Pushing the Building Envelope: The Impact of Cutting-Edge Technologies

Thursday, July 11th, 2019
9:00 AM – 10:30 AM
Session Panel

Mahabir Bhandari
Oak Ridge National Laboratory (ORNL)

Wendell Brase
University of California, Irvine

Jessica Abralind
Arlington County (VA)

Cedar Blazek
DOE (Moderator)
Pushing the Envelope: Cutting Edge Research

Mahabir Bhandari, PhD
Building Envelope and Urban Systems Research Group
Oak Ridge National Laboratory

ORNL is managed by UT-Battelle, LLC for the US Department of Energy
Agenda Topics

• Join us! Get involved with the Better Building Building Envelope Technology Research Team (ETRT)
• Envelope Research: Emerging Technologies
• Envelope Deployment: Integration/Field Studies
• Q&A

Acknowledgement: Diana Hun, PhD, ORNL Building Envelope Subprogram Manager and other team members
Building Envelope: 5.81 Quads

The commercial building envelope is the primary determinant of the amount of energy required to heat, cool, and ventilate a building.
Better Buildings Alliance: Leadership to Deploy Advanced Technologies

TECHNOLOGY SOLUTIONS TEAMS
- Lighting & Electrical
- Space Conditioning
- Plug & Process Loads
- Refrigeration
- Energy Management Information Systems
- Renewables Integration
- Building Envelope

MARKET SOLUTIONS TEAMS
- Energy Efficiency Project Financing
- Leasing and Tenant Build-Out
- Energy Data Access
- High Performance Property Valuation and Mortgages

To join, contact Melissa Lapsa at lapsamv@ornl.gov
A Unique and Diverse Team…

Informing R&D Plans, Case Studies, and Demonstrations

- Demonstration of high performance envelope technologies and solutions
- Comprised of Better Buildings Partners and representatives from the design community, including A&E firms

To join, email Melissa Lapsa: lapsamv@ornl.gov
Envelope Research: Emerging Technologies
Insulation Materials with High-R/in

<table>
<thead>
<tr>
<th>Material</th>
<th>R-value/in (h·ft²·°F/in/Btu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIP</td>
<td>35</td>
</tr>
<tr>
<td>Polyiso</td>
<td>5.6</td>
</tr>
<tr>
<td>XPS</td>
<td>5</td>
</tr>
<tr>
<td>EPS</td>
<td>4.4</td>
</tr>
<tr>
<td>Fiberglass</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Vacuum Insulated Panels (VIPS)

- Outer barrier film
- Inner, porous bag
- Core

Evacuated Spheres

- Target ≥R14/in
- Evacuated hollow sphere
- Spherical air/vapor barrier
- Damaged barrier
- Sphere at ambient pressure
- Binder

Hollow Silica Particles

Target ~R10/in

Self-Healing Film for VIPS

1 mm
Prefab Assemblies

Vinyl Siding Insulated with VIPs ~R10

Lightweight Insulated Precast Panels

New design

1½" : 4" : 1½"

Concrete density = 100 pcf
Panel weight = 25 psf

Second trial

Photo courtesy of Gate Precast

Fiber Reinforced Polymer (FRP) Insulated Panels

Photo courtesy of Kreysler & Associates
Self-Healing Sealant

Joints are among the weakest areas in the air and water barrier systems of building envelopes

Adhesion Failure

Cohesion Failure

After “self-healing” at room temperature
Additive Manufacturing and Integrated Energy (AMIE)
New Mold Manufacturing Process for Precast Concrete

Building Elevation

Cornice Cross Section

First 3D Printed Mold Prototype

Current Assembly Process

3D Printing

Machining
First building with precast façade made with 3D printed molds
New Mold Manufacturing Process

3D Printing  Machining  Mold

Casting setup  Concrete casting  Precast parts

[Images of the process steps]
Onsite 3D Printing of Buildings

Traditional Gantry System

ORNL’s SkyBAAM
SkyBAAM
Envelope Deployment: Integration/Field Studies
Building Envelope Performance Metric
Building Envelope Performance

Heat Flux (W/(m^2,K))

Time (s)

