

Building America Envelope Research & Roadmap Support



Welcome to
Building America [Building Science Advisor](#)

Building America Building Science Advisor (BSA) is a website that provides expert advice on building envelope system performance from industry's best researchers and building scientists. This knowledge tool promotes better-informed decisions regarding energy efficient and moisture durable building envelope solutions. BSA communicates uncertainty associated with moisture durability in a simplified manner. Please refer to the [Security & Privacy Notice](#) before using Building Science Advisor.

Before starting BSA, we ask you make a decision that suits your needs. The "Expert" pathway allows you to make your own decisions uninterrupted. "Education" guides you through each step of the material selection process, while providing feedback on your entries.

Let's get started!

Expert Educational

Project: BSA 1-HAM Chamber Model Predictions 2 by 6 Wall Low Interior Moisture Load

Layer Name	Orientation/Thickness/Height	Surface Transfer Coeff	Initial Conditions
Chamber Shared Ex and Int	0.10004		
Interior Gull (Gull)	0.02000		
1.02000 0.02000			

Assign Name: Gull
Material Database: Automatic
Example Cases: Medium
Thick Thickness: Thickness: 0.92 m
Thin Thermal Performance: R-Value: 16.951 R² F²h
U-Value: 0.059 Btu/h² F²

Oak Ridge National Laboratory
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Project summary

Timeline:

Start date: 4/1/2015

Planned end date: 9/30/2019

Key Milestones

1. Expand the Building Science Advisor (BSA) to include the development of other structural systems (06/30/2018)
2. Complete evaluation of two additional wall systems and compare results to hygrothermal modeling (03/31/18)
3. Draft revision of the DOE Moisture Control Handbook completed (09/30/2018)

Budget:

Total Project \$ to Date:

- DOE: \$1,060,000
- Cost Share: \$0

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Key Partners:

Building Science Corporation	ARES Consulting
Building America Teams	Home Innovation Research Laboratory
RDH Building Science	

Project Outcome:

A web-based tool that provides building professionals with guidance to minimize moisture-related risks in low energy, high performance homes. Based on the knowledge of the industry's best researchers and building scientists, this tool will enable users to make informed decisions to minimize risks and confidently construct homes that are energy efficient and free of moisture related durability issues.

