Passive Building Systems vs Active Building Systems and the Return On Investment

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Goals

Discussion on the challenges faced by owners in defining performance criteria in a competitive market with a focus on the tradeoffs between maintenance costs and the initial installation costs and how this can effect the Return On Investment.

The presenters bring over 40 years of experience from both the public and private sectors to review this issue as they analyze building mechanical systems, envelope design, etc.
Presenters

Andrew Blumenfeld – A veteran of more than 20 years in public sector construction, Mr. Blumenfeld was recently appointed to be the National Director of Acquisition for GSA’s Public Building Service. Previous Assignments include Director of Construction for GSA’s National Capitol Region, Project Executive for the Renovation of the Pentagon, Legal Counsel to the Pentagon Renovation Program and Deputy General Counsel for the Baltimore District of the U.S. Army Corps of Engineers.

William T. Thumm - Mr. Thumm has managed over 2.5 billion dollars in construction over the last 17 years with Hensel Phelps. His most notable projects include the Pentagon Renovations during 911, the Baltimore Hilton Convention Center Hotel and the Russell Knox Headquarters project at Quantico, VA. He has the following certifications: DBIA, LEED BD+C, STS and PMP. William has an MS from Columbia University and a BS from Lehigh University both in Civil Engineering. He is also the acting President of the Roger Williams University Construction Management Professional Advisory Board.
Market Forces Driving Change

Compelling need to reduce energy costs
- Regulatory Demands (State, Local & Federal)
- Customer Demands – LEED™ Cachet
- Market Forces/Discipline of the Marketplace

Energy Efficiency is Determined by 4 Key Factors:
- Active Energy Conservation
- Passive Energy Conservation
- Quality of Operations & Maintenance
- Demand Management (not addressed here)
Owners tend to:
- Overinvest in Active Energy Conservation
- Underinvest in Passive Energy Conservation
- Underestimate the Maintenance Costs of Complex BAS

Complexity is the Price of Performance
- Toyota vs. Ferrari
Recognizing & Managing the Impact of Complexity

- Redistribution of the Total Cost of Ownership ↓
  - Energy Costs ↓
  - Mechanical/Controls Maintenance Costs ↑
  - The Theory: Decreases in Energy Costs should offset increased construction and maintenance costs

Rebalancing these Factors can Improve the Owner’s return on Investment
Functional Purpose

Success/Stability brings excess

Excess bring Unsustainable Design

Unsustainable design brings about regulation

Or more simply chaos regulate theory

Outcome = Complicated building systems with competing requirements

Result

– High maintenance systems with a potential for a poor ROI

Ironic Evolution
Active Building Systems

Active Building Systems

- Principally Mechanical (HVAC)
  - Automatic Valves, Dampers etc
- Lighting Controls
- Occupancy Controls
- Demand Management & Peak Shaving
- Elaborate monitoring schemes (Intelligent Systems)

Advantages of Active Systems

- High Performance when properly operated and maintained
- Integrates multiple systems into a single “front end”
- Advanced Analytics and Real-Time performance monitoring
- Maintenance alerts via alarm
- Infinitely customizable down to the individual office
- High “Cool” Factor
Active Building Systems

Disadvantages of Active Building Systems

- High First Cost (Known)
- High Maintenance Costs (More Difficult to Predict)
- VIP Overrides
- Software Intense – Requires Periodic Updates
- Security Issues: Addressable nodes
- Lots of Moving Parts – Higher Failure Rates
- Proprietary – Owner “Locked In”
- Hidden Interdependencies
- Skill Gap
  - Requires new and different skills
  - Substantial Training Costs
- Without proper (i.e. costly) maintenance performance deteriorates quickly
Active Building Systems

Bottom Line: Beware the Maintenance Tail of Active Systems - Buy What You Can Afford to Maintain

Sometimes the Camry is the Right Answer!
Passive Systems

4 Key Building Envelope Issues
- Water/Air/Vapor/Thermal

Advantages of Passive Building Systems
- One time cost
- Costs Fixed and Known - High Cost Certainty
- Predictable stream of benefits
- Typically requires no Little or No Maintenance
- No Moving Parts & works 24 hours per day