0 1 2 3 4 5 x 10^4

0 0.2 0.4 0.6 0.8 1
Proposed Metric = Peak | Time | Resistance

Thermal Resistance (ft. °F h/BTU)

Time (h)

Proposed Metric = 

<table>
<thead>
<tr>
<th>Peak</th>
<th>Time</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building</td>
<td>Peak</td>
<td>Time</td>
</tr>
<tr>
<td>----------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Building A</td>
<td>42%</td>
<td>2.8h</td>
</tr>
<tr>
<td>Building B</td>
<td>26%</td>
<td>6.2h</td>
</tr>
</tbody>
</table>
Cross-Laminated Timber

• Lendlease
  – Owner, developer, design-builder, and asset manager
  – CLT hotels
    • Redstone Arsenal, AL
    • Fort Drum, NY
    • Fort Bragg, NC

• Validation study
  – Evaluation of energy/hygrothermal performance
  – Fort Jackson, SC
  – Energy savings
  – Peak load reductions
Air Leakage Calculator

• Online tool uses simulation results from EnergyPlus and CONTAM

• Estimates from improvements in airtightness
  • Energy savings
  • Cost savings
  • Reductions in moisture transfer

• 50+ cities

• Building types
  • Standalone retail
  • Medium office
  • Mid-rise apartment
  • High-rise apartment
  • Hospital
  • Large hotel
  • Secondary school
Envelope Research Facilities

Facilities for Assembly Evaluations

- Syracuse, NY
- Charleston, SC
- Tacoma, WA
- Oak Ridge, TN

Facilities for Whole Building Evaluations

- Metal building that simulates construction from the 1980s
- Commercial building that simulates construction from the 1980s
- Residential building
Join the Envelope Technology Research Team!

Upcoming ETRT Activities:
- Field testing the BEP metric
- Investigating market interest in an Envelope focused challenge and recognition campaign
- ETRT Team Meetings: Fall 2019

To join, contact Melissa Lapsa at lapsamv@ornl.gov
Thank You!

Questions/comments:
Melissa Lapsa: lapsamv@ornl.gov
Mahabir Bhandari: bhandarims@ornl.gov
Wendell Brase
University of California, Irvine
Pushing the Building Envelope: The Impact of Cutting-Edge Technologies

Wendell Brase
Associate Chancellor - Sustainability
University of California, Irvine
UC Irvine’s Path to Better Buildings

Started in 1992, when . . .

- Buildings built prior decade met Title 24 upon completion
- Premature major maintenance
First Step : Set Goals

1. Beat Title 24 by 30% for new construction
2. No major maintenance for 20 years
3. Develop a framework of life-cycle performance standards
University of California, Irvine
Construction Standards and Costs

Overall Goals and Quality Standards

Building Organization and Massing

Design Concepts that Work Synergistically for Laboratory Buildings

Structural and Foundation Systems

Building Mechanical Systems

Management of Solar Heat Gain

Roofing and Flashings

Site Development

Exterior Cladding and Interior Finishes

Priorities and Trade-Offs

Benefits and Cost-Control Strategies

Results
Example of New Performance Standard: Massing
Second Step: Research (1993)

1. Premature life-cycle failures prior 20 years
2. Labs 21 (now Intl. Institute for Sustainable Laboratories)
3. LBNL study on building envelope
Step 3: Shaped Design-Build to Incentivize Life-Cycle Design

