required	
Y	Prereq 2	**Minimum Energy Performance**	Required	
Y	Prereq 3	**CFC Reduction in HVAC&R Equipment**	Required	
Y ? N	Credit 1	**Optimize Energy Performance**	2	
Y ? N	Credit 2.1	**Renewable Energy,** 5%	1	
Y ? N	Credit 2.2	**Renewable Energy,** 10%	1	
Y ? N	Credit 2.3	**Renewable Energy,** 20%	1	

Doing it Right From the Start

1. Integrated Design Definition

2. Case Studies

3. Observations

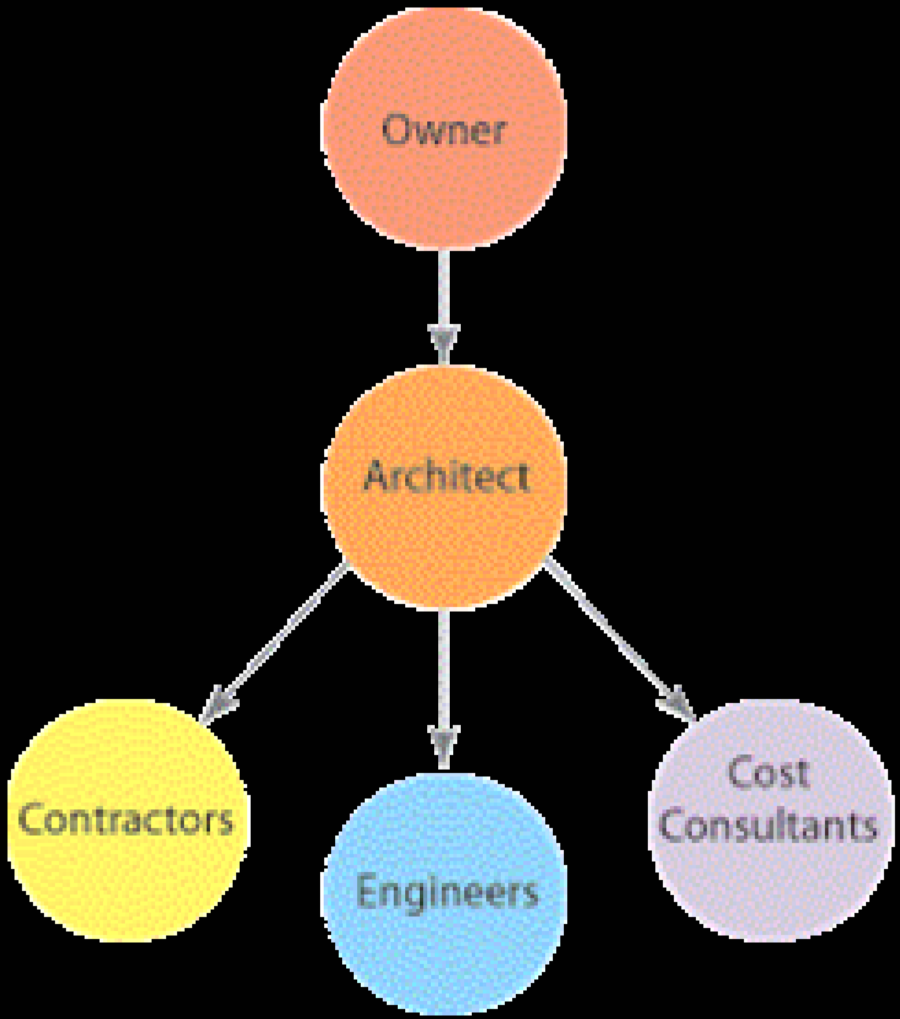
Integrated Design Process

TEAMING

TIMING

TRACKING

TEAMING

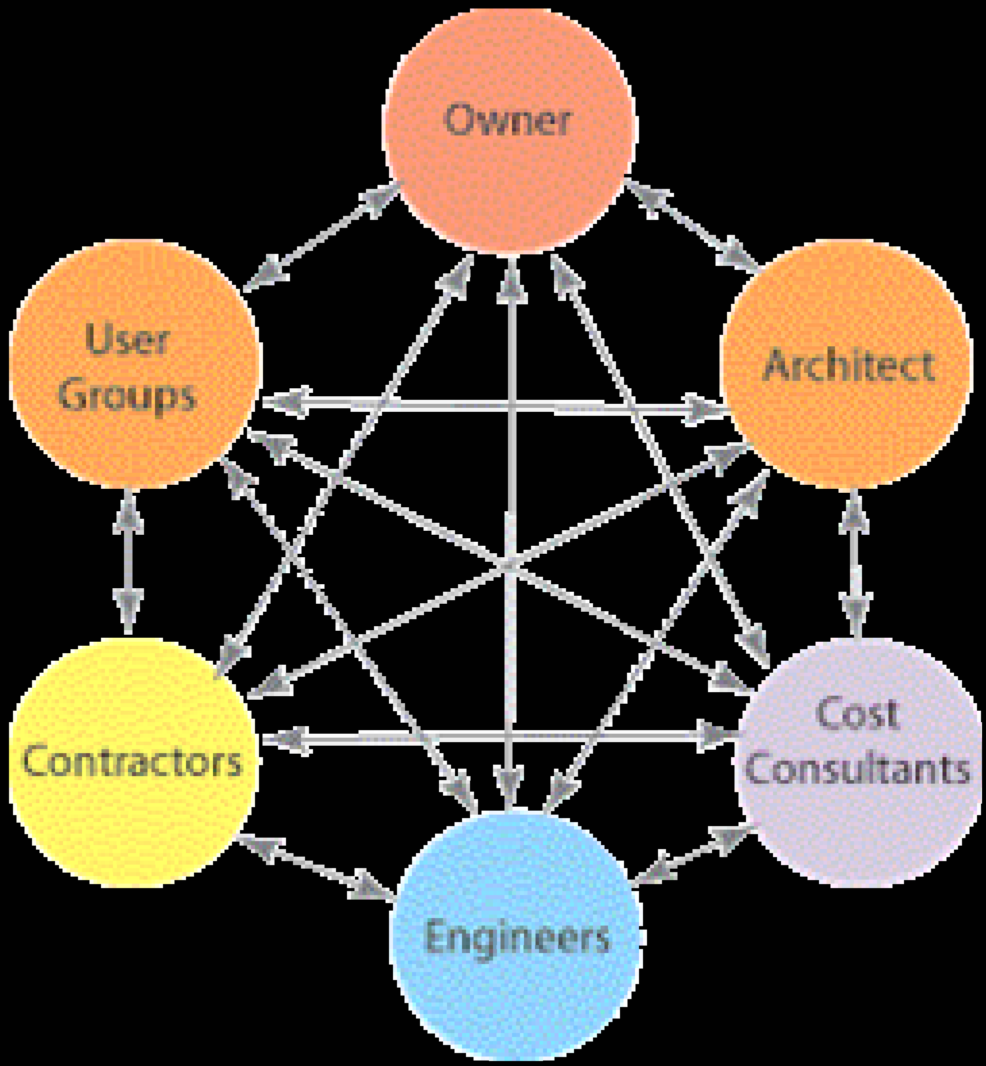


TRADITIONAL DESIGN TEAMS

Traditional

- **Hierarchical Organization**
  - ***Owner - Architect - Engineer***
- **Transactional Design Process**
- **Silo-ed Disciplines**

TEAMING

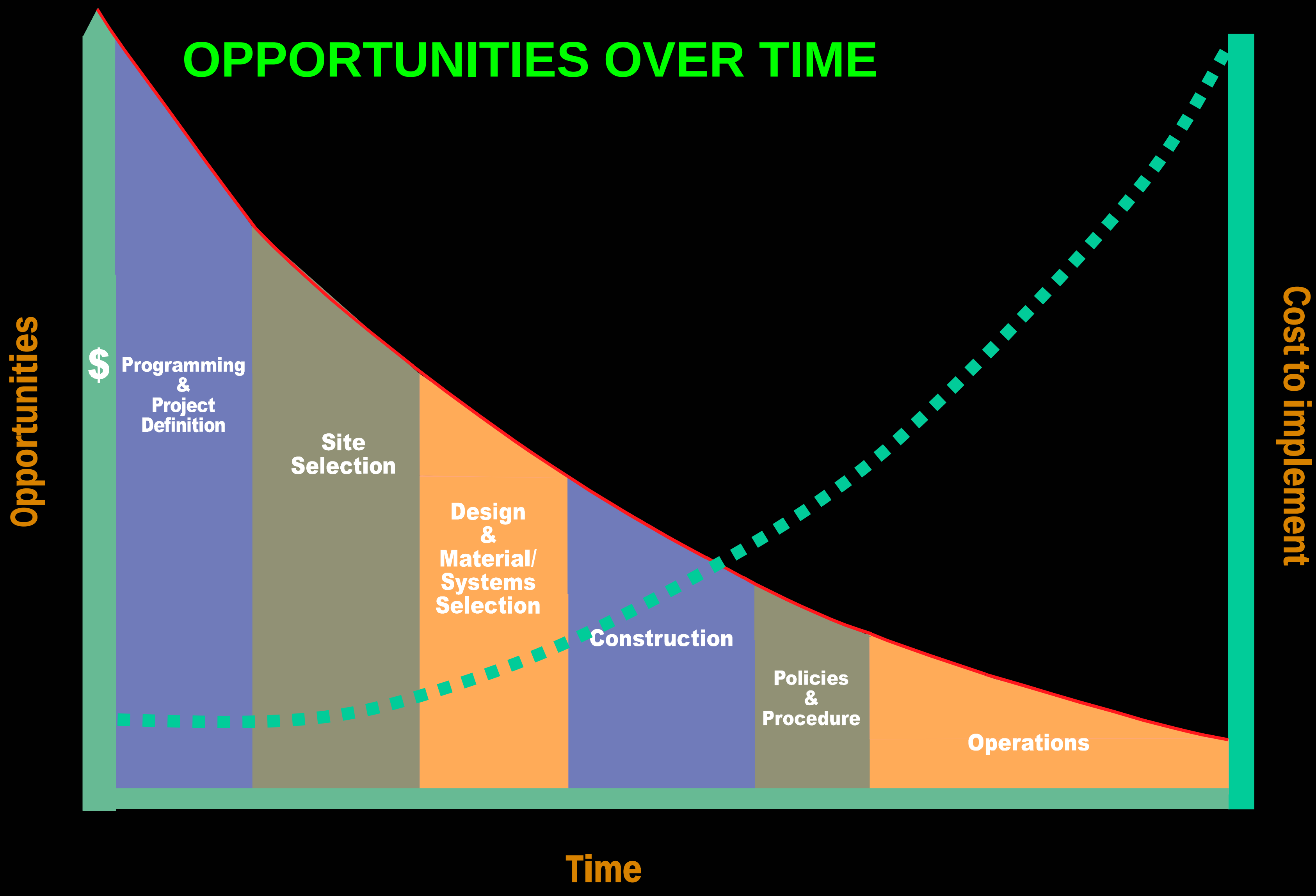


INTEGRATED DESIGN TEAMS

Emerging

- **Holistic Thinking**
- **Team Based**
- **Organic Design Process**
- **Larger Team**
  - ***Users, Operators, Constructors***
- **Innovation encouraged by Client**

TIMING



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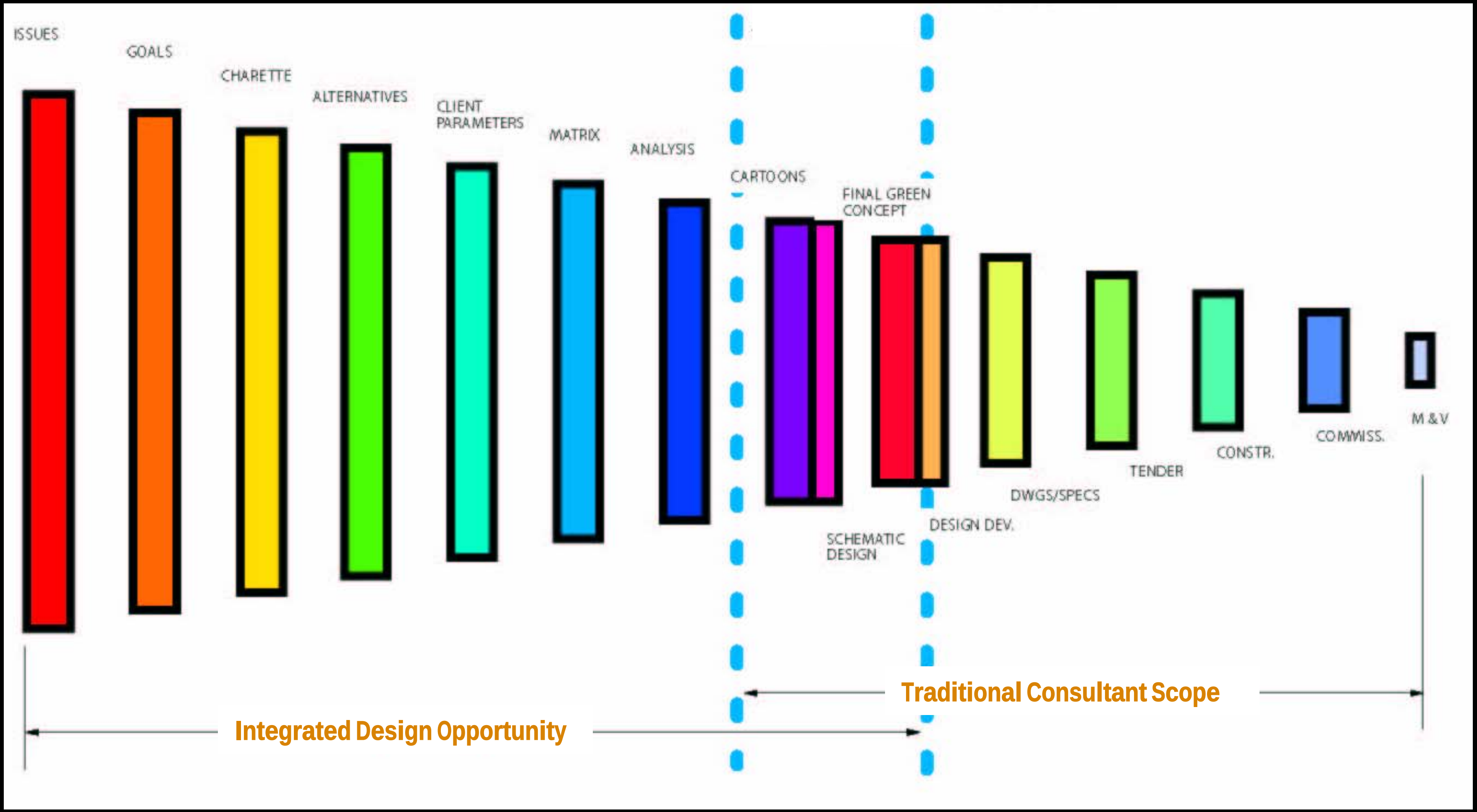
TIMING

