

Building Science Advisor

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U.S. DEPARTMENT OF
ENERGY

BSA objective

- Assist in reducing or mitigating the impact that moisture plays on the buildings industry.

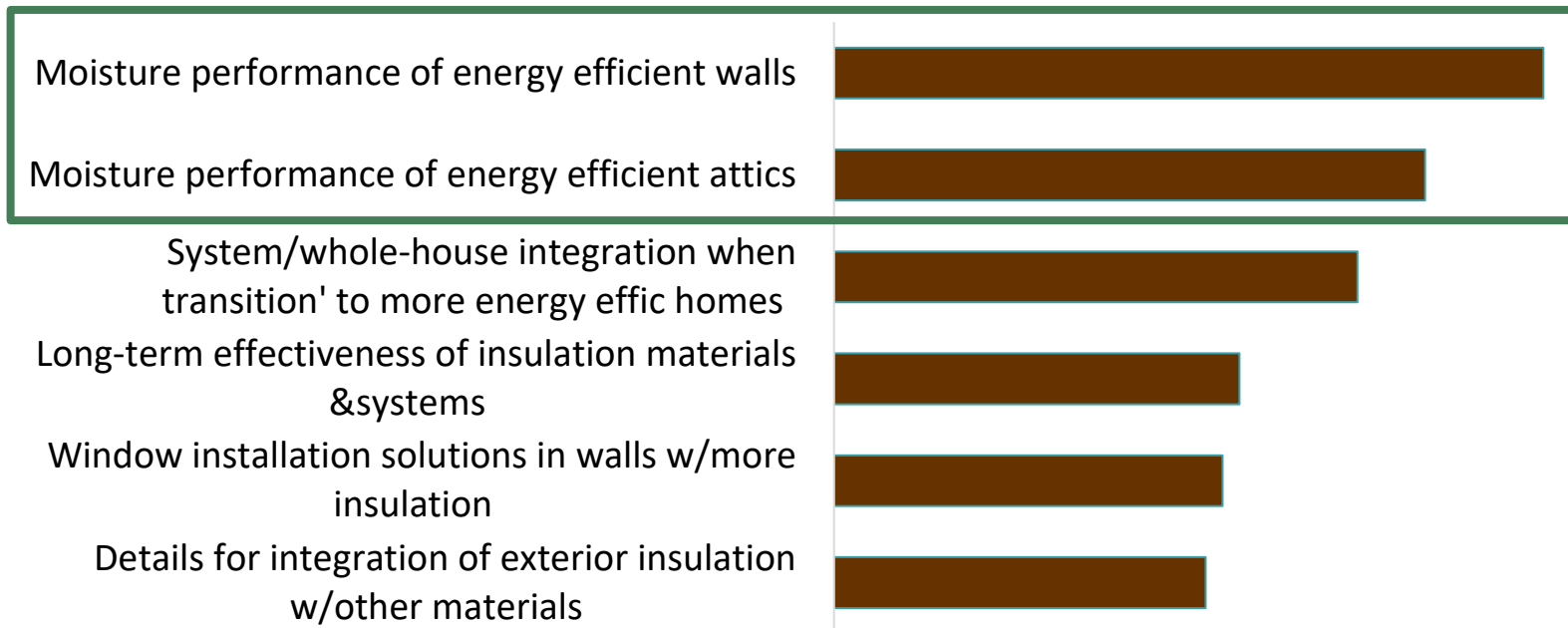


- The Housing Act of 1949 calls for “a decent home and suitable living environment for every American family...” (42 U.S. Code § 1441).

Builder's perspective



Builder's reaction...



*Total of 14 issues and challenges presented to respondents

Building scientist's perspective



What building scientists think...



What building scientists think...

"Fascinating! I wonder which hygrothermal transport mechanism led to this Stachybotrys colonization?!"