Team



Accawi



Antretter



Boudreaux



Desjarlais



Lstiburek



Pallin

Accawi: Webmaster

Boudreaux: Experimental capabilities

Lstiburek: Forensic and field experience

Antretter: Hygrothermal modeling

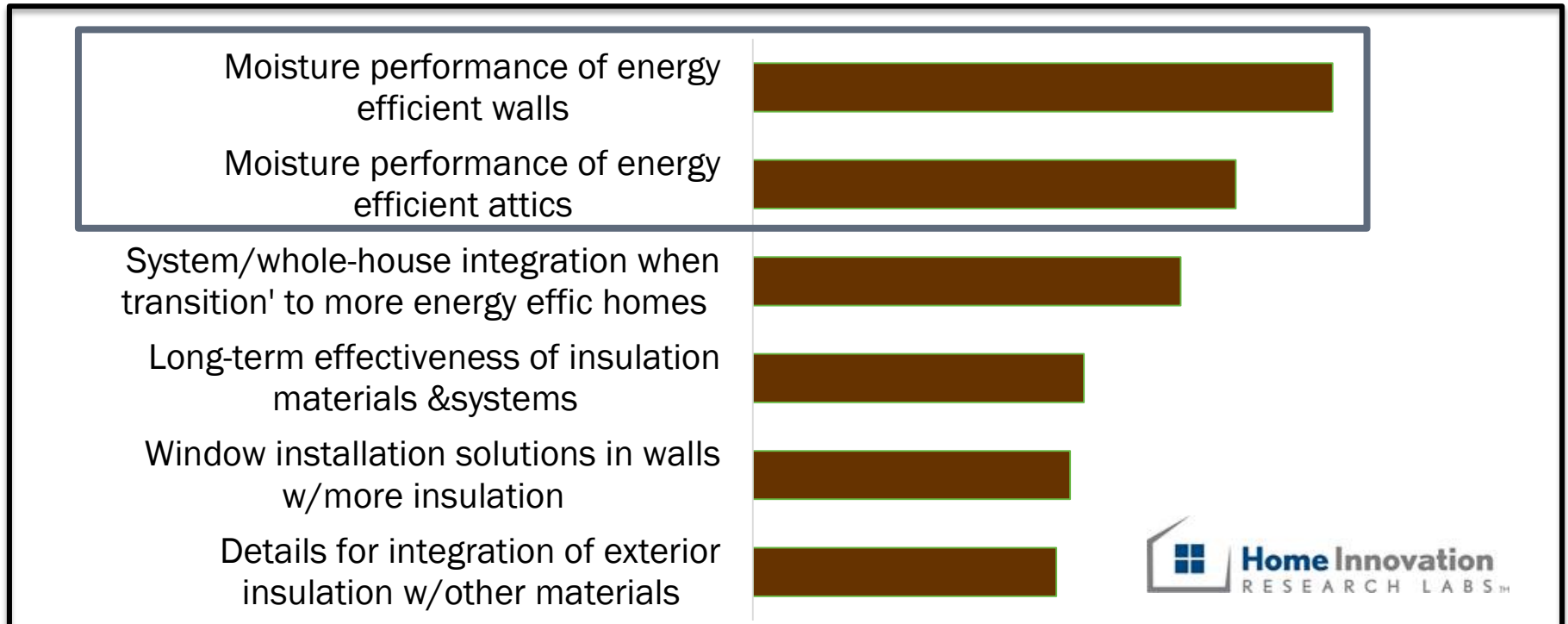
Desjarlais: Program management

Pallin: Hygrothermal modeling

Team includes world-class experts in moisture transport and modeling, world-class expertise in moisture-related building envelope forensics and education, and unparalleled facilities and knowledge in performing hygrothermal system testing.

Challenge

- As building envelope assemblies continue to evolve, they become less tolerant of design and installation flaws.
- There is market uncertainty regarding the moisture risk of high-performing envelope systems, which in turn hinders rapid adoption.
- Builders, architects, and other building professionals lack access to credible guidance on durable, energy-efficient wall assemblies to mitigate risks.
- Knowledge gap must be addressed to achieve residential energy reduction targets.