- Beat Title 24 20-30%
- No major maintenance for 20 years
- Apply framework of life-cycle performance standards
- Use design-build evaluation criteria to score requirement sufficiency and incentivize stretch goals
# Mechanical System Energy Performance Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-handler face velocity / air-speed through filtration</td>
<td></td>
</tr>
<tr>
<td>Total air system pressure drop (supply+exhaust+filtration)</td>
<td></td>
</tr>
<tr>
<td>Air-handler and duct sound-attenuators</td>
<td></td>
</tr>
<tr>
<td>Minimum occupied lab air-changes per hour (ACH)</td>
<td></td>
</tr>
<tr>
<td>Minimum unoccupied lab air-changes per hour (ACH)</td>
<td></td>
</tr>
<tr>
<td>“Purge” laboratory air changes per hour (ACH)</td>
<td></td>
</tr>
<tr>
<td>Exhaust stack discharge velocity (labs)</td>
<td></td>
</tr>
<tr>
<td>Exhaust by-pass damper (outside air into exhaust header)</td>
<td></td>
</tr>
<tr>
<td>Illumination power density</td>
<td></td>
</tr>
<tr>
<td>Heat-generating equipment exhaust</td>
<td></td>
</tr>
<tr>
<td>Fume hoods</td>
<td></td>
</tr>
</tbody>
</table>
Example of Building Completed 2004
Step 4: 2007 Climate-Neutrality Goal Raised the Bar
• Out-perform Title 24 by 50%
• Mechanical system performance requirements
• “Smart” HVAC controls and high efficiency lighting
• “Information layer” to ensure sustained “smart” performance
• Use design-build process to drive results.
What is a “Smart” Building?

Just enough energy, at just the right place, at just the right time!

How:

✓ Challenge all accepted design practices
✓ Use software and sensors to make building systems dynamic and “smart”
Key Components of a “Smart” Building

- Demand-controlled HVAC
- Many HVAC zones
- Right-sizing airchanges to minimize reheat
- Demand-controlled LED lighting.
# Mechanical System Energy Performance Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-handler face velocity / air-speed through filtration</td>
<td>300 ft. (91.4 m.) /minute maximum</td>
</tr>
<tr>
<td>Total air system pressure drop (supply+exhaust+filtration)</td>
<td>Labs: &lt; 5 in. of water (1,250 pascals)</td>
</tr>
<tr>
<td></td>
<td>Non-lab spaces: &lt; 3.5 in. of water (875 pascals)</td>
</tr>
<tr>
<td>Air-handler and duct sound-attenuators</td>
<td>None</td>
</tr>
<tr>
<td>Minimum occupied lab air-changes per hour (ACH)</td>
<td>4 ACH with contaminant sensing (Aircuity)</td>
</tr>
<tr>
<td>Minimum unoccupied lab air-changes per hour (ACH)</td>
<td>2 ACH with contaminant sensing + reduced thermal inputs while building &quot;coasts&quot; during setback</td>
</tr>
<tr>
<td>&quot;Purge&quot; laboratory air changes per hour (ACH)</td>
<td>10-12 ACH when contaminants sensed</td>
</tr>
<tr>
<td>Exhaust stack discharge velocity (labs)</td>
<td>Requires wind study; design goal ~1,500 FPM; &gt; 1,500 FPM if/when necessary to avoid re-entrainment</td>
</tr>
<tr>
<td>Exhaust by-pass damper (outside air into exhaust header)</td>
<td>Only activated by adverse wind conditions</td>
</tr>
<tr>
<td>Illumination power density</td>
<td>&lt; 0.5 watt/SF including task lighting where needed</td>
</tr>
<tr>
<td>Heat-generating equipment exhaust</td>
<td>Linear exhaust grilles over equipment such as freezers</td>
</tr>
<tr>
<td>Fume hoods</td>
<td>Occupancy controlled, low-flow/high performance</td>
</tr>
</tbody>
</table>
What Next?

☑ Lighting efficient and demand-controlled
☑ HVAC efficient and demand-controlled
☑ Exhaust efficient and demand-controlled
☑ Envelope thermal mass
☑ Cool roof
☑ Windows high-performance glass
☐ ???
☐ ???
<table>
<thead>
<tr>
<th>Glass Type</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-performance glass</td>
<td>75% effective</td>
</tr>
<tr>
<td>Electrochromic glass w/ smart controls</td>
<td>90% effective</td>
</tr>
<tr>
<td>Fully shaded glass</td>
<td>98% effective</td>
</tr>
<tr>
<td>Combination of HP glass + 50% shading</td>
<td>88% effective</td>
</tr>
</tbody>
</table>
## UCI Sunlight Management Performance Requirements