Disadvantages of Passive Building Systems
- Increases First Cost
- Essentially Fixed
- Cannot be easily Upgraded
- No Sex appeal or cool plaques
Design Drivers

Monthly Cooling Load

- Misc Equipment
- Light Fixtures
- Occupants
- Window Solar
- Window Conductive
- Infiltration
- Underground Surroundings
- INT Surroundings
- Roofs
- Walls

Data for each month from January to December.
Other Design Drivers

- Temperature Set Point Constraints
  - 72 degrees plus or minus a degree
- Future Flexibility
- Peak vs Off Peak Loads
- Occupied vs Unoccupied Loads
- CO2 Monitoring/Occupancy Sensors
Simple Active Mech. Solution

- Chillers
- AHU/RTU
- FPIU
- VAV
- Exhaust Fans
- Boilers
- Supply Fans
Future Active Systems

- Adaptive and Fuzzy Logic
- Enthalpy/Energy Recovery Exchangers
- Microenvironments (Occupancy Sensors)
- Geo Thermal
- Liquid Desiccant Air Conditioning
- Microchannel Heat Exchangers
Reality

Interdependencies are increasing
  – Electrical tied to Controls tied to Mechanical tied to security

Controls Packages are getting more proprietary and complicated

Addressable Controls create potential security issues
Passive Systems

Stagnant systems require no power, no moving parts, no controls and little to no maintenance

Built around the Four External Envelope Issues

**Water / Air / Vapor / Thermal**
Water/Air/Vapor Details
Solar
Water/Vapor/Air/Thermal

NOTE: SEE 4/A3101 FOR COLUMN ENCLOSURE DETAILS AT SIM. NO WINDOWS AT SIM.

03 4500.K - 7" PRECAST CONC PANEL TYPE U. RE: A5203 FOR TYP. PANEL TYPES

07 9200.H - TWO STAGE RAINSCREEN SEALANT JOINT
03 4500.L - 7" PRECAST CONC CORNER. COLOR TO MATCH ADJACENT PANELS. RE ELEVATIONS FOR PANEL TYPE.

05 1200.B - STL COLUMN RE: STRUC.

09 2900.A - 5/8" GYP BD
09 2216.C - 2-1/2" MTL STUD

07 2100.N - 3" MEDIUM DENSITY SPRAY POLYURETHANE INSULATION

08 5113.A - SCHD ALUM WINDOW
Passive System Technology

Building Science Improvements

- More studies and experts

Better Material

- Liquid Applied
- Sprayed

Qualified Installers

- Training

Qualified Designers

- Interface details
Maintenance!!
Maintenance Reality

Data Point Overload
- Massive amounts of data

Reactive vs Proactive Maintenance

Overrides
- Manual and Programmed
Maintenance Challenges

Trouble with Troubleshooting

- Building system interdependencies create massive issues with troubleshooting.

Education/Compensation Lag

- Unbalanced with current systems

System Training vs Technical Training

- Builder can’t make up the difference
Maintenance Moving Forward

TSO (Transition to Stabilized Occupancy)
- Look to the builder to overlap first 180 ~ 360 Days

Challenge Industry
- RFPs should require maintenance savings ideas in the proposals and be willing to pay for them

Pump Up the Pay
- Owners need to analyze the maintenance staff and beef them up to match systems

ReCx (ReCommissioning)
- Good benchmark to see how the maintenance is going
  - Don’t be afraid of it.
Passive Systems Future

Maximize Passive Systems
- High Initial Cost with a low trailing Cost

Building Commissioning
- Building Pressure tests
- Water Tests

Third Party Inspectors

Simple Redundant Systems
- Gravity is free
- Belts and Suspenders Method
Active Systems Future

Work Backwards

- Realistically Align Systems with Maintenance Capacity

Minimalize

- Only do if it you need it not because it can do it.

Reduce Constraints

- Lessening some of requirements may encourage a simpler system which may actually enhance maintenance.

Technology

- Use technology that simplifies not complicates – e.g. Chilled Beams
Maximize the ROI

Owners should seek to maximize the Passive systems, Simplify the Active systems and Balance their Maintenance capabilities to seek the ideal ROI from their investments.