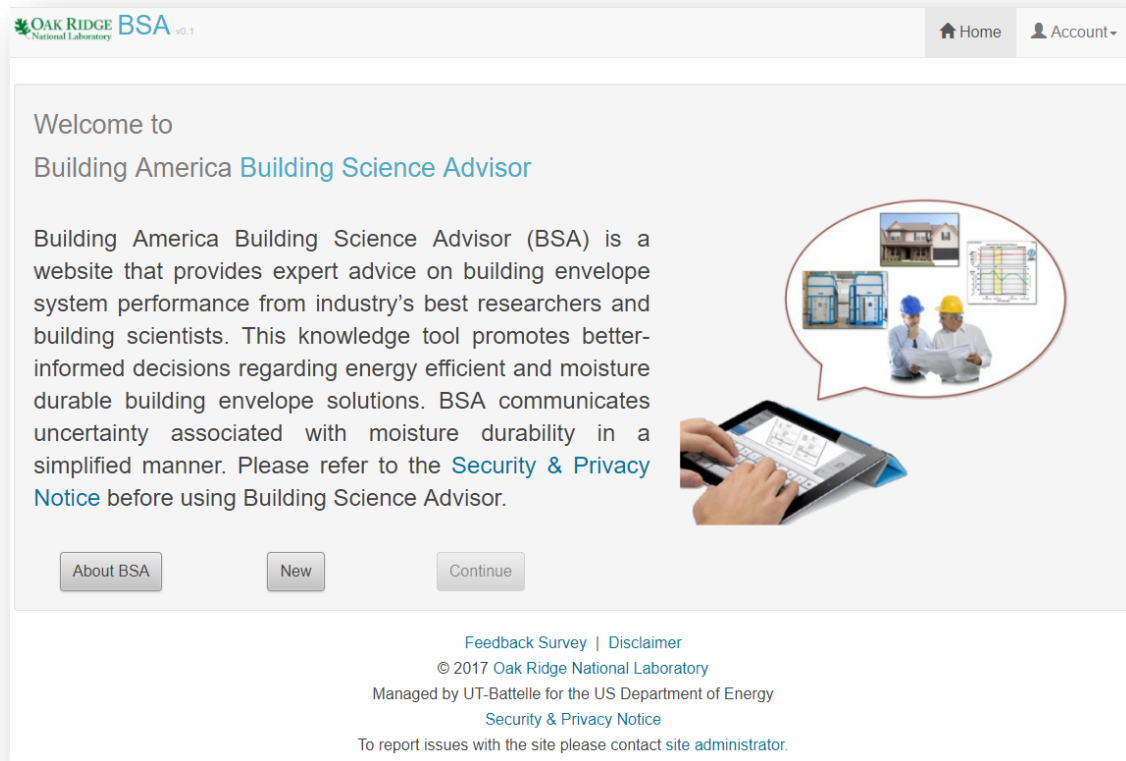


Approach

Give every building professional instant access to the knowledge of the industry's best researchers and building scientists.

Distinctive Characteristics:

- First application of an expert system for moisture management in buildings.
- Articulates guidance for durable wall systems based on expert consensus, field data, and empirically validated hygrothermal modeling and simulation.
- Will employ probabilistic modeling analysis.
- Web-based; available as an App?



The screenshot displays the Oak Ridge Building Science Advisor (BSA) website. At the top left, the logo for Oak Ridge National Laboratory BSA v0.1 is visible. On the top right, there are navigation links for 'Home' and 'Account'. The main content area features a welcome message: 'Welcome to Building America Building Science Advisor'. Below this, a paragraph describes the BSA as a website providing expert advice on building envelope system performance. To the right of the text is an illustration of two construction workers in hard hats reviewing plans, with a speech bubble containing icons of a house, a window, and a graph. Below the text are three buttons: 'About BSA', 'New', and 'Continue'. At the bottom, there are links for 'Feedback Survey | Disclaimer', copyright information for 2017 Oak Ridge National Laboratory, and contact information for the site administrator.

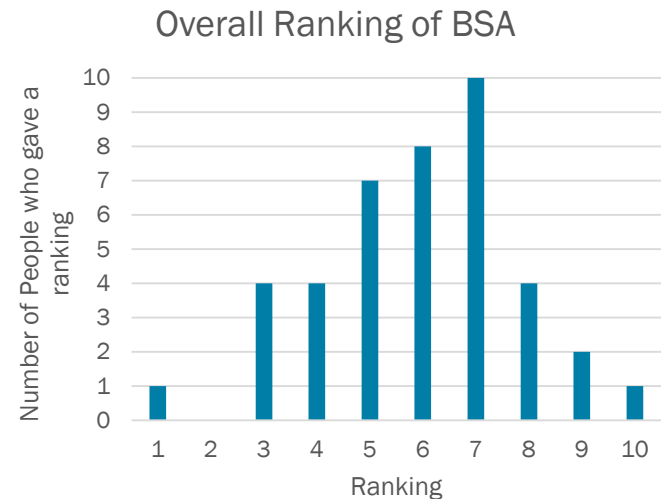
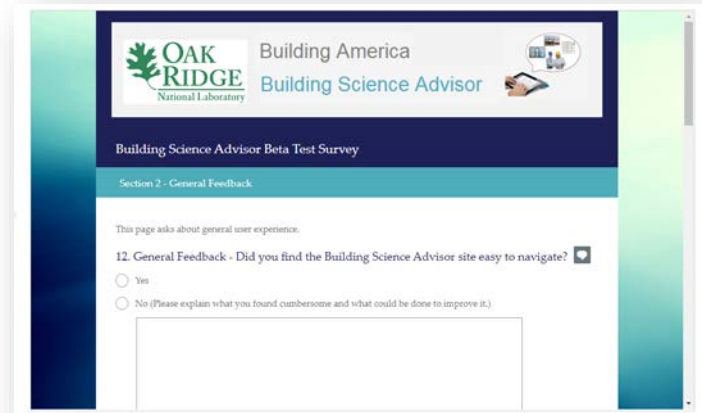
Impact