INTEGRATED
DESIGN SCHEDULE



HOK Sustainable Design

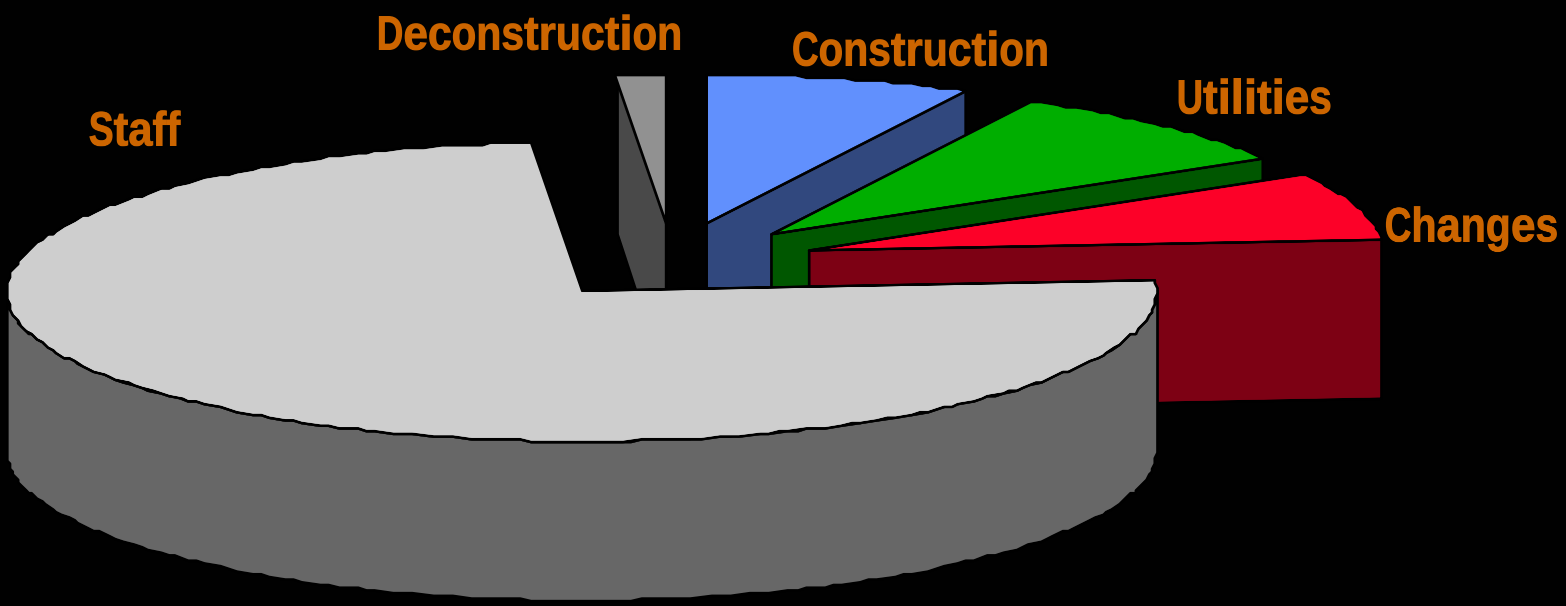
TIMING

LIFE CYCLE COST OF BUILDINGS

Target of typical efficiencies

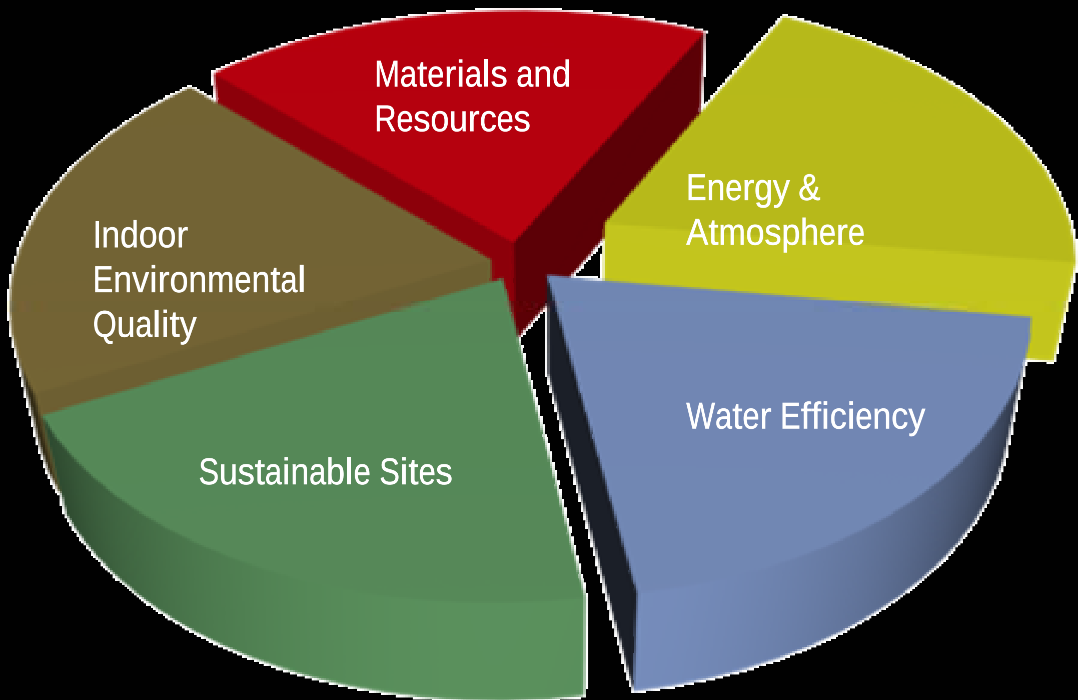
vs.

Target of most impact



TRACKING

LEED
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN



TEAM METRICS

LEED™ Green Building Rating System

Five major categories in which to earn points of credits towards a certification level:

- **Sustainable Sites**
- **Water Efficiency**
- **Energy and Atmosphere**
- **Materials and Resources**
- **Indoor Environmental Quality**

Credits may also be earned for design innovation

Case Study

Emory University

Whitehead Biomedical Research Building

Location: Atlanta, Georgia

Project Type: Office and Lab

Size: 325,000 SF

Cost: $82 Million

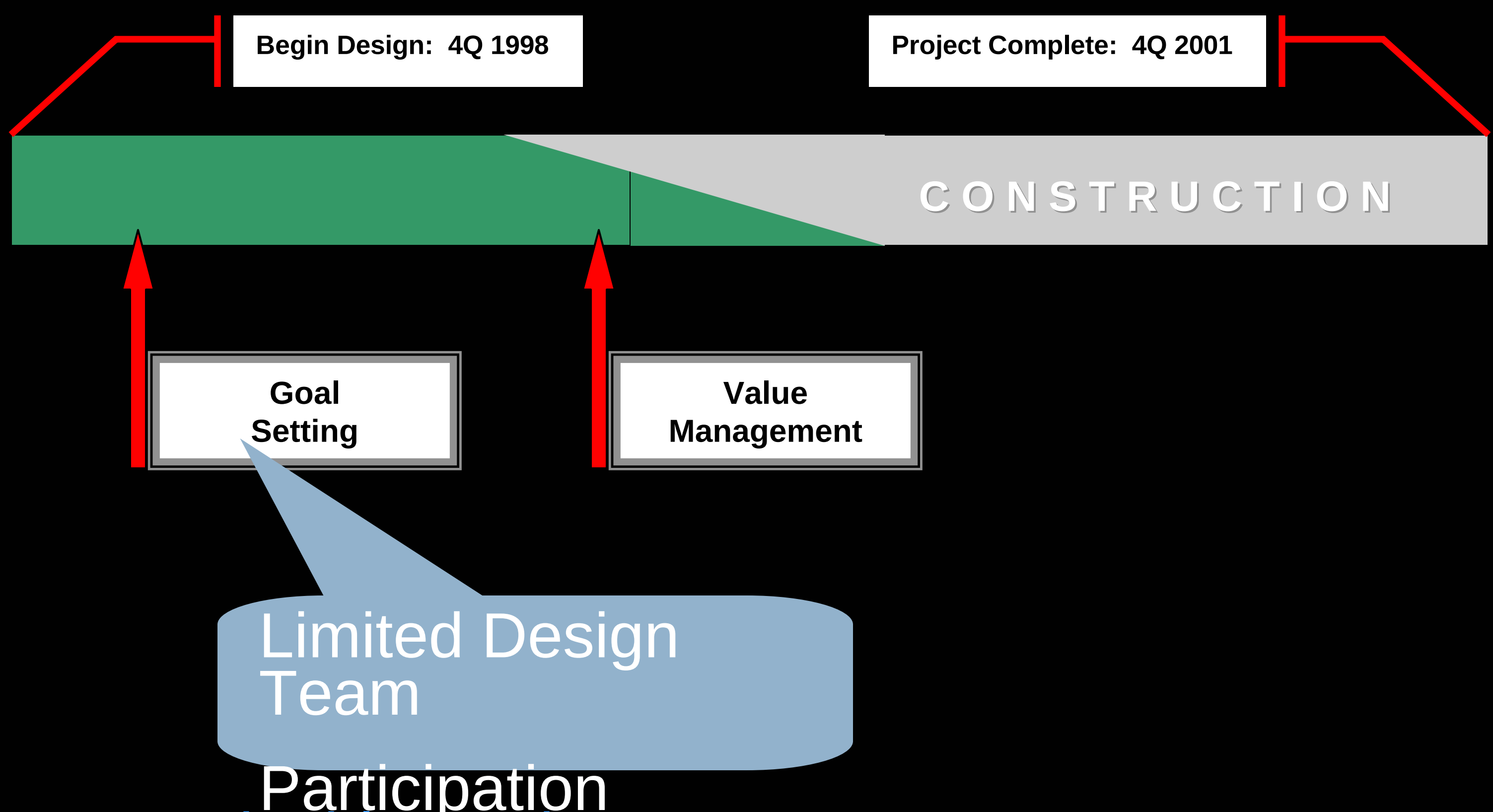
Completion: Dec 2001

Delivery: CM at Risk

HOK role: Arch, Interiors, Planning

Case Study

Context of the Design Process. . .



Goal Definition Worksession

Client goals

- Reduced LCC – Value Management
- Campus standards
- Higher cost + fee burden
- “Research Center without Walls”
- Focus on interactive work/casual spaces

HOK Internal Goals

- No / low construction cost
- Low design fee burden
- “Invisible” green goals

Whitehead Research Building
Emory University
Project No. 98.0215.00

ENVIRONMENTALLY RESPONSIBLE DESIGN CHECKLIST

		Category				Additional First-Cost?	Est. cost
		Site	Building	Construction	Operational	(Not in budget)	
	Full systems building commissioning		X			N	
	Verify compliance with the Department of Energy's Building Measurement and Verification Protocol (IPMVP).		X			D	
	Research potential for utility rebates for renewable energy and energy efficiency.		X			D	
	Establish a preference for building materials and products that are made from renewable, sustainably acquired materials, have recycled-content, are durable, low-maintenance, non-toxic or low-toxic, low-polluting in manufacture, shipping, and installation, and recyclable.	X	X			D	
	Establish a preference for electrical lighting and plumbing fixtures that are energy- and water-efficient.					Y	
	Identify and establish a preference for locally manufactured building materials and products.	X	X			D	
	Evaluate the potential for rainwater harvesting for irrigation, building services, etc.	X	X			Y	
	Identify composting facility to process organic construction waste into landscape material.			X			
X	Utilize trees and other landscape features to create microclimates.	X				N	
	Consider use of photovoltaics for site lighting.	X				Y	
	Consider use of photovoltaics or other alternative energy sources for building services.		X			Y	
	Consider lighting dimming system to maximize use of natural light. Address artificial lighting requirements and heat gain.		X			Y	
	Optimize design of the building envelope, including selection of insulation, glass, sun shading, etc.		X			Y	
X	Minimize or shade south-facing glass.		X			N	
X	Recover energy from ventilation air.		X			N	