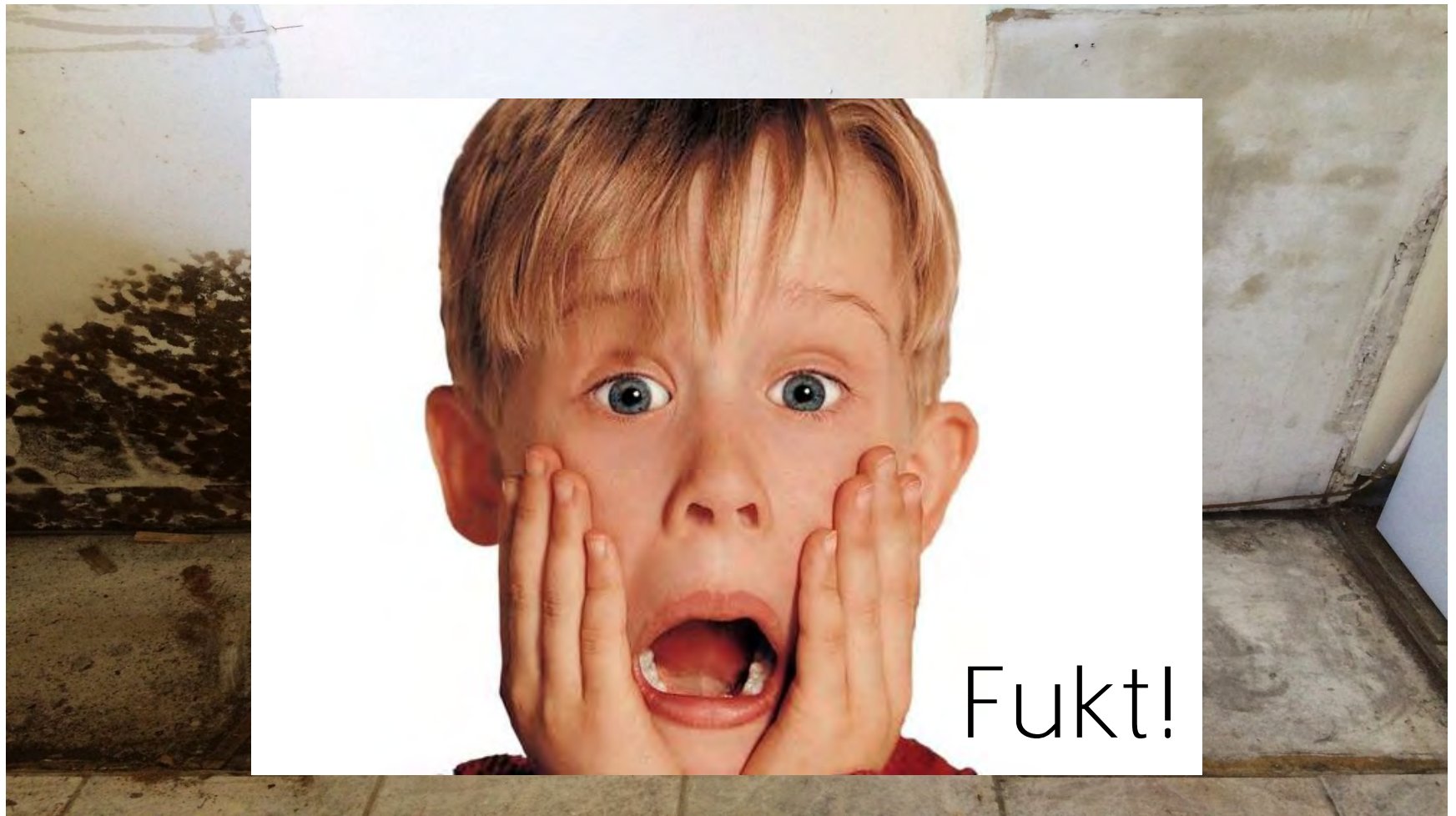
Homeowner's perspective



What homeowners are thinking...