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shading Requirement</th>
<th>Glazing Type</th>
<th>Interior Window Covering / Glare Control</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>North, northeast, and northwest exposures</td>
<td>No exterior or glass shading required for facades &gt; 30° N of E or W</td>
<td>Clear insulated glass</td>
<td>Perforated blinds or shades for glare and sun-control (except lobbies, stairwells, other public spaces)</td>
<td>Not tinted</td>
</tr>
<tr>
<td>N / E / W exterior sun-shading devices</td>
<td>Reduce 85% of annual direct sun</td>
<td>Clear insulated glass</td>
<td></td>
<td>Include shade from adjacent buildings, mature trees, building overhangs, recesses, and fins</td>
</tr>
<tr>
<td>N / E / W exterior sun-shading + high performance glass</td>
<td>Reduce 85% of annual direct sun</td>
<td>High performance glass</td>
<td></td>
<td>Example: 40% effective seasonal shading system with 0.25 shading coefficient would attain 85% annual performance requirement</td>
</tr>
<tr>
<td>N / E / W electrochromic glass</td>
<td>Reduce 85% of annual direct sun</td>
<td>Electrochromic (dynamic) glass</td>
<td>Not required, as shading coefficient of 0.10 can be achieved</td>
<td>Electrochromic glass with smart controls &amp; dynamic shading coefficient</td>
</tr>
</tbody>
</table>
Value Priority Assigned to Daylighting

- LEED
- Other green rating systems
- An obsolete value?
Fluorescent vs. High-CRI LED Lighting

Spectral Distribution of Different CRI Light Sources

Wavelength (nm)

μW/nm

82 CRI  95 CRI  95+ Red CRI
Our Solution at UC Irvine

- CRI-95 lighting
- More selective use of glass
Other Ideas Being Explored

• “Fatter” buildings
• Larger trees
• Lutron pilot
• Shift energy load to low-carbon
Exploiting the “Duck Curve” to Reduce Carbon Footprint

Net load - March 31

Ramp need ~13,000 MW in three hours

UCI
### How Do We Pay For Life-Cycle Performance?

<table>
<thead>
<tr>
<th>Cost-Control &amp; Savings Opportunities</th>
<th>Areas Into Which Savings are Redirected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid custom-fabricated, exotic, specialized materials</td>
<td>High-quality teaching spaces</td>
</tr>
<tr>
<td>Conventional interior finishes</td>
<td>Stainless steel flashings</td>
</tr>
<tr>
<td>No floor coverings in laboratories</td>
<td>Durable hardware and interior finishes</td>
</tr>
<tr>
<td>Generic acoustical materials</td>
<td>Operable office windows (w/HVAC interlocks)</td>
</tr>
<tr>
<td>No sound absorption in partial-height partitions or walls w/doors</td>
<td>Quality hardscape and landscape features</td>
</tr>
<tr>
<td>Downsize HVAC due to sun shading</td>
<td>Sound isolation where needed (e.g., offices)</td>
</tr>
<tr>
<td>Essentially eliminate window coverings if electrochromic glass is used</td>
<td>Weather-protection canopy to extend life of roof-mounted equipment</td>
</tr>
<tr>
<td>Eliminate exterior wall insulation, furring, sheetrock, and paint</td>
<td>Sun-shading 85% overall annual effectiveness</td>
</tr>
<tr>
<td></td>
<td>Exterior walls ≥ 12 in. concrete integral color, exposed both sides</td>
</tr>
</tbody>
</table>
## Results: How Much Better After 25 Years?

<table>
<thead>
<tr>
<th></th>
<th>1992</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy performance</td>
<td>Met code, then deteriorated</td>
<td>30-50% better than code no deterioration</td>
</tr>
<tr>
<td>Premature major maintenance</td>
<td>Excessive</td>
<td>Zero</td>
</tr>
<tr>
<td>LEED Awards</td>
<td>--</td>
<td>18 Platinum 10 Gold</td>
</tr>
<tr>
<td>National Awards</td>
<td>Numerous architectural awards</td>
<td>DBIA Awards:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 National Awards of Merit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 National Awards of Excellence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Excellence in Engineering Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project of the Year</td>
</tr>
</tbody>
</table>
University of California, Irvine
Construction Standards and Costs

The University of California, Irvine pursues performance goals in new construction and applies quality standards that affect the costs of capital projects. Construction costs are not "high" or "low" in the abstract, but rather in relation to specific quality standards and the design solutions, means, and methods used to attain these standards. Thus, evaluating whether construction costs are appropriate involves determining whether:

- Quality standards are excessive, insufficient, or appropriate;
- Resultant project costs are reasonable compared to projects with essentially the same quality parameters.