- The Building America Research-to-Market Plan states that high-R building envelope assemblies in new and existing homes can decrease energy use by about 2.75 quads per year.
- This project outcome is a web-based tool that provides guidance to minimize moisture related risks in low energy, high performance homes that can reduce the energy use intensity of new single-family homes.
- Builders, raters, and building science consultants have been engaged in the development of this tool, particularly through surveys and presentations and follow on discussions at key conferences (e.g. EEBA and RESNET).



Survey summary

- In late summer, a survey was circulated and 50 percent of the 170 people surveyed supplied feedback.
- **Respondents wanted more...**
 - Climate options
 - Other material options in the drop down menus
 - Additional performance indicators
 - Drying potential
 - Risk of decay
 - More guidance
 - Improved website graphics
 - Fewer input screens
 - Disliked “recommended walls” option



BSA after beta testing

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[About BSA](#)

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[Expert](#) [Educational](#)

What's new!

- Educational pathway replaces “recommended walls” option.
- Location selection now unlimited (analyses done at climate zone level).

Input selection screen


Climate Cladding Structure **Insulation** Water Control Interior Control Results

Cavity Insulation and Type Help?

Low Performance Fiberglass (R-11/R-19)
Medium Performance Fiberglass (R-13/R-21)
High Performance Fiberglass (R-15/R-24)
Cellulose Loose Fill
Open Cell Spray Foam
Closed Cell Spray Foam
Flash and Batt (with 3/4-in. CCSPF)
SIPS - Expanded Polystyrene (EPS)
Dense Pack Cellulose
Mineral Wool R-15/R-23
Phenolic Foam

Continuous Insulation

None
Expanded Polystyrene (EPS)
Extruded Polystyrene (XPS)
Polyisocyanurate Foam
Mineral Fiber Board



Improvements:

- Number of input screens reduced;
- More obvious “Help” menu;
- More “drop down” menu selections;
- “Results” button requires complete input selection;
- More thickness variations in the continuous insulation menu; and
- Better image graphics.


Results screen



Improvements:

- Durability indicator changed from traffic light to dial;
- Added code level R-value; and
- Added “drop down” menu capability (no need to return to input screens to modify wall).

Results screen



✉ Email a question about this wall.

Moisture Performance

This wall assembly does not have sufficient continuous insulation to meet 2015 IRC Table R702.7.1. Continuous insulation should be equal or greater than R-7.5. The wall assembly has low permeance materials on both the interior and exterior, enclosing the timber framed wall. If water enters into the wall, by rain or air leakage, then it might not dry easily. Remove the low permeance material on the exterior side of the wall to allow moisture to dry to the exterior, or increase insulation level to meet code.

General Guidance

The IECC 2015 R-value requirement is not met for the selected climate zone and wall assembly. This doesn't necessarily mean that your selection is in conflict with your state/county code. Please seek expert guidance to determine adopted code in your region.

Improvements:

- Significant improvements in guidance (more to come when new revision of the Moisture Control Handbook is added);
- Wall schematic added; and
- Option to display several wall systems simultaneously added.

Stakeholder engagement

- **Collaborating with the experts:**

Bailey Brown, RDH Building Science Inc.