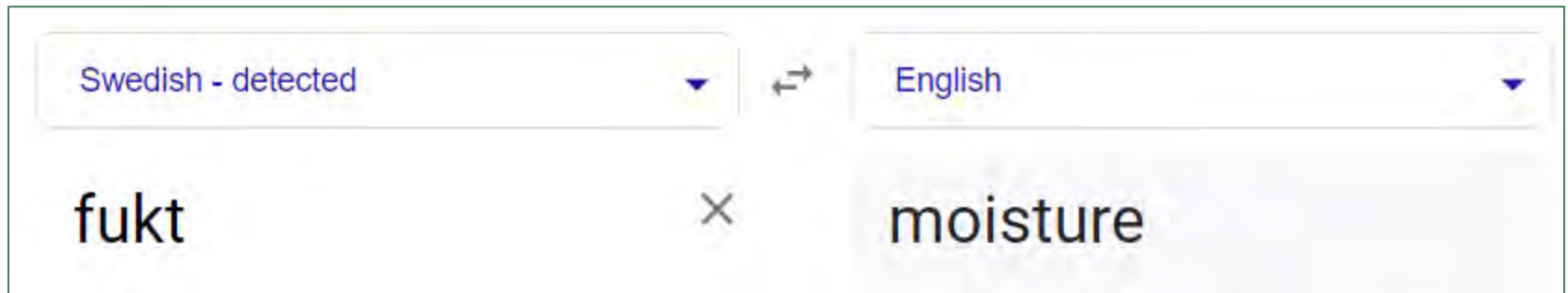
What homeowners are thinking...



What homeowners are thinking (in Swedish)...

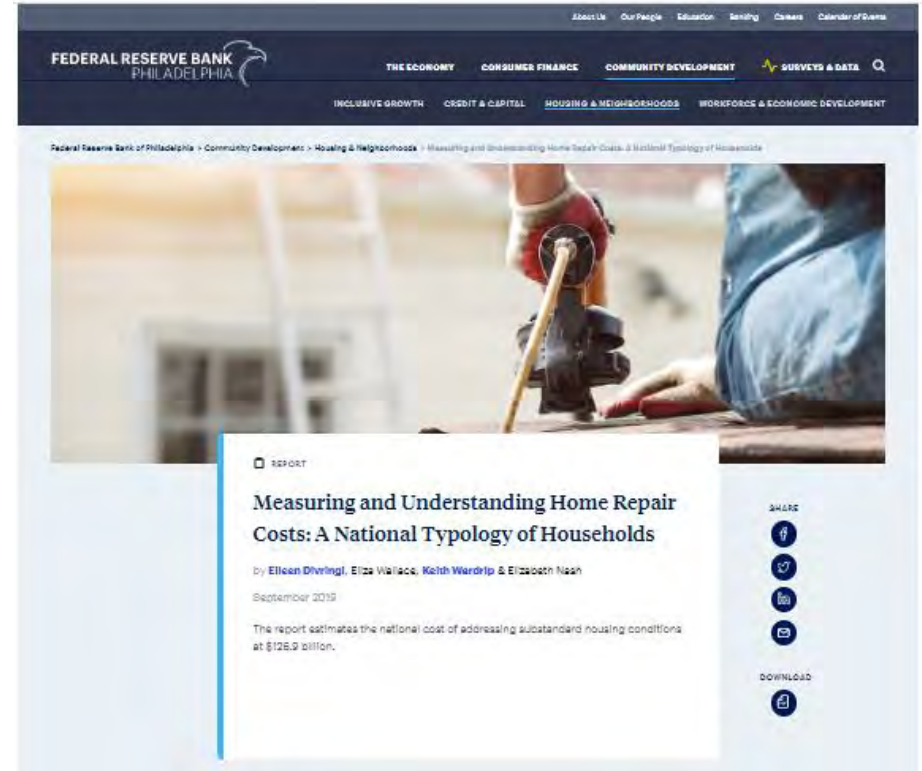


Fukt!