Design Process - Construction – Sustainable Goals

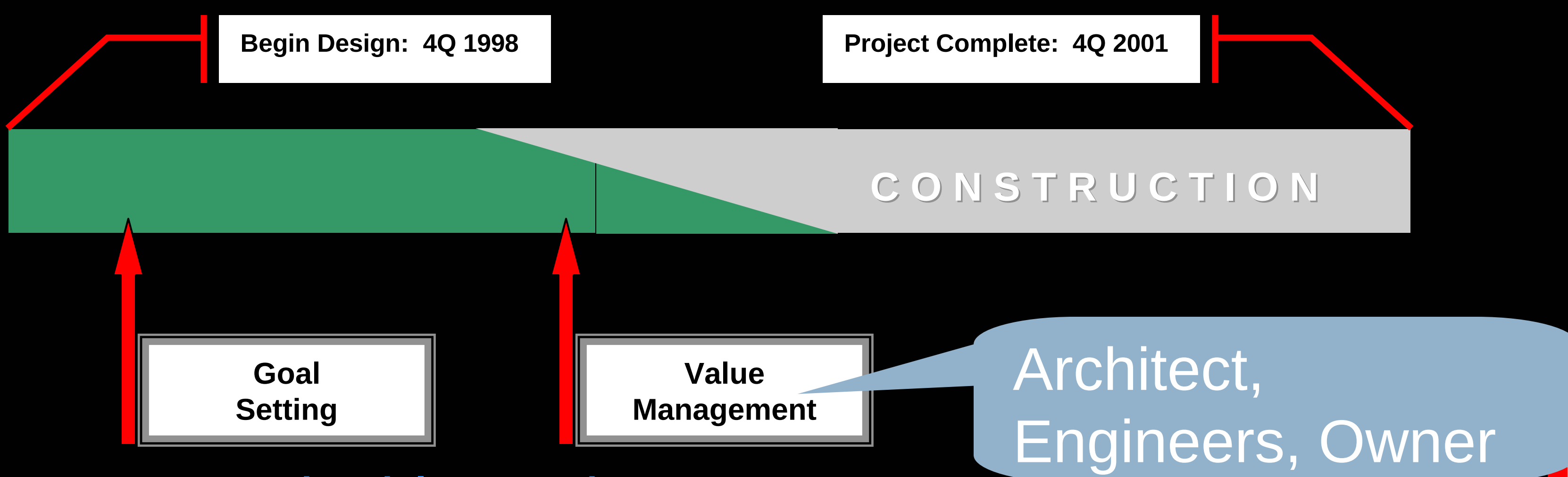
Emory's Whitehead Biomedical Research Building project will:

- Reduce its water demand by 2.5 million gallons per year
- Reduce the sanitary sewer load by 2.5 million gallons per year
- Reduce electricity and gas usage due to energy recovery systems-
- $140,000+ annual savings due to energy recovery alone
- Reduce the amount of construction debris sent to landfills
- Reduce demand on natural resources by utilizing recycled
- building materials
- Impact the regional market

Design Process - Value Management

Looked at 3 key major areas:

- Lighting controls
- Enthalpy Wheel
- Finishes



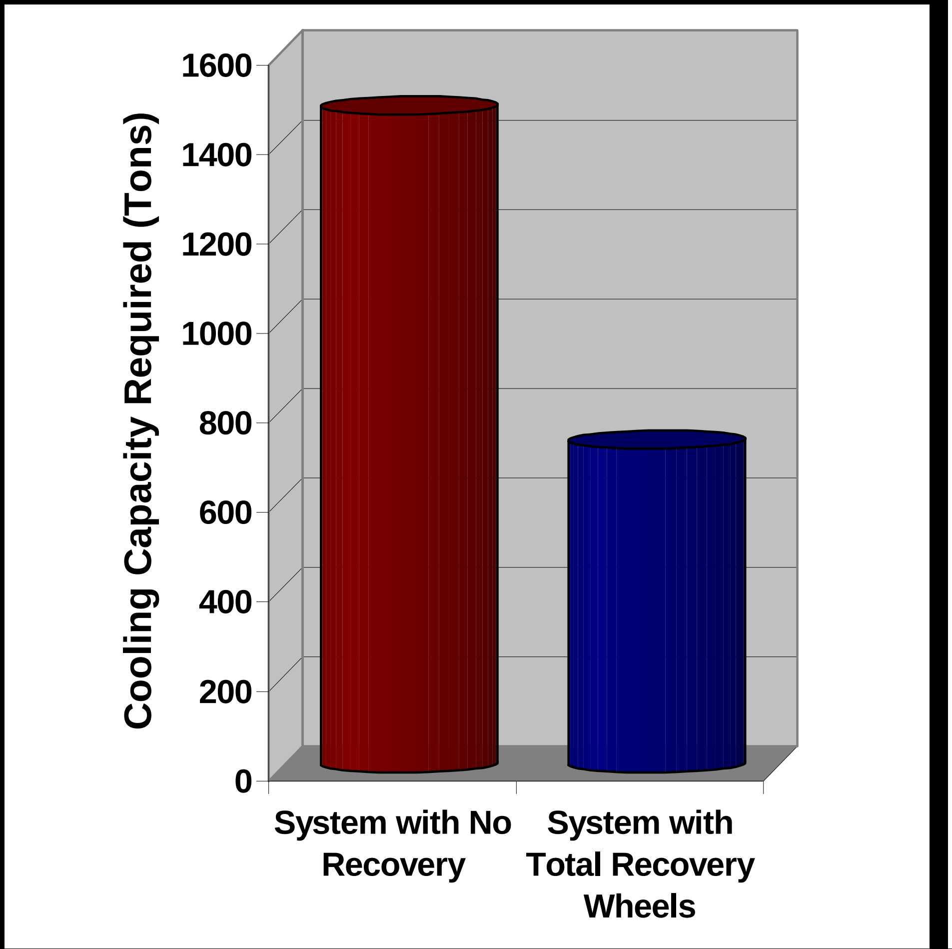
*Design Process - **Value Management***

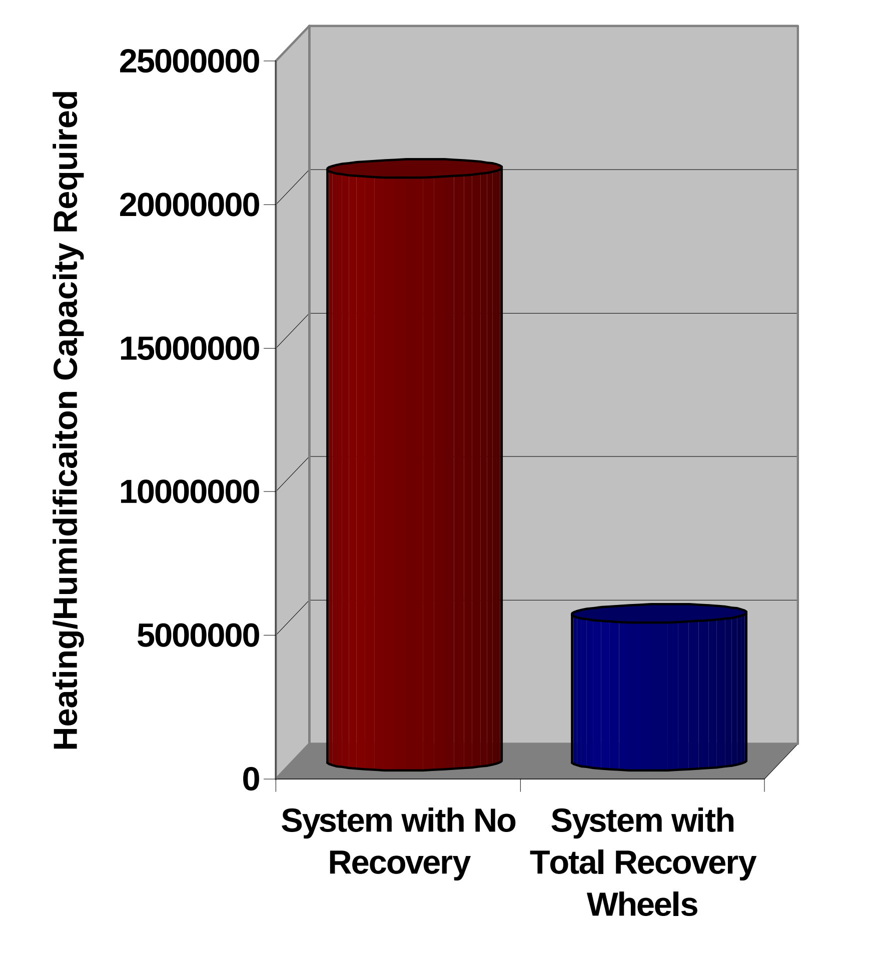
Enthalpy Wheel - Whitehead Life Cycle Analysis

- Total energy recovery wheels save an estimated $245,000 annually, three times that of a coil to coil recover option
- Total recovery cut 750 tons of chiller capacity and 450 Boiler horsepower
- Provided a positive present value cash flow of $1,700,000 based on 20 year life cycle
- Provides estimated energy savings in the amount of $5,900,000 based on a 20 year life cycle analysis*

* Assumes: inflation at 2.5% and cost of capital of 8%, 50% taxes

Economics: Whitehead Building

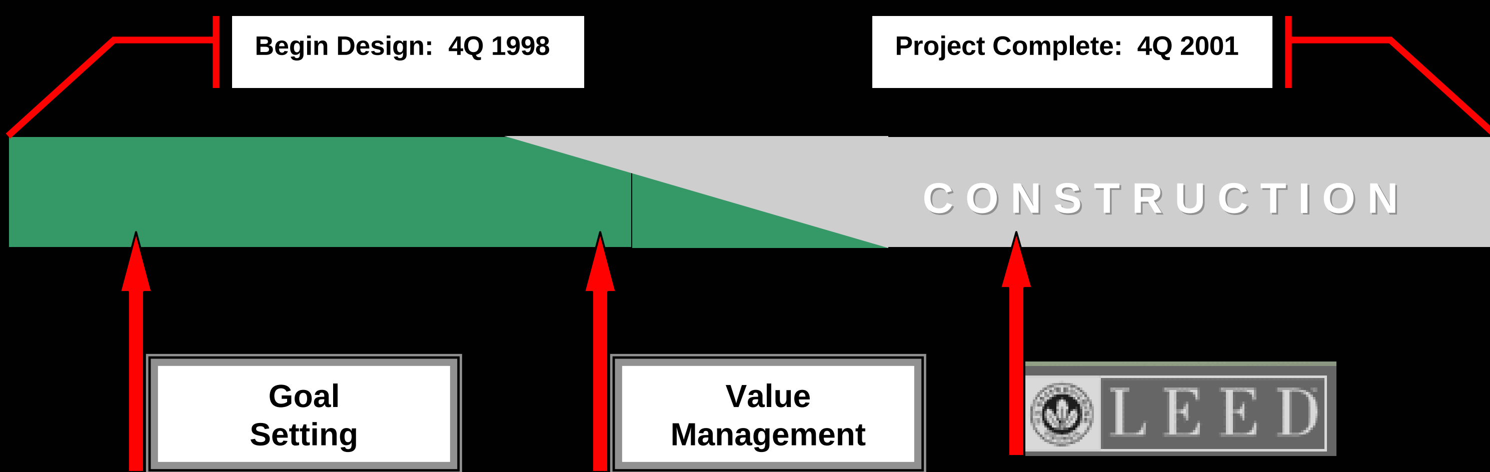




Design Process - Construction

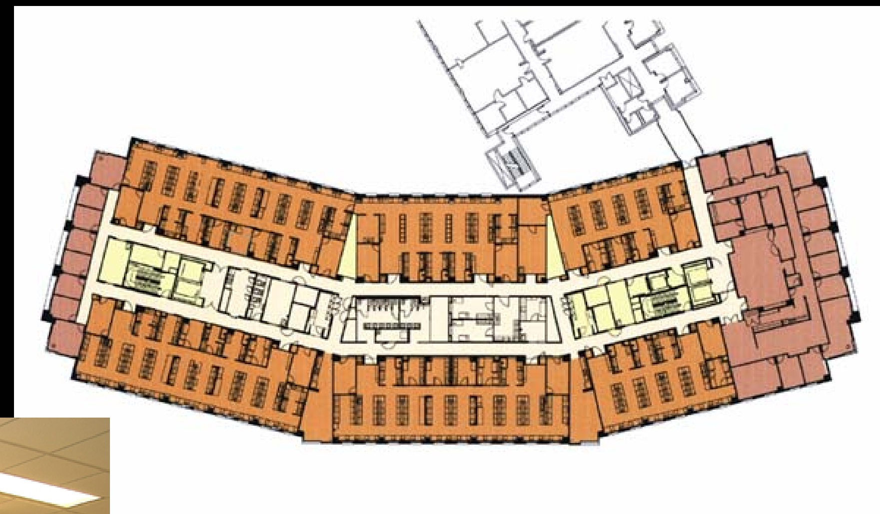
To LEED or Not to LEED?