Lena Burkett, NREL

Jay Crandell, ARES Consulting

André Desjarlais, ORNL

Samuel Glass, FPL

Roderick Jackson, NREL

Vladimir Kochkin, HIRL

Joseph Lstiburek, BSC

Simon Pallin, ORNL

Sam Rashkin, U.S. Department of Energy

Chris Schumacher, RDH Building Science

Eric Werling, U.S. Department of Energy

- **Communications:**

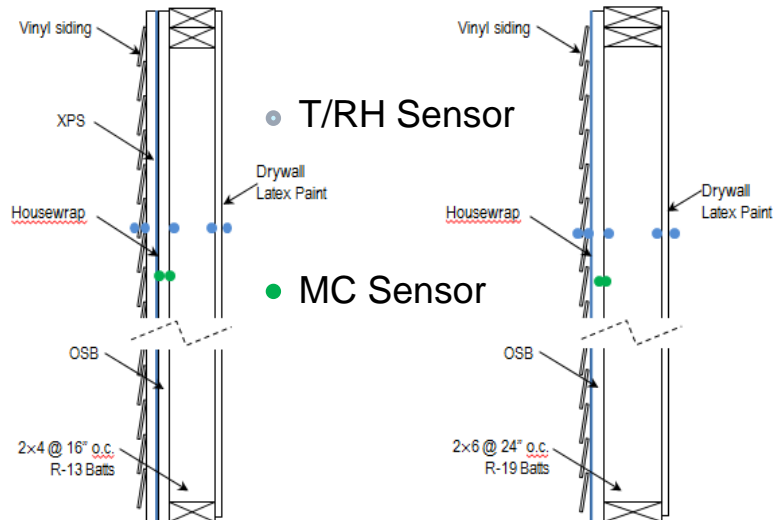
1. EEBA, 10-12 October 2017, Atlanta GA. *High Performance Moisture Managed Envelope Systems*, André Desjarlais.

2. Building America Webinar, 7 February 2018. *Building Science Advisor – A Web-Based Design Tool to Manage Moisture Risk in Walls*, André Desjarlais.