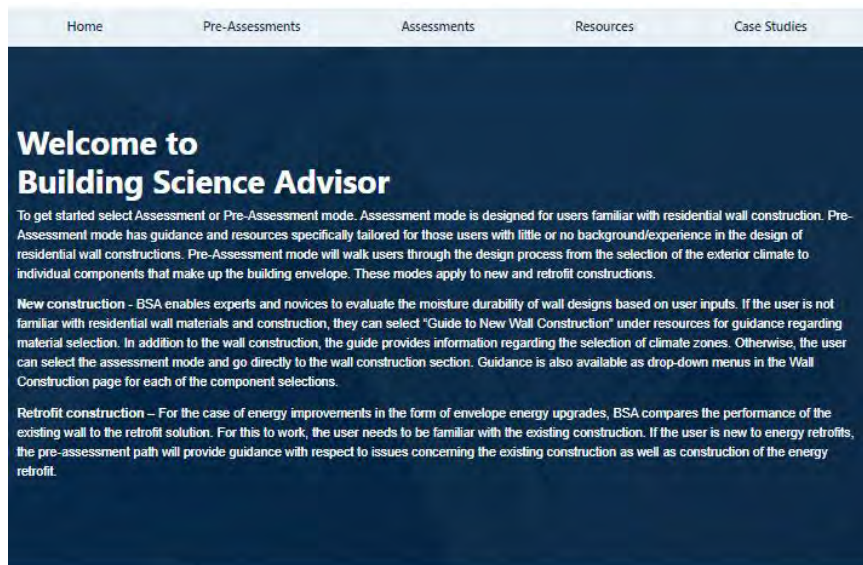


What is the magnitude of the problem?

- In 2018, home repairs due to leaks and mold cost \$32B and were more acute for low-income families (Federal Reserve Bank).
- New code and proposed retrofit requirements take builders out of their “tried and true” comfort range.
- Building science required to reduce risk associated with modern building envelope and retrofit strategies.



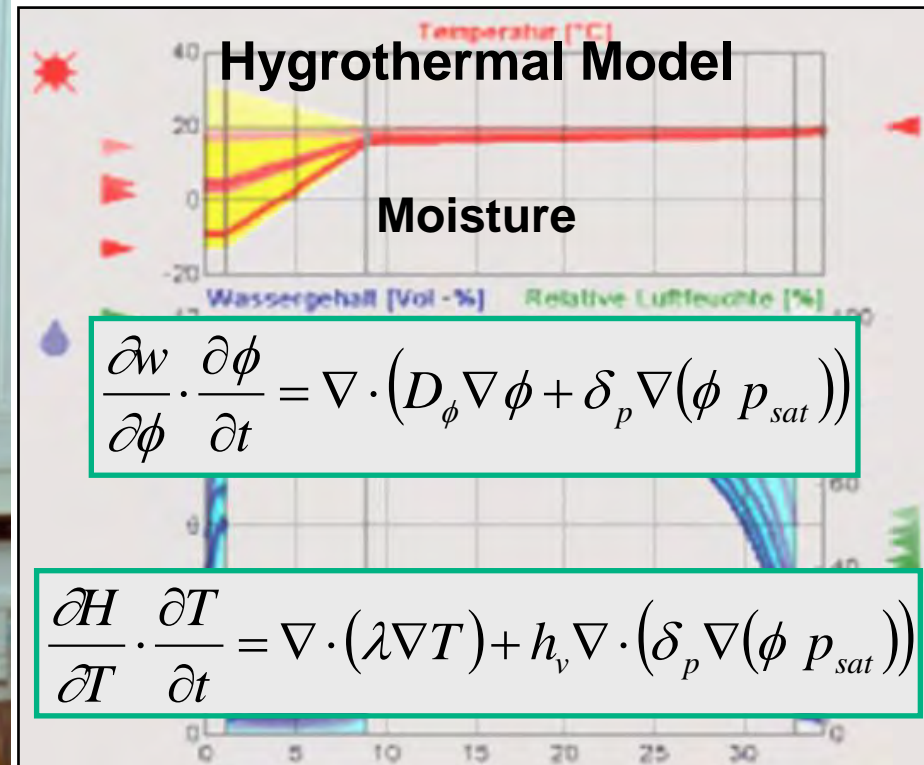
The Building Science Advisor



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 for new and retrofit constructions. BSA communicates uncertainty associated with moisture durability in a simplified manner. Please refer to the Security & Privacy Notice before using Building Science Advisor.