- Owner driven request to pursue LEED
- Joint Team Training
- Meetings every 2 weeks
- Some Changes made in construction

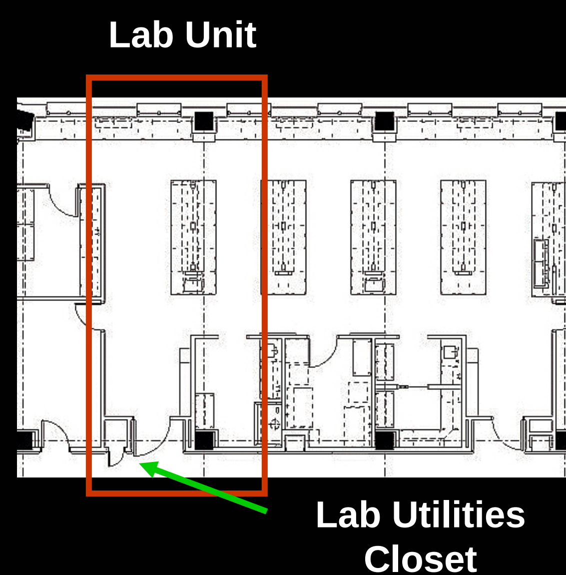


Sustainable Design Strategies

Flexible Design



Modular Lab / Office Plan
Modular HVAC & Piping Design



Sustainable Sites

- LEED Credit 2 – Urban Redevelopment
- 61,700 SF per acre
- LEED 4.1 – Public Transportation

Water Efficiency -

LEED 1.2 Water Efficient Landscaping

Local Plant Material – no grass.
Rainwater collected in cistern for irrigation

Water Efficiency -

LEED 3.2 Water Use Reduction - 30%

Condensate Pipe Out

32% reduction in potable water through enthalpy wheel reduction in humidification levels and cold room compressor

Energy & Atmosphere -

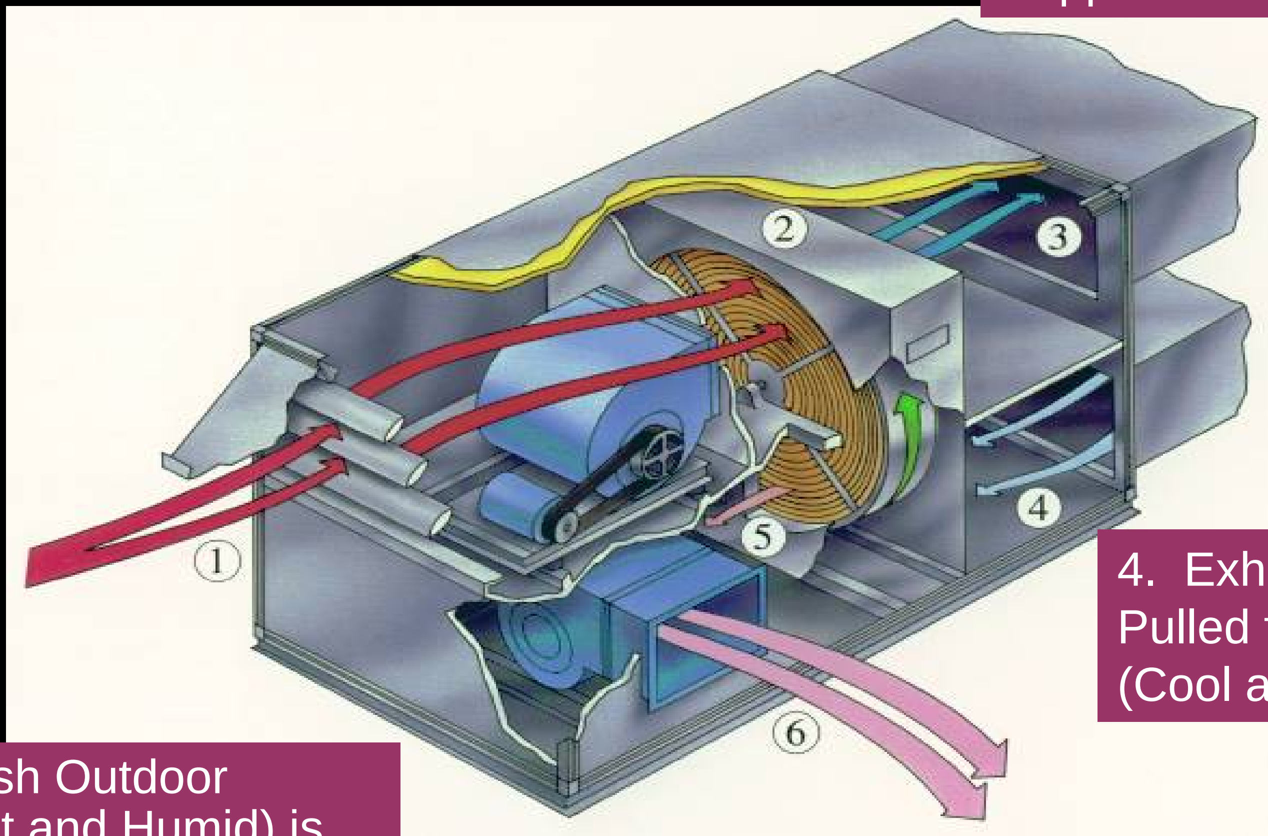
LEED 1.1 Optimize Energy 20%

- Long East/West Axis
- Enthalpy Wheel – Heat recovery
- High Performance Glazing
- Cage Wash

Enthalpy Wheel

How it Works? (cooling mode)

2-3. Outdoor Air is Cooled, Dehumidified then Supplied to HVAC System



4. Exhaust Air is Pulled from the Space (Cool and Dry)

1. Fresh Outdoor Air (Hot and Humid) is Passed Through the Wheel

Energy & Atmosphere -

LEED 1.1 Optimize Energy 20%

Daylighting Sensors

LEED 4.2 – 50% Recycled Content:

1. Selected materials that contributed at no add'l cost
   - Steel
   - Flooring
   - Used metal strapping in place of wood blocking
   - Counters – Trespa Toplab

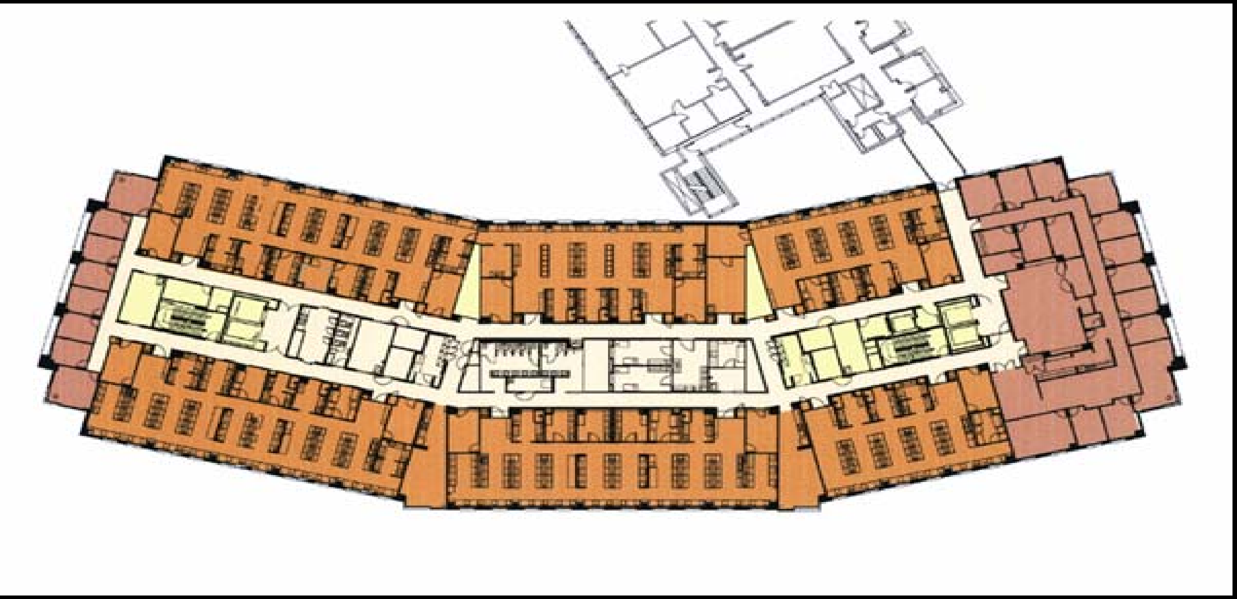
LEED 5.1 – Local/Regional Materials

2. EIFS cladding (local plant)

3. Block/concrete

LEED 4 – Low Emitting Materials: paint, carpet, adhesives

LEED 8.2 – Daylight and Views: 94% of spaces



Innovation Credit

Robotic Cage Wash

Case Study –
Biomedical Research Building/Emory University

Keys to success:

- Visionary, involved client
- Early goal-setting and documentation = **TIMING**
- Effective leadership
- Team / consensus building (buy-in) = **TEAMING**
- Value management
- Documentation and periodic review of internal and external goals = **TRACKING**
- Effective use of available design tools

TENACITY

Stuart Lewis,
Atlanta

Case Study

Charlottetown Government of Canada Building

Location: Charlottetown, PEI, Canada

Project Type: Office Building

Size: 17,345 M2

Cost: $27M Canadian

Date of Completion: 2005

Team: HOK Architects, Keen Engineering, B, G, H J Assoc. Architects

Green: Flagship Sustainable Project; LEED Gold Anticipated

- Historic District Revitalization
- Rainwater capture and Greywater reclamation – 80% Reduction
- Mixed Mode Ventilation
- Building Mass as dynamic thermal storage (radiant heat and chilled slab)
- Maximum Daylight Harvesting
- Zoned Lighting Controls
- Target 60% Energy Reduction
- Predominant Local and Recycled Materials
- Low VOC Materials
- Construction Waste

HOK Sustainable Design

Case Study

Charlottetown Government of Canada Building

- Building Envelope
- Neutralize the Perimeter
- Dynamic Thermal Storage
- Stratification
- Natural Ventilation
- Local Source Materials
- Site Selection
- Building Orientation
- Lighting Levels
- Daylighting
- Water Conservation
- Renewable Energy

Cost-Effective Green Design: Working Drawing review proposed NO changes to the design

Case Study

Charlottetown GOCB

University Avenue
approach drive
'highway commercial'

Euston Street
border to Downtown

BGHJ office

Municipal Capital

Provincial Government Centre

Queen Street
commercial 'Main Street'

'gateway'
grid shift at
border to Downtown

Atlantic Technology Centre

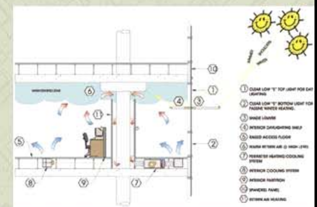
Province House
ceremonial focal point

Great George Street
cultural street

Confederation Landing

Sustainable Design

Charlottetown GOCB

	Site/Water	Energy	Materials	Indoor Environment
Sustainable Design	• Orientation of building • Native landscaping • Ground water recharge • Public transport • Minimize foot print • Public open space • Bicycle storage • Carpool parking • Stormwater - control, capture as greywater  	• Natural ventilation • Operable windows • Photovoltaic • Waste energy reclaim • Passive and active solar • High performance building envelope, thermal mass heating and cooling, daylight, orientation, building geometry, night time flushing   	• Regional materials within a 500 km radius • Low maintenance, long life • Recycled content, recyclibilty after use, life cycle cost, environmental impact during manufacturing process, manufactures environmental record  	• Natural materials • Vegetation • Living wall • Low VOC's • Products manufactured with natural materials • 100% fresh air • Daylighting, displacement ventilation, thermal comfort control 
Supportive Work Environment	• Attractive outdoor open space • Suntrap • Celebrate winter - all seasons • Xeroscape landscape • Water features • Storm water cisterns • Evaporative cooling  	• Increased personal control • Material, building structure, community, mother nature • Sun, building system, user education	• Regional economy • Natural environment Indoor environment • Occupants, building owner 	• High quality indoor air • Daylight and views to outside • Increased performance • Decreased absenteeism • Increased satisfaction 
Connectivity	• Relationship to the urban environment, the livable city • Transit • Connection to diurnal and seasonal cycles • Sun path • Wind flow • Awareness of weather  	• Global warming • Energy crisis • Long life • Macro environment • Generations • Bench mark • Community • Ecosystem 	• Use of latest development in materials • Show connection of materials to environment (natural, recycled, recyclable) • Tactile experience • Visual experience • Community  	• Connection to outside environment • Seasons • Community • Daily weather patterns

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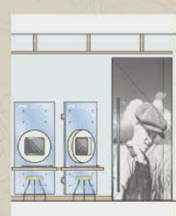
Supportive Work Environment

Charlottetown GOCB

	Culture	Space	Tools	Amenity
Sustainable Design	• Awareness of environmental issues through building initiatives • User-controlled aspects of green systems responsive to the changing environmental patterns of both day and night • Responsive to localized users, utilize energy saving devices (reheat coils) • Understanding of the building operation equals participation in its management,	• Superior quality of light and air - increased employee satisfaction • Integration of recycling in oasis social space • Flexibility ensures longevity of facility, maximum reuse of components 	• Ease of reconfiguration supports user control  	• Amenities connecting to outdoor environment • Celebration of seasons  
Supportive Work Environment	• Community-building environment • Space designed for wayfinding/orientation • New worker looking for lack of hierarchy but seek out mentors • Support Communication  	• Master plan "bylaws" provide user guide to office space, user reconfigurable components reduces cost of churn • Daylighting and views, mix of collaborative and private environments • Zoning of open and closed spaces  	• Kit-of-parts approach to tools - from desking to meeting rooms • "Fold-n-go" user-changeable components • Whiteboards and other mobile tools throughout to support informal collaboration and meeting   	• Variety of supportive amenity spaces • Accessible locations   
Connectivity	• Canada Place - connecting to national culture • Fostering urban street life 	• Organization provides connection to all amenities  	• Tools support collaboration, internally and remotely 	• Support of ties to the neighbourhood community • Connection to amenities in other adjacent facilities 

Connectivity

Charlottetown GOCB

	Technology	Public	Governments	Neighbourhood
Sustainable Design	• User oriented controls • Increased monitoring of building systems and environments • Higher efficiency and longevity of building services equipment	• Demonstrable commitment to the environment • Stewardship through minimized operation costs 	• 'Green' image representative of all government services 	• Minimize sun shadow effects for neighbours • Reduced air pollution through optimized operating systems • Minimal light pollution
Supportive Work Environment	• Collaborative workspaces • Increased information access • Increased flexibility (touchdowns) • Multiple work environments • Ease of churn	• Transparency of building organization from the street • Welcoming reception/interaction areas • Areas for research, meeting, community services, security • Wayfinding 	• Visitor drop-in workspaces (Business Centre)  	• Inviting/habitable building edges • Landscape elements • Public seating 
Connectivity	• Accessible technology pathways • Adaptability to future technologies • On-going monitoring program • Work-anywhere opportunity  	• Accessibility to all government services from a centralized location/live and virtual • 'Transparency' of government at work • 'Humane' image of government services  	• Increased accessibility to government services for both public and staff use • Shared amenities between adjacent government facilities (municipal, provincial, federal)   	• Accessibility and proximity of government services • Transparency of building activities from the street • Special events • Receptive outdoor areas for all seasons • Gateway to CBD • Presence on 'principal access route' • Participation in neighbourhood economy  

The Integrated Design Process starts . . .

