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 external selection process, while providing feedback on your entries.

Oak Ridge National Laboratory
André Desjarlais, Program Manager
865-574-0022 / desjarlaisa@ornl.gov
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)

Key Partners:

<table>
<thead>
<tr>
<th>Building Science Corporation</th>
<th>ARES Consulting</th>
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<tr>
<td>Building America Teams</td>
<td>Home Innovation Research Laboratory</td>
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<tr>
<td>RDH Building Science</td>
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Budget:

Total Project $ to Date:
- DOE: $1,060,000
- Cost Share: $0

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- Cost Share: $0

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: 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.

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<td>Long-term effectiveness of insulation materials &amp;systems</td>
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<td>Window installation solutions in walls w/more insulation</td>
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<td>Details for integration of exterior insulation w/other materials</td>
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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?
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).

(Dregger, 2012)
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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Let's get started!

Expert
Educational

What’s new!
• Educational pathway replaces “recommended walls” option.
• Location selection now unlimited (analyses done at climate zone level).
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

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:**
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

- 2x4
- 2x6
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: FY16 – FY17 budget to date: $560,000
Variances: None
Cost to Date: $450,000 in FY18.
Additional Funding: None

### Budget History

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<th>FY 2018 (current)</th>
<th>FY 2019 – FY 2020 (planned)</th>
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<tr>
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## Project plan and schedule

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<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
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<tr>
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<td>Q1</td>
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<td>Q3</td>
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<tr>
<td>Gain industry consensus on the risk protocol</td>
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<td>Research plan for probabilistic approach to energy savings predictions</td>
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<tr>
<td>&quot;Expert system&quot; for the walls that are evaluated in FY16 through the moisture durability protocol</td>
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<td>Peer reviewed publication documenting the GIHM tool.</td>
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<td>Expand BSA to include expert guidelines for walls for all U.S. climate zones</td>
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<td>Complete the evaluation of 4 wall assemblies in U.S. climate zones</td>
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<td>Address comments on BSA developed from beta review.</td>
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<td>Complete the evaluation of two additional wall systems</td>
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