- Provides user with sources of information to consider prior to performing an energy retrofit.
- User defines wall he wants to construct or existing assembly.
- Tool rates its energy and moisture performance.
- Tool makes recommendations regarding improvements.
- bsa-new.ornl.gov

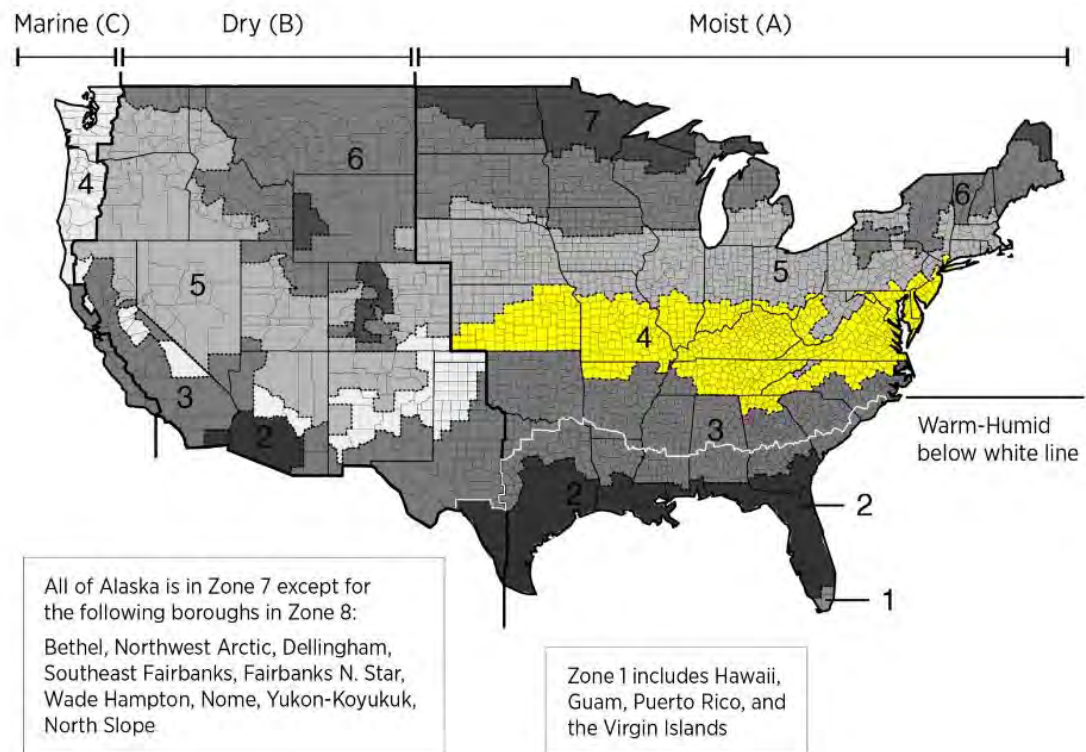
Building Science Advisor does not replace:



Select Climate Zone

Climate Zone *

4A - Mixed-Humid ▾



Select Wall Assembly Components:

Wall Name *

Enter name for wall construction

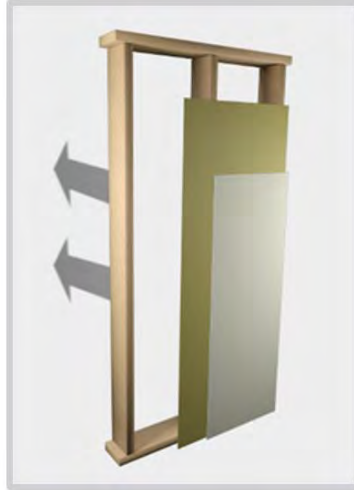
- | | | |
|-----------------------------------|--------------------------------------------|---|
| ▶ Exterior Cladding | Vinyl/Metal Siding | ▼ |
| ▶ Air Space | Drained/Ventilated | ▼ |
| ▶ Continuous Insulation | Expanded Polystyrene | ▼ |
| ▶ Continuous Insulation Thickness | 1 in. | ▼ |
| ▶ Water Resistive Barrier | Housewrap/Building Paper (≥ 10 perm) | ▼ |
| ▶ Exterior Sheathing | Plywood/OSB/Fiberboard/Wood Plank | ▼ |
| ▶ Wall Structure | 2 x 4 16 inch o.c. Wood Frame | ▼ |
| ▶ Cavity Insulation | Fiberglass/Cellulose/Open Cell Foam (R- | ▼ |
| ▶ Interior Vapor Retarder | Polyethylene Sheet/Aluminum Foil | ▼ |
| ▶ Interior Finish | Drywall/Latex Paint | ▼ |