Matrix as guideline

Full team visioning / kick-off session

- Full team participation – clients, users, consultants. . .
- Establish goals, milestones, opportunities

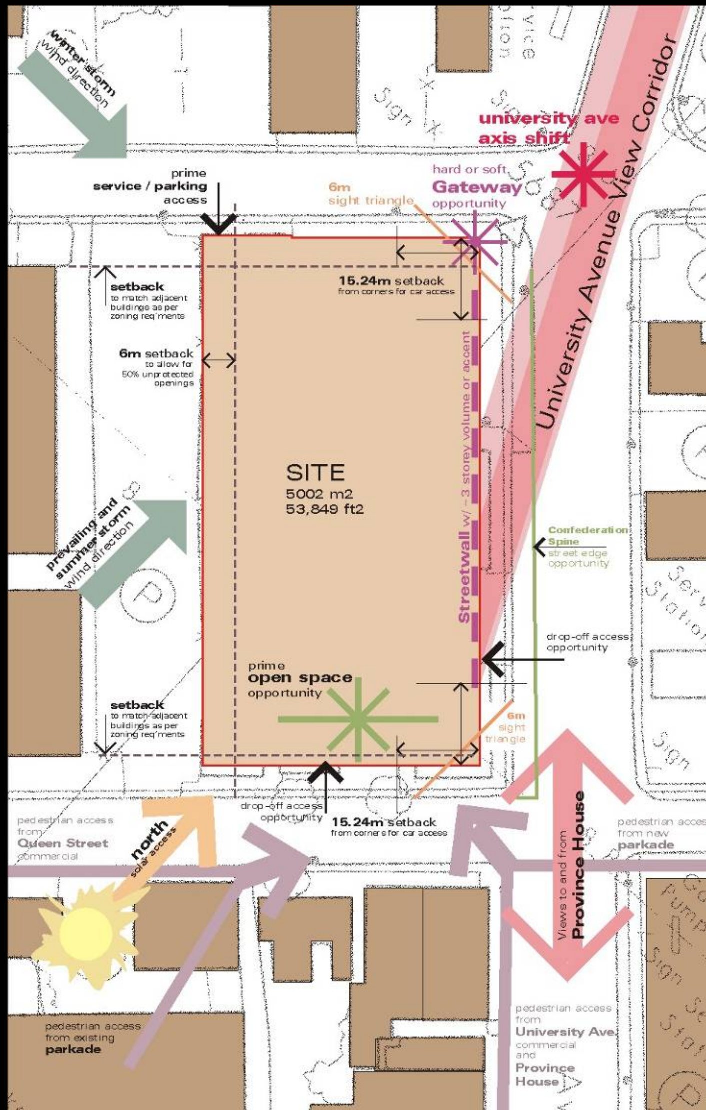
Worksession format repeated at milestones

- Update of LEED, energy and budget targets
- Reaffirm vision for users
- Not a presentation!

Client acknowledgement of thoroughness of process

Case Study

Charlottetown GOCB



Site Analysis

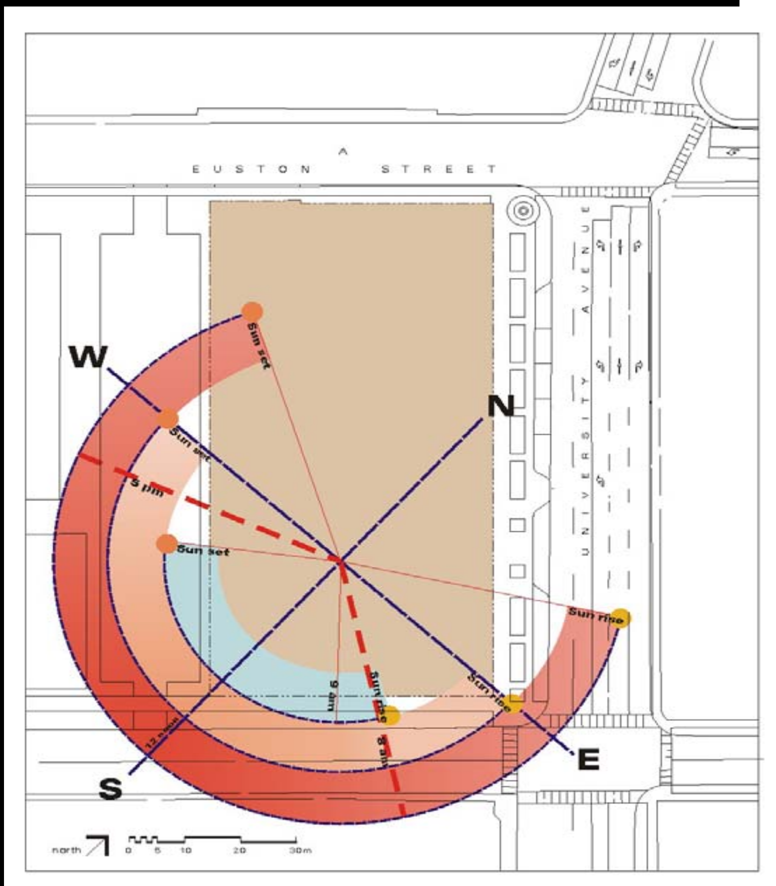
Analysis Plan

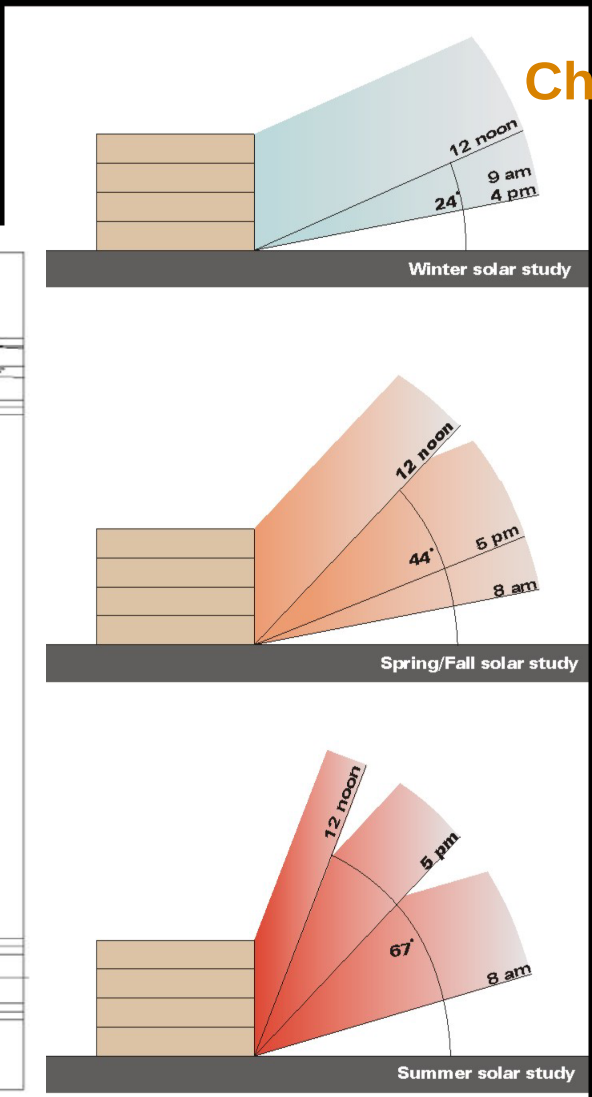
•Urban Context Analysis

•Climatic Conditions

•Regulatory Requirements

Case Study





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TECHNIQUES

Building Envelope

Neutralize the Perimeter

Natural Ventilation

Building Orientation

Lighting Levels

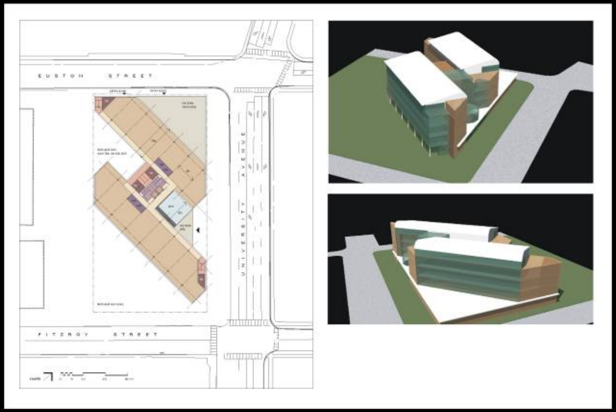
Daylighting

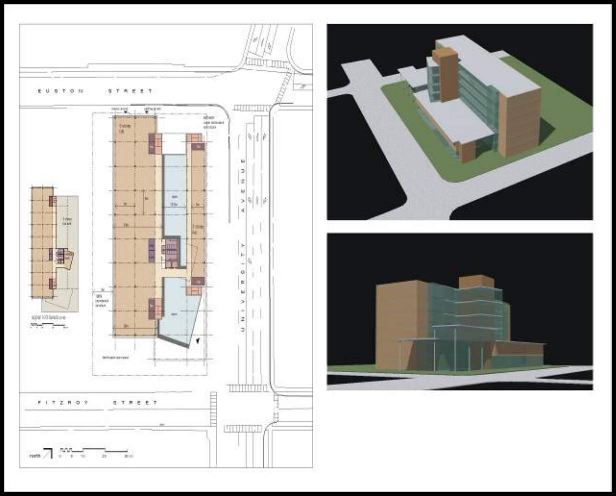
Renewable Energy

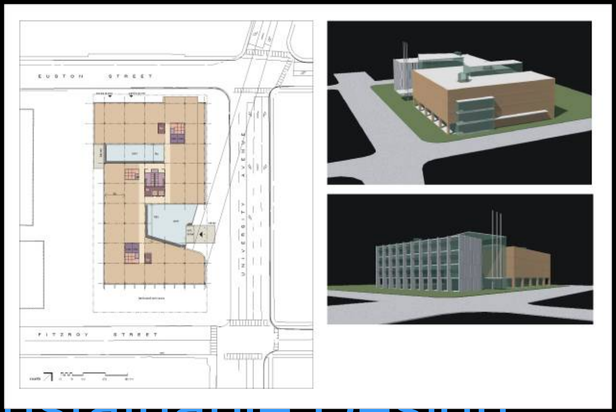
Case Study

Charlottetown GOCB

Massing Options







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Case Study

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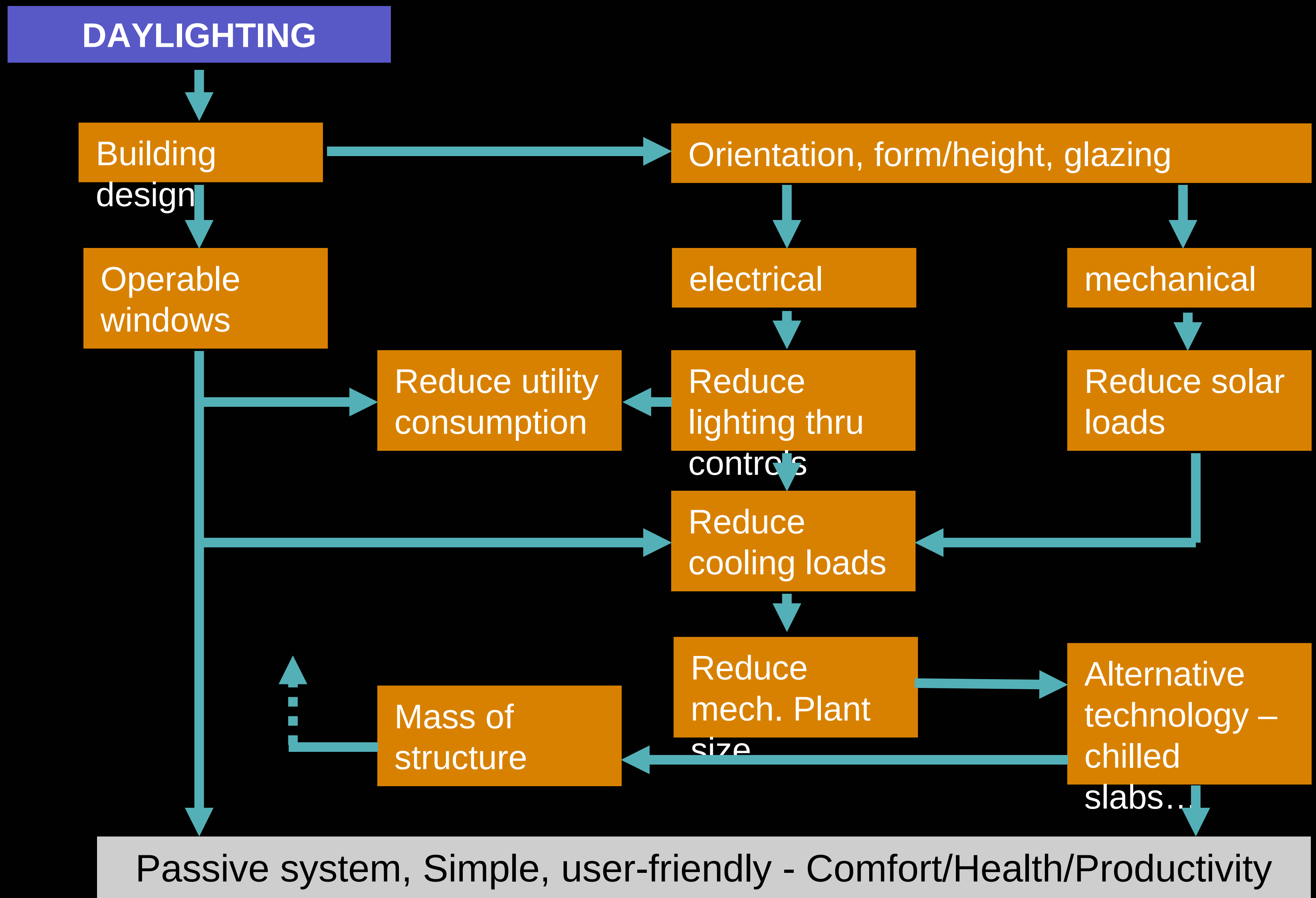