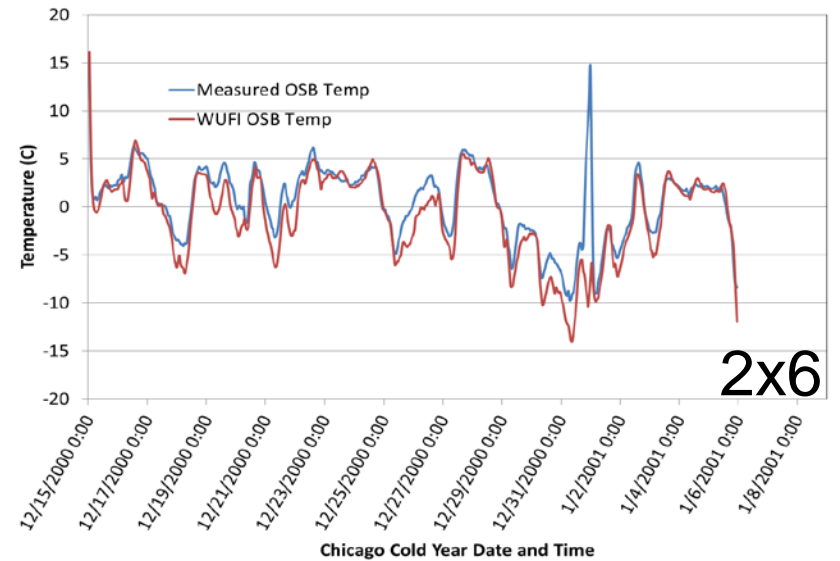
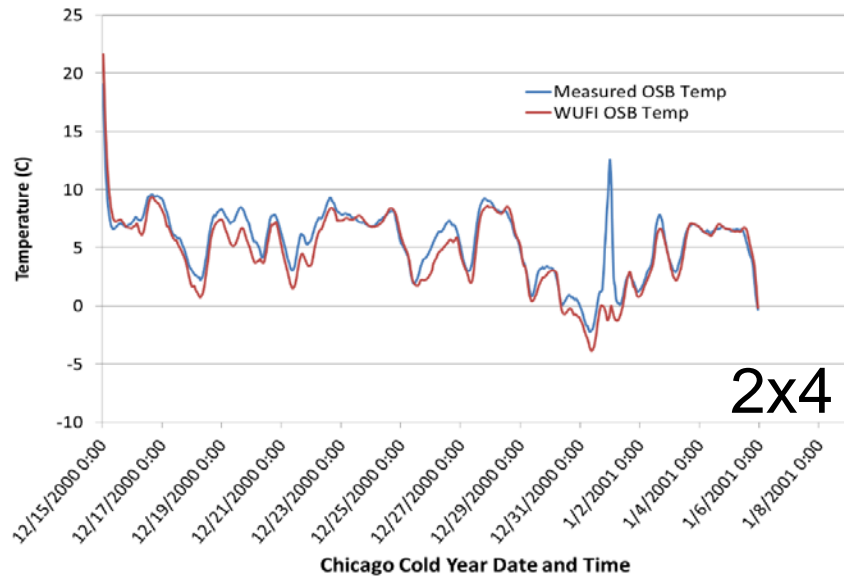
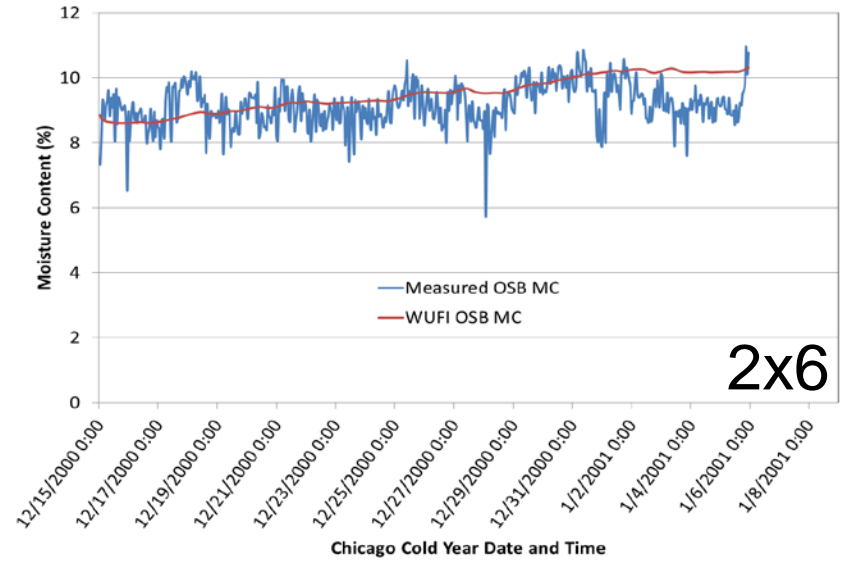
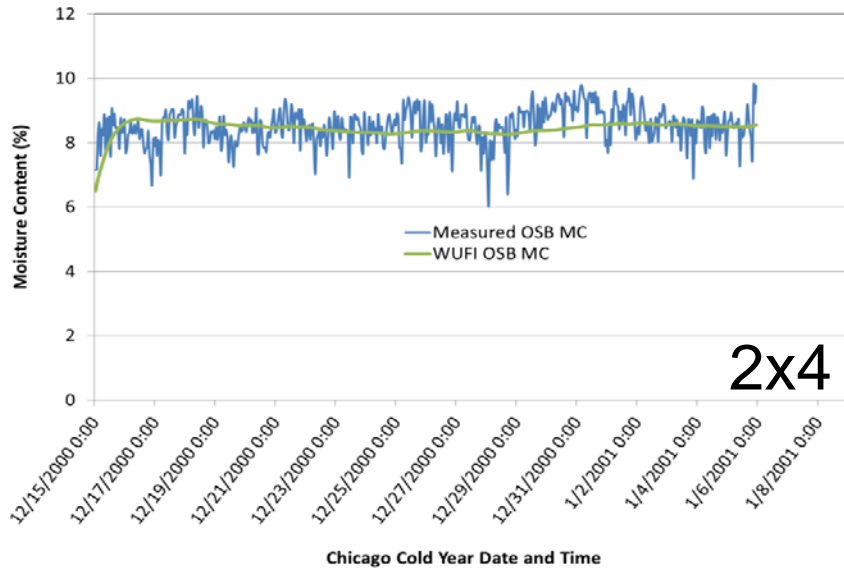
3. RESNET, 27-28 February 2018, Orlando FL. *What is the Building Science Advisor*, Eric Werling.