Select Analysis (new or retrofit)



New Construction



Exterior Retrofit



Interior Retrofit



Gut Retrofit

Retrofit assessment and recommendations

Home

Pre-Assessments

Assessments

Resources

Case Studies

Recommendations

The table below contains all the components in the gut retrofit apart from the framing material. Starting from left to right (exterior to interior) the table lists the **cladding, air space, continuous insulation, insulation thickness, water resistive barrier, exterior sheathing, cavity insulation, vapor retarder and interior finish**. Using the drop-down menus, you can select your preference of materials or no preference. Once the selection is complete a list of recommendations will be updated by order of performance based on insulation and durability values. For more detailed information on the performance of a specific retrofit wall assembly select the radio button adjacent to the recommendation and then select Next to go to the results page.

Preferences:

ID	Cladding	Air Space	Cont. Insulation	Insulation Thickness	Water Resistive Barrier	Exterior Sheathing
<input type="radio"/>	Brick/Stone	Drained/Ventilated	None	None	No Preference	Plywood/OSB/Fiberbc
<input checked="" type="radio"/>	128621 Brick/Stone	Drained/Ventilated	None	None	Impermeable Coating/Membrane (< 1 Perm)	Plywood/OSB/Fiberboard/Wo Plank

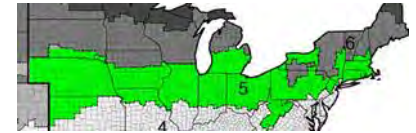
Showing 1 to 1 of 1 results

«« « 1 » »»

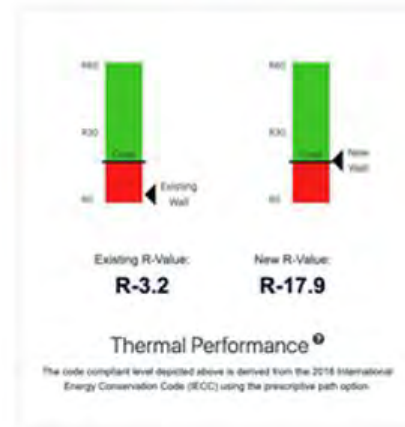
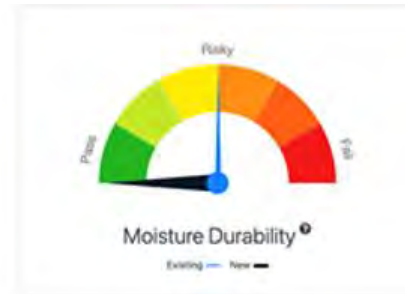
*Please select a recommendation above.

BSA output screen – Retrofit

- Information on moisture durability and energy efficiency summarized along with recommendations to improve performance.
- Provide users confidence in new energy efficient designs and retrofits?



	Existing Wall	New Wall
Exterior Cladding	Acrylic Stucco/Treated Brick	Brick/Stone
Air Space	None	Drained/Ventilated
Continuous Insulation	None	Foil Faced Polyiso
Insulation Thickness	None	1 in.
WRB Air Barrier	Housewrap/Building Paper (>= 10 perms)	Housewrap/Building Paper (>= 10 perms)
Exterior Sheathing	Plywood/OSB Fiberboard/Wood Plank	Plywood/OSB/Fiberboard/Wood Plank
Wall Structure	2 x 4 16 inch o.c. Wood Frame	
Cavity Insulation	None	Fiberglass/Celulose/Open Cell Foam (R-13/R-21)
Interior Continuous Insulation	None	
Interior Continuous Insulation Thickness	None	
Interior Vapor Retarder	