Case Study

Charlottetown GOCB

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Case Study

Charlottetown GOCB

TECHNIQUES

Building Envelope

Neutralize the Perimeter

Local Source Materials

Natural Ventilation

Site Selection

Case Study

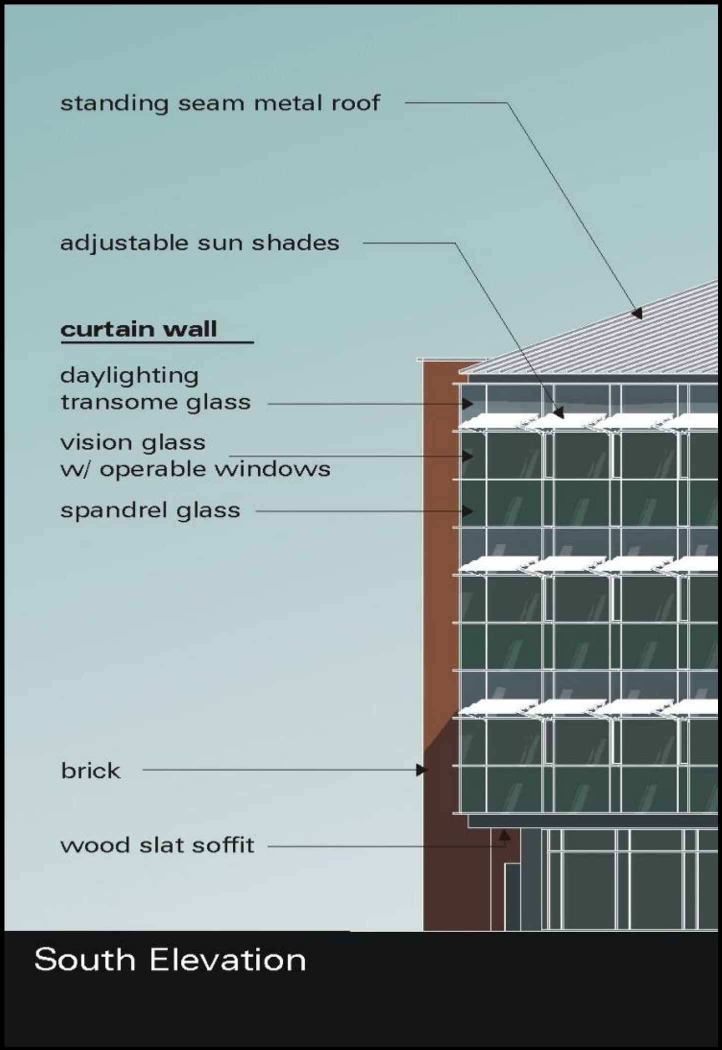
Charlottetown GOCB

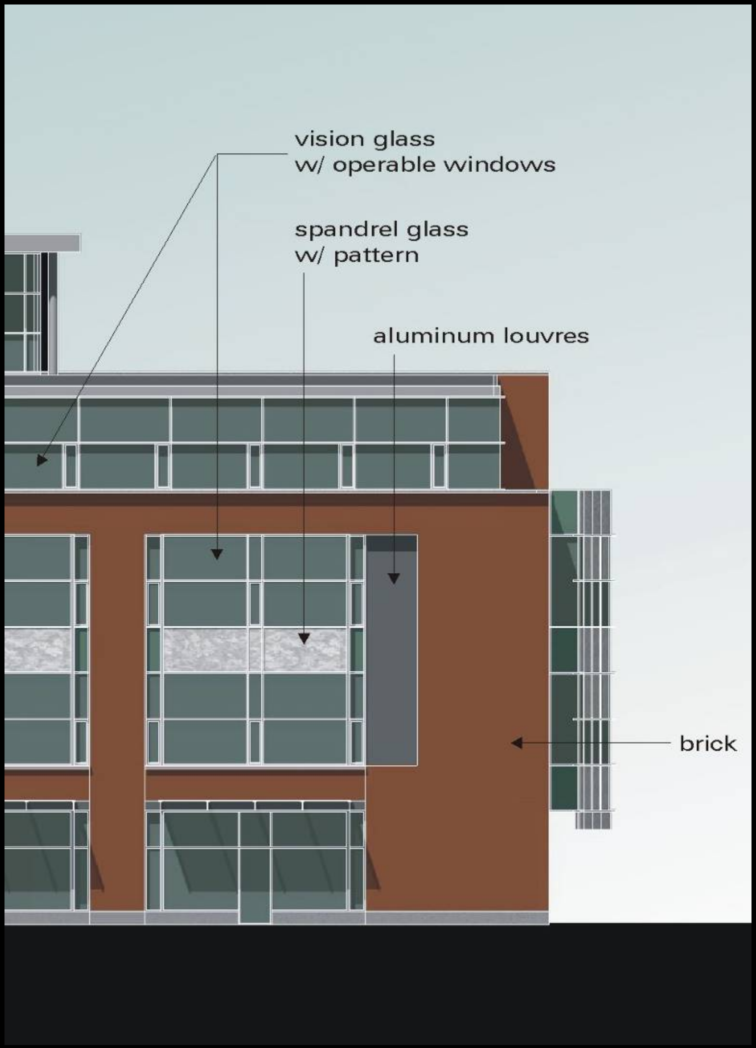
TECHNIQUES

- Site Selection
- Building Orientation
- Daylighting
- Neutralize Perimeter
- Rainwater Harvesting
- Renewable Energy

Case Study

Charlottetown GOCB





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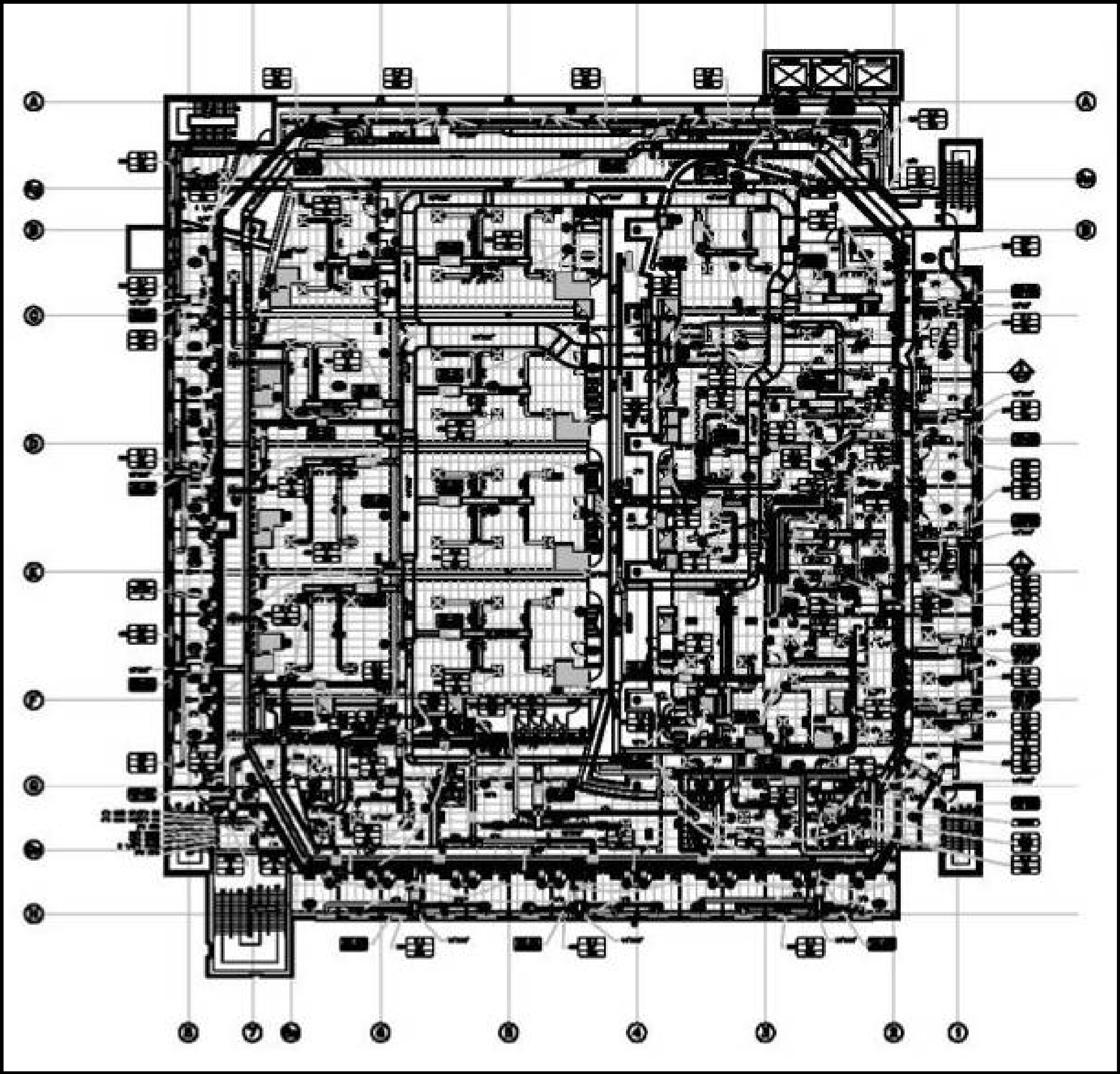

THE TRADITIONAL SYSTEM

- System Intensive

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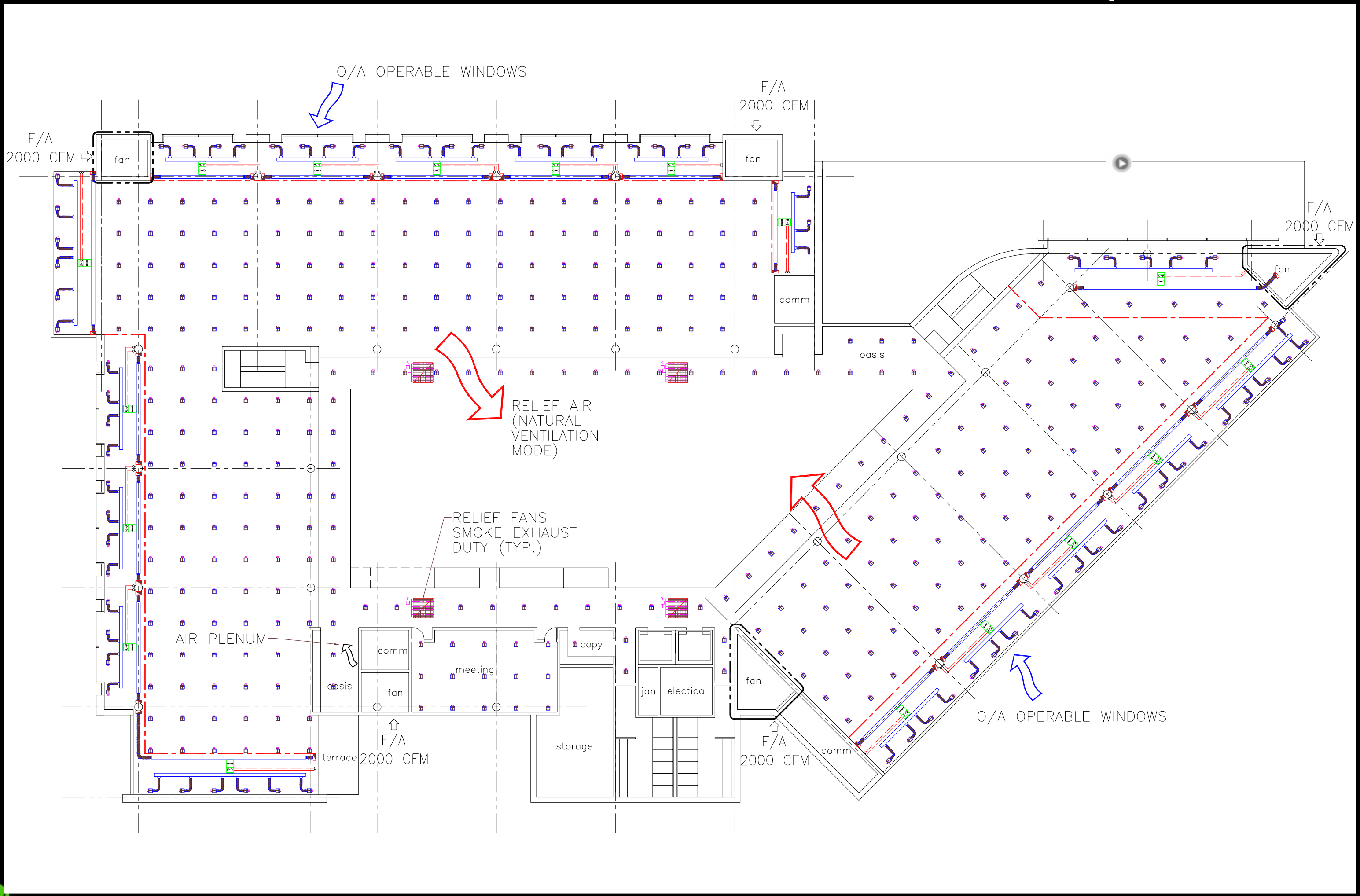
UFAD + Radiant Slab SYSTEM