"Quality" encompasses the durability of building systems and finishes; the robustness and life-cycle performance of building systems; the aesthetics of materials, their composition, and their detailing; and the resource sustainability and efficiency of the building as an overall system.

Overall Goals and Quality Standards

UCI, in order to support distinguished research and academic programs, builds facilities of high quality. As such, UCI facilities are designed to convey the "look and feel," as well as embody the inherent construction quality, of the best facilities of other UC campuses, leading public universities, and other research institutions with whom we compete for faculty, students, sponsored research, and general reputation.

Since 1992, new buildings have been designed to achieve five broad goals:

1. New buildings must "create a place," rather than constitute stand-alone objects -- forming social, aesthetic, contextually sensitive relationships with neighboring buildings and the larger campus.
2. New buildings reinforce a consistent design framework of classical contextual architecture, applied in ways that convey a feeling of permanence and quality, and interpreted in ways that meet the contemporary and changing needs of a modern research university.
3. New buildings employ materials, systems, and design features that will forestall the expense of major maintenance (defined as >1 percent of value) for at least 20 years.
4. New buildings attain exemplary sustainability performance -- at least LEED Gold and outperforming California's Title 24 energy efficiency standards by as much as 50 percent.
5. Capital construction projects are designed and delivered within the approved project budget, scope, and schedule.
How Did We Do It?

1. Technology
2. Questioned status-quo design practices
3. Targeted energy waste that was built-into building systems
4. Made intentional, explicit trade-offs to fund life-cycle performance
5. Never stop improving!
Pushing the Building Envelope in Arlington County, VA

Jessica Abralind, Green Building Planner
Arlington County, VA
July 11, 2019
Outline

• Arlington’s Facility Sustainability Policy for New Construction and Major Renovation
• Renovation example – Solid Waste and Traffic Engineering and Operations facility
• New Construction example – Lubber Run Community Center
Arlington’s Facility Sustainability Policy

- **RECENT UPDATE**: more focus on building enclosure, prioritize passive energy saving strategies like insulation, air sealing

- **POLICY INCLUDES EARTHCRAFT LIGHT COMMERCIAL (ECLC) RATING SYSTEM AS COMPLIANCE PATH** because it fits smaller buildings better than LEED and includes a blower door test and air leakage performance standards

- **INTERDEPARTMENTAL WORKING GROUP** including facilities maintenance, facilities design and construction, Parks, Fire, Housing, Inspection Services

- **WHY?** energy and GHG reductions, cost savings, occupant comfort and health
Facility Sustainability Policy - Implementation

- **SW TE+O** – first time trying ECLC, first blower door test, first pre-construction occupant survey

- **CHALLENGE**: design team was already engaged and ECLC, testing, and envelope improvements were not in the scope of work
SW & TE&O Assessment

ASSESSMENT METHODS:

- Thermal comfort survey
- Enclosure test
- Field Observations & thermal imaging
- Energy Benchmarking

Figure 1. SW & TEO located at 4300 29th Street South, Arlington County, VA.
Commercial Enclosure Definitions

**Enclosure:** part of any building that physically separates the exterior environment from the interior environment(s); (BSC, 2006)

**Infiltration:** the flow of outdoor air into a building through cracks and other unintentional openings and through the normal use of exterior doors for entrance and egress; (ASHRAE, 2009)

**Exfiltration:** is leakage of indoor air out of a building through through cracks and other unintentional openings; (ASHRAE, 2009)

**Air barrier:** a plane that one intends to be the sole, or at least the primary, resistor to airflow; (Straube and Burnett, 2005)

**EarthCraft Light Commercial:** a regional green building certification program offering third-party recognition for environmentally responsible design and construction practices for small-scale commercial buildings in the Southeast (Southface, 2018)
## Site and Building Context

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>SW &amp; TEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Use Group</td>
<td>B-1</td>
</tr>
<tr>
<td>Building Conditioned Floor Area (Ft²)</td>
<td>15,234*</td>
</tr>
<tr>
<td>Occupancy Load</td>
<td>130*</td>
</tr>
</tbody>
</table>

**CLIMATE ZONE 4A | ARLINGTON, VA**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation (ft.)</td>
<td>66</td>
</tr>
<tr>
<td>Mean Air Temperature (°F)</td>
<td>58.1</td>
</tr>
<tr>
<td>Mean Relative Humidity (%)</td>
<td>65.8</td>
</tr>
<tr>
<td>Daily Solar Ration (kWh/m²/d)</td>
<td>3.95</td>
</tr>
<tr>
<td>Atmospheric Pressure (kPa)</td>
<td>101.7</td>
</tr>
<tr>
<td>Mean Wind Speed (mph)</td>
<td>8.5</td>
</tr>
<tr>
<td>Earth Temperature (°F)</td>
<td>56</td>
</tr>
<tr>
<td>Heating Degree-Days, HDD (64.4 °F)</td>
<td>4001</td>
</tr>
<tr>
<td>Cooling Degree-Days, CDD (64.4 °F)</td>
<td>1524</td>
</tr>
</tbody>
</table>
User-centered Assessment

THERMAL COMFORT:

✓ 2-page survey
✓ Likert scale, multiple choice
✓ Why? Buildings are for people
✓ Users are rich sources of data
Enclosure Test Plan

**OVERVIEW:**
- Communication
- Define test boundary
- Identify power sources
- Identify system locations
- 3-4 hrs of prep for the test
- 4 staff x 5 hrs: 20 hrs
Enclosure Test Results

<table>
<thead>
<tr>
<th>PASCAL (Pa)</th>
<th>CUBIC FEET/MINUTE (CFM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25</td>
<td>16,560</td>
</tr>
<tr>
<td>-30</td>
<td>18,521</td>
</tr>
<tr>
<td>-35</td>
<td>20,333</td>
</tr>
<tr>
<td>-40</td>
<td>22,072</td>
</tr>
<tr>
<td>-45</td>
<td>23,522</td>
</tr>
<tr>
<td>-50</td>
<td>25,012</td>
</tr>
<tr>
<td>-55</td>
<td>26,651</td>
</tr>
<tr>
<td>-60</td>
<td>28,420</td>
</tr>
<tr>
<td>-65</td>
<td>30,005</td>
</tr>
<tr>
<td>-70</td>
<td>32,133</td>
</tr>
<tr>
<td>-75</td>
<td>34,102</td>
</tr>
</tbody>
</table>

Envelope Leakage Ratio$_{75}$: 1.03

Coefficient of Determination ($R^2$): 0.996
Enclosure Improvement Opportunities
Enclosure Opportunities

ENCLOSURE PENETRATIONS

✓ 13 intentional holes
✓ Sealed for test
✓ Testing dampers
Project Team

**PHILIP AGEE**
Technical Director
Viridiant

- *EarthCraft Light Commercial*
- *ASHRAE Level Commercial Audits*
- *DOE Advanced Commercial Building Initiative*

**JESSICA ABRALIND**
Green Building Planner
Arlington County Government

**JEREMY JENKINS**
Construction Management Specialist
Arlington County Government
Lubber Run Community Center

- VMDO/ CMTA design team
- 53,000 s.f. new construction
- Targeting:
  - Net Zero Energy “Ready”
  - Energy Use Intensity (EUI) of 24 kbtu/s.f./year
  - LEED Silver
  - Building Enclosure Test
Lubber Run Community Center

Green building highlights
✓ Ground Source Heat Pumps
✓ LEDs
✓ 30% window to wall ratio (WWR)
✓ East-West building orientation
✓ Thermomass® Concrete Sandwich Panel
Thermomass® Concrete Sandwich Panel
Thermomass Concrete Sandwich Panel
Thank you!

Jessica Abralind, Green Building Planner
Arlington County, Virginia
Office of Sustainability and Environmental Management
Thank You

Provide feedback on this session in the Summit App!

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Contact Us

(Speakers)
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