Sustainable, High Performance Buildings Need Air Barrier Performance

Practical Cases Identifying The Issues

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Sustainable, High Performance Buildings: Bad For Business As Usual:

Construction and Utility Business Relies on Poor Performance in Buildings

Maintenance, Re-Construction, Energy: $Trillion/Year
“Businesses (Countries) which prepare for and take advantage of the new energy reality will prosper - failure to do so could be catastrophic.”

Computer Simulation Process: Infiltration Responsible for 33% Increase in Heating, 3% Decrease in Cooling? Suggest Performing Actual Tests, These Results Suspect
What Sustainable, High Performance Buildings Need From Mechanical Systems

Energy: 95% Reduction in Electrical & Fossil Fuel Use.

Eliminate A/C Electric Demand

Maintenance: Easy Preventive Maintenance, 70% Less Cost.

Triple Life Cycle

Thermal Comfort: Double it!
Human Thermal Comfort

A/C Comfort Rating $\approx 40\%$

Need Comfort Rating $>80\%$
Maximize Comfort/Productivity

Radiant & Humidity Control

Potential 85% Energy Reduction
Displacement Ventilation

0.05-0.3 cfm/ft², 67°F, 100% OA

Potential 97% Energy Reduction
Desiccant Humidity Control
(Liquid 2X Efficient, 2X Cost)

Exhaust Air
Add Heat in the Summer for Dehumidification
Add Cooling in the Summer & Warming in the Winter to Temper the Air

Outside Air
Summer: 95°F/50%Rh
Winter: 10°F/50%Rh

Exhaust Air From Building
Summer: 82°F/40%Rh
Winter: 72°F/40%Rh

Supply Air to Building
Summer: 65°F/30%Rh
Winter: 67°F/50%Rh
Example Building: 26 Story Dorm

Original Plan
1,500T Refrigeration, 20,000,000BTU Heat.

Mechanical System:
- Rooms: 4 Pipe Fan Coils;
- Corridors and Common Areas: VAV Systems.

180ºF Heating Water, 45ºF Chilled Water
Sustainable Building

Eliminated: 1,500 Tons Refrigeration
Electric Demand: 1800KW to 50KW

96% Electric Saving
94% Fossil Fuel Saving

Original Building
Building Envelope

Air/Vapor Barrier Improved
Extra R15 for Walls, R30 for Roof,
Serious Windows
Commissioning of Envelope

Will This Envelope Really Perform for 100 Years?
What Sustainable, High Performance Mechanical Systems Need From Building Envelopes

Indoor Humidity Control
Indoor Air Control
Indoor Comfort

Life Cycle Perf, 100 - 300 Years
Climate Change Over 100 Years
Sustainable Performance Stds?

LEED: 3 year 30% Mechanical System Efficiency Loss. %Blame of Building Envelope?

Passive House, No LCP

Historic Preservation, None

US Residential? Commercial?
Building Component Longevity, Stuart Brand’s Book

What Component Is The Air Barrier? Structure, Skin, Both?
Air Barriers

Tend to be Membranes

Resilient Air Barriers, Fact or Oxymoron?

1/2” from Inside Room Surface: Puncture Position, Inside Sheetrock

Air Retarder/Vapor Barrier on Outside of Wall Insulation
Passive House Design

Insulated Air
Tight Envelope
Details Stop
Thermal/Air Breaks
Air Barrier Is Inside Skin, Vulnerable
Current Commissioning

Passive House: 0.6AC/H @ 50Pa
PH Existing Bldgs: 1AC/H @ 50Pa
No Life Cycle Performance

UK Tests: 1.5AC/H @ 50Pa
40 Year Old Test
No Life Cycle Performance
Proposed Pre-Commissioning

Pre & Post Envelope Lab Tests

Seismic Tests
100 to 350MPH Projectile,
Wind and Water Tests

Air Tests: 0.5AC/H @ 50Pa
2AC/H @ 300Pa
What You’re Getting Validates the “Design”

Commissioning Validates The Design & Design Intent

That the design works and meets the “design intent”

Design
Construction
O & M

Retro; Re; or Ongoing Cx
What Commissioning Should Be

Validate Owner’s LCP Requirements

Commissioning Validates The Design Will Perform To The Owner’s Detailed Life Cycle Performance Requirements

Design

Construction

O & M

Changing Needs

Commissioning

“Re” Cx

Detailed Design Intent
The Detailed Design Intent Document (DDI)

A Detailed CB + DI + BOD

A Detailed Explanation of How and Why Components and Systems were Selected, Sized and Integrated into Total Design.

Transparency of Design Decisions
No Grey Areas or Wiggle Room
DuPont Tyvek Home, Stucco and Commercial Wrap

Walls Above Ground, No Basement or Roof Systems

Static Tests for Air @ 75PA

Static Vapor and Water Penetration Tests
Henry Company
Building Envelope Solutions

Walls, Roof, Basements & Joints
Complete Envelope Products

Static Tests for Air @ 75PA
Static Vapor and Water Penetration Tests
Superior Walls
Factory Manufactured Pre-Cast, 5,000lb Concrete Walls
Pre-Insulated Concrete Walls
Basement, Plus 2 Stories
Moisture Resistant and Insulated.
Needs Basement and Other Floors Plus Roof Connection Details
Shearwall Provides Resilient, Protected Air Barrier System
InterGreat Envelopes: Factory-Constructed, Specific Material Selected Envelopes

Pre & Post Envelope Lab Tests

Seismic Tests: Shake Table 100 to 350MPH Projectile, Wind and Water Tests

Pre & Post Air Tests: 0.5AC/H @ 50Pa, 2AC/H @ 300Pa
Summary: What We Need for Sustainable, High Performance Buildings

Tests to Prove Initial & Life Cycle Wall Performance & Resilience

Total Quality Cx with a DDI

PERFORMANCE DOCUMENTATION
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