Envelope Intensive



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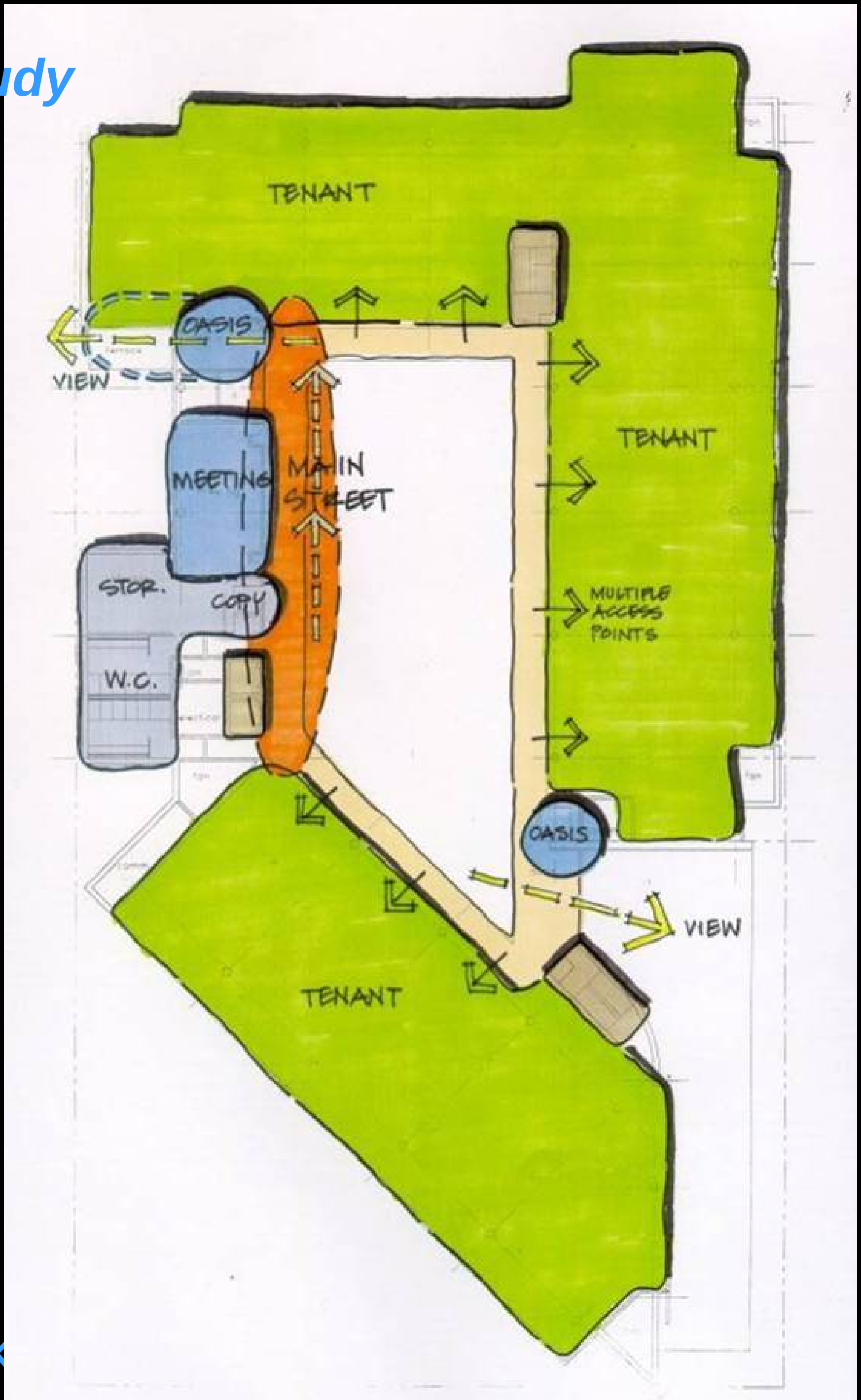
Case Study



Charlottetown GOCB

Interior Relationship Diagram

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Case Study

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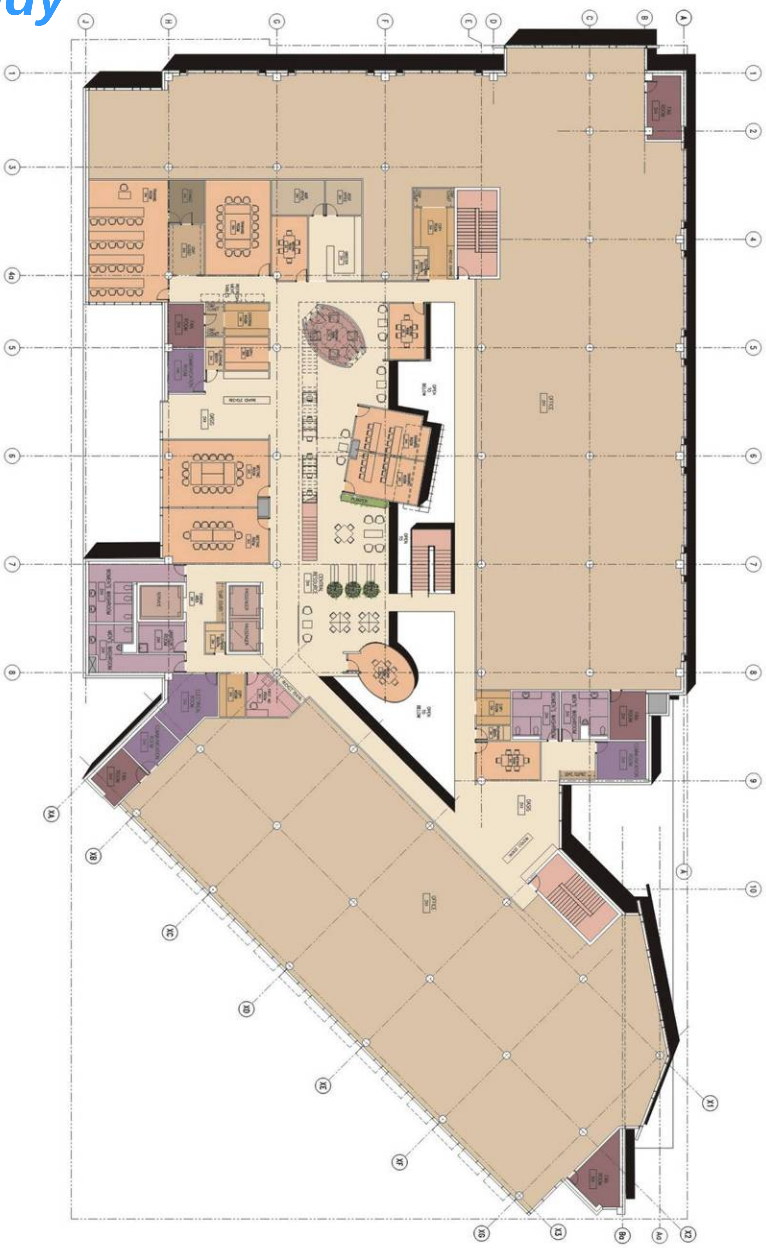

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Case Study

Charlottetown GOCB

Atrium – Town Centre

TECHNIQUES

Dynamic Thermal Storage

Stratification

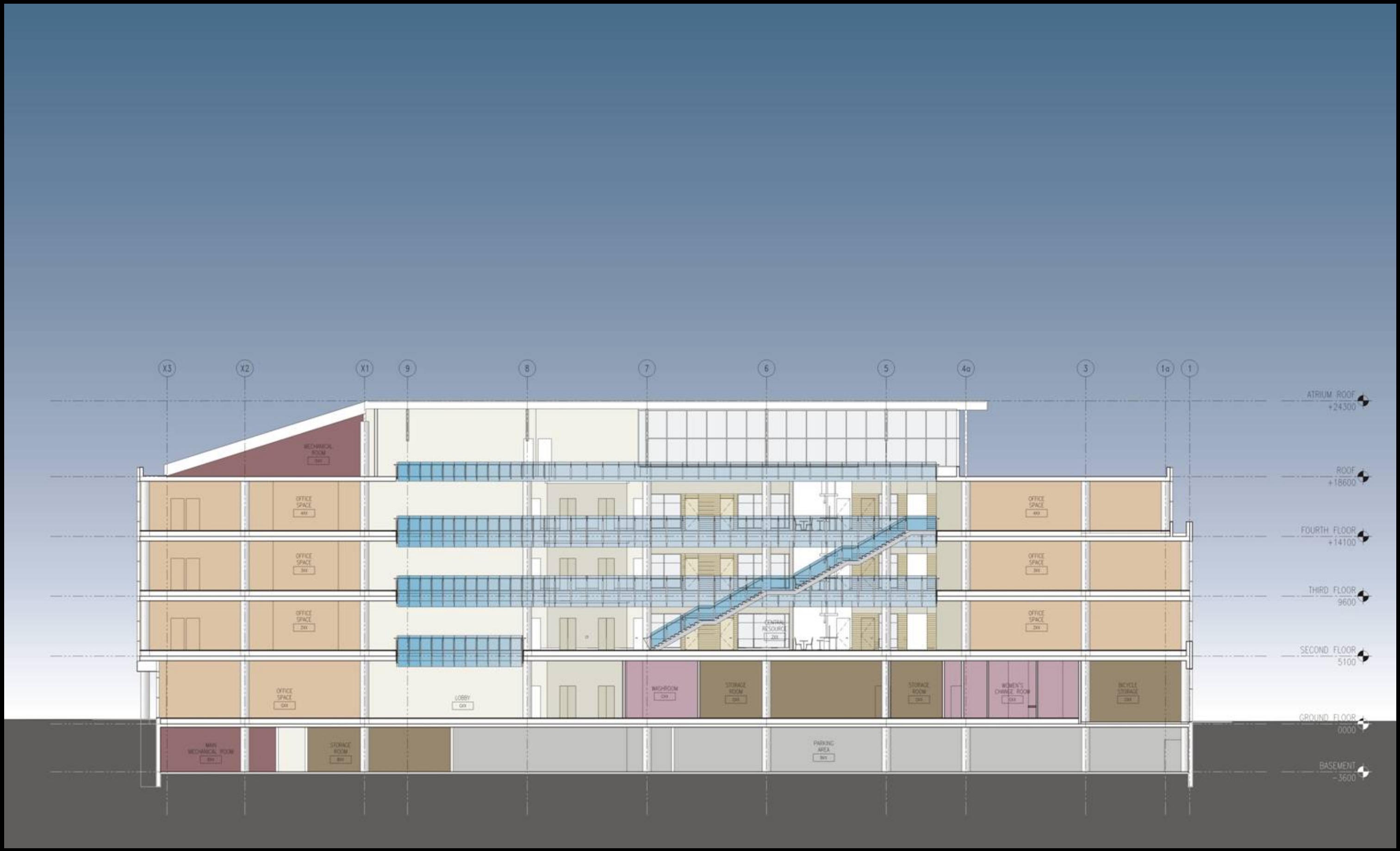
Natural Ventilation

Lighting Levels

Daylighting

Case Study

Charlottetown GOCB



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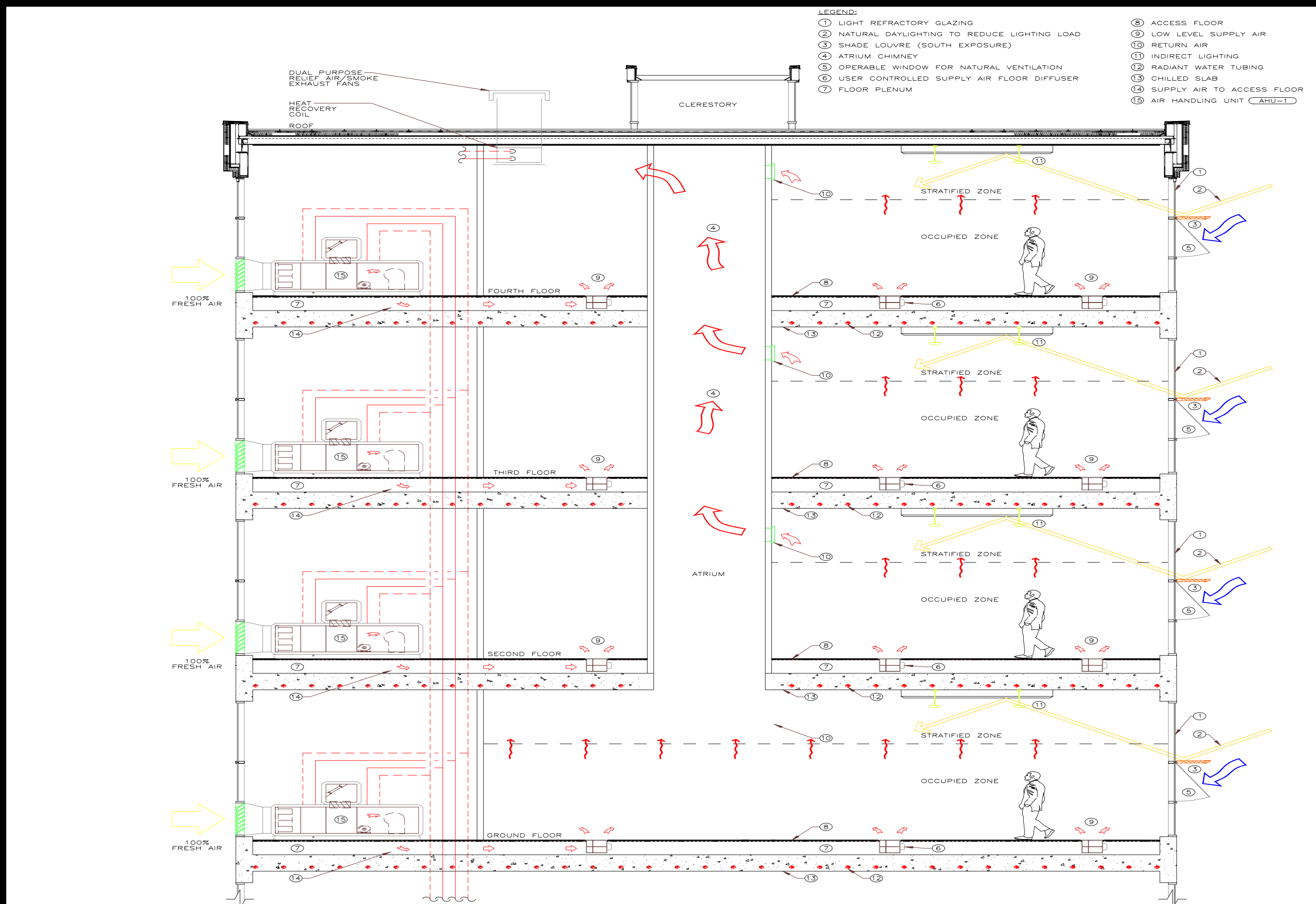
Case Study

Charlottetown GOCB

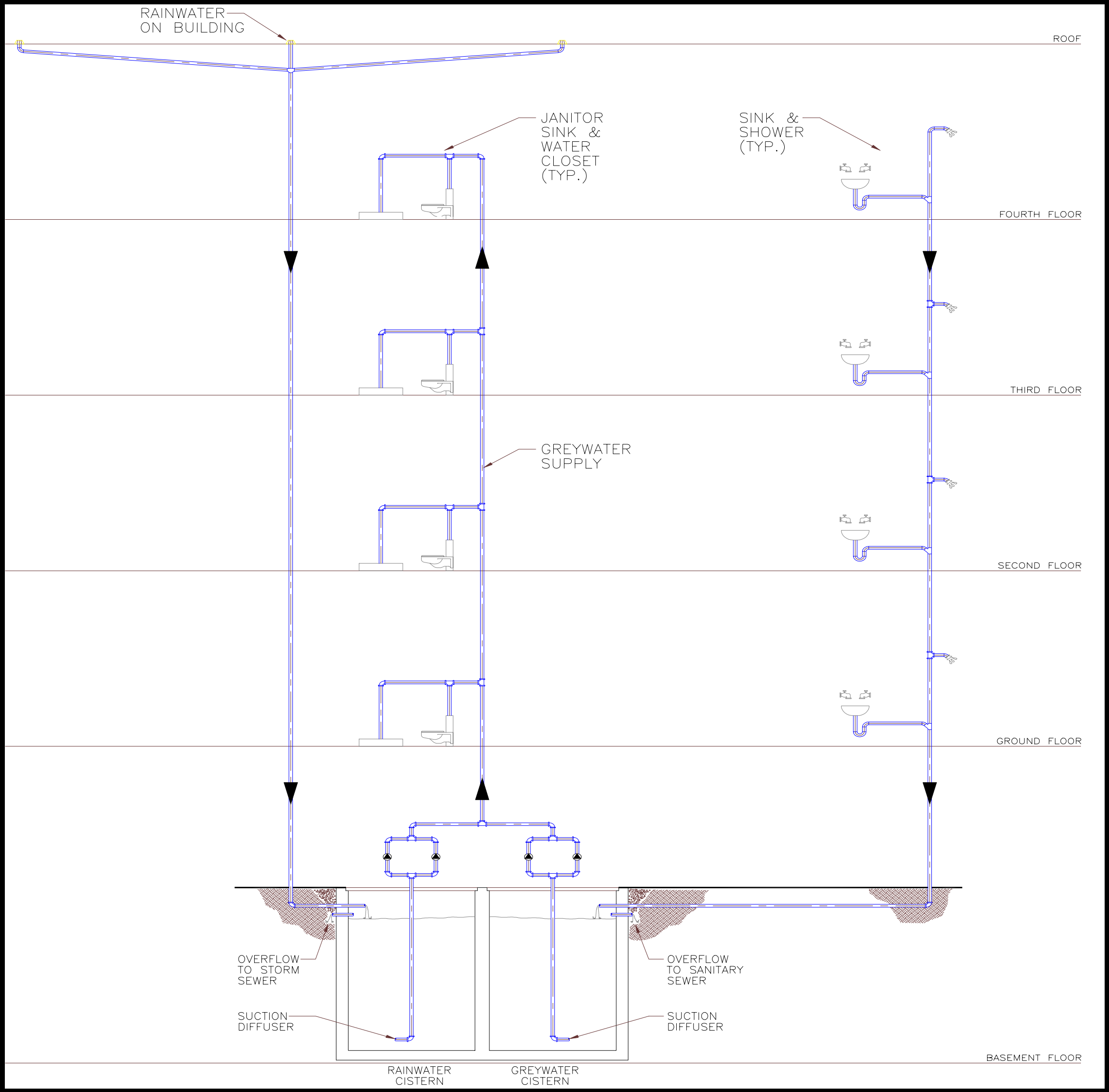
Atrium – Mechanical System



Case Study

Charlottetown GOCB

Rainwater / Grey Water Piping Schematic



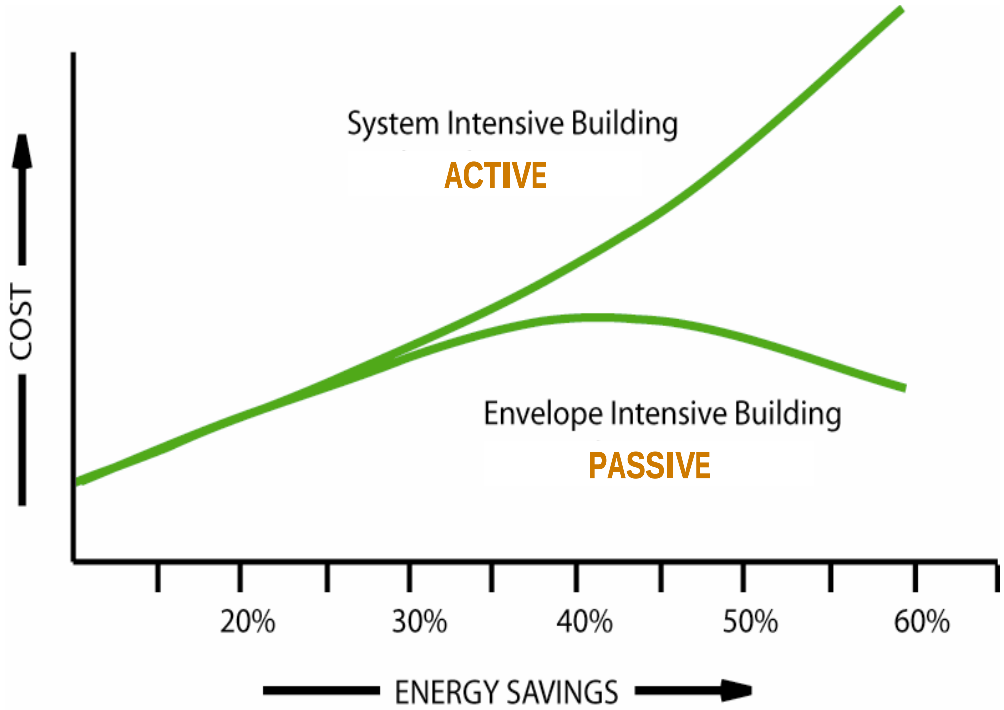
HOK Sustainable Design

Case Study

Charlottetown GOCB

Case Study

Charlottetown GOCB



Source: USGBC LEED Advanced Workshop

COST & PERFORMANCE

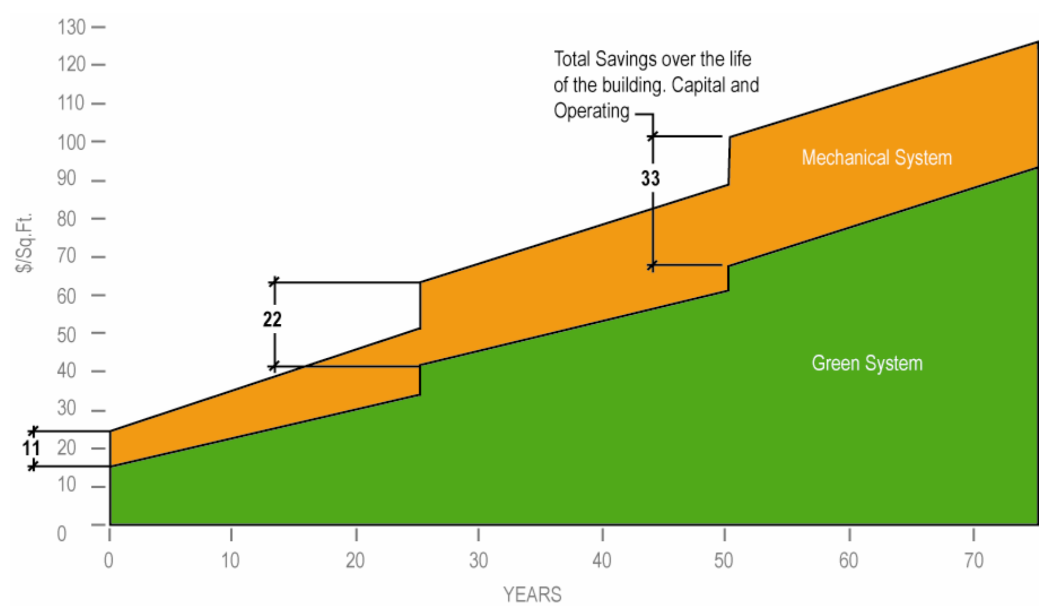
System Intensive

- **Additive process**
- **Linear**
- **Reactive**

Envelope Intensive

- **Reductive process**
- **Cyclical**
- **Anticipatory**

COST & PERFORMANCE



Minimization through innovation makes sense

- •environmentally
- •socially
- •economically

Conventional Mechanical System

Green Mechanical System

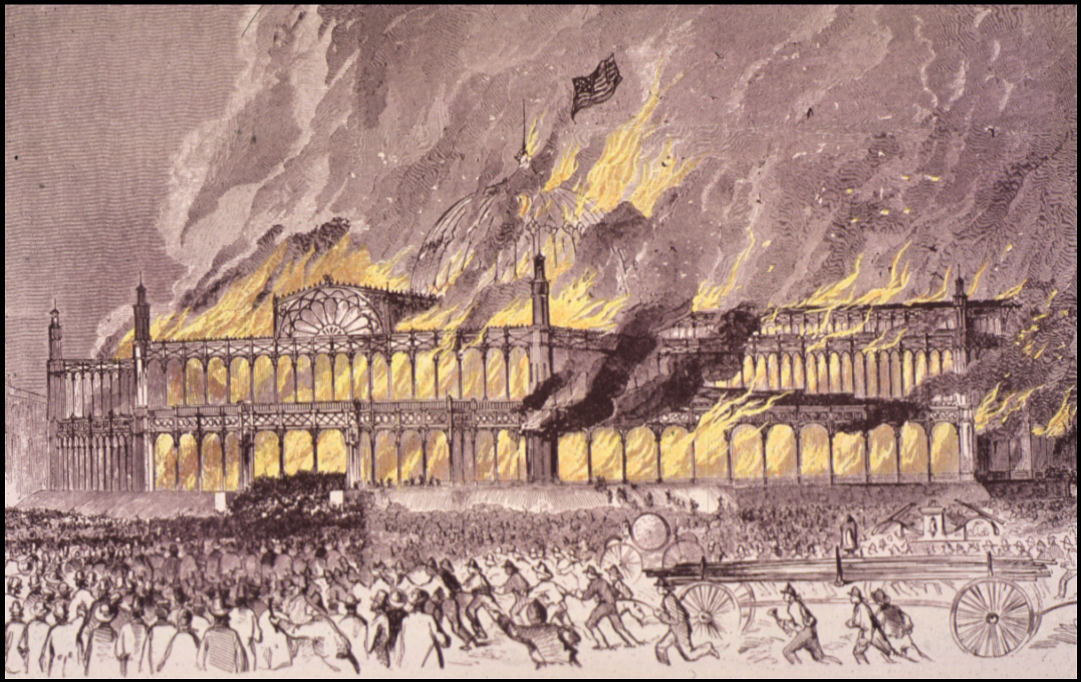
75 Year Life Cycle	Conventional Mechanical System	Green Mechanical System
Capital Cost…………………………….	$25.00 per sq. ft………………………	$15.00 per sq. ft.
Yearly Maintenance Cost…………..	$1.00 per sq. ft………………………	$0.75 per sq. ft.
Replacement Cost (every 25 Years)….	50% of original Capital Cost………..	50% of original Capital Cost

Case Study

Charlottetown GOCB

Who	The integrated Team = TEAMING
	designers, consultants, owners, users, commissioning, contractor
When	As early in the process as possible = TIMING
	essential for goals and integration to have any value
Where	clients are requesting it
	PWGSC, Manitoba Hydro, Toronto District School Board . . .
What	Goals + Metrics = TRACKING
	agree on them and use them consistently throughout = TENACITY
Why	The triple bottom line
	adds quality and long term value to any project

Is sustainable design simply a collection of best practices that reduce environmental burden, or is it fundamental to the process of design?



Life Safety Analogy

. . . transformed design practice

Sustainability and Integrated Design

Now

. . . market advantage

Soon

. . . market necessity

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