Hygrothermal model validation

- Experimental boundary conditions
 - Indoor climate – static 68°F at 40% RH
 - Outdoor climate – cold year Chicago winter weather from WUFI, began 12/15 and ran for 3 weeks
- Test walls are 2015 IECC compliant for Zone 5
- No pressure differential, no solar, and no rain
- Compare experimental temp and RH of exterior sheathing to WUFI simulation.



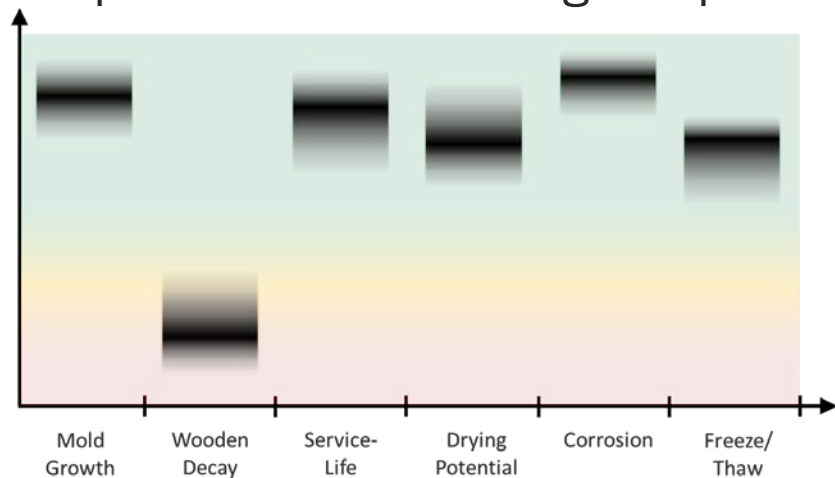
Model validated against HAM chamber tests



Remaining project work

Next Steps and Future Plans:

- Address issues brought up in the survey as best as possible;
- Complete the database rulesets to include all materials on drop down menus;
- Continue model validation exercises to include rainfall, air leakage, and solar effects;
- Release BSA in summer 2018;
- Continuously update moisture management guidance for new materials and envelope assemblies; and
- Initiate probabilistic modeling component to fill in blanks in expert advice.



Comments:

The selected wall cladding can absorb water, causing the wooden sheathing to rot. To ensure moisture durability add at least a 1/4" (1" for brick or stone cladding to avoid mortar contacting sheathing) ventilation cavity behind cladding.

Thank You

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REFERENCE SLIDES

Project budget

Project Budget: FY16 – FY17 budget to date: \$560,000

Variances: None

Cost to Date: \$450,000 in FY18.

Additional Funding: None

Budget History

FY 2016 – FY 2017 (past)		FY 2018 (current)		FY 2019 – FY 2020 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
\$560,000	\$0	\$500,000	\$0	\$500,000	\$0

Project plan and schedule

Milestones	FY16				FY17				FY18			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Gain industry consensus on the risk protocol	■	■										
Research plan for probabilistic approach to energy savings predictions	■	■	■	■								
"Expert system" for the walls that are evaluated in FY16 through the moisture durability protocol	■	■	■	■								
Peer reviewed publication documenting the GIHM tool.					■	■						
Expand BSA to include expert guidelines for walls for all U.S. climate zones					■	■	■	■				
Complete the evaluation of 4 wall assemblies in U.S. climate zones					■	■	■	■				
Address comments on BSA developed from beta review.									■	■		
Complete the evaluation of two additional wall systems									■	■		
Expand the BSA to include the development of two additional structural systems									■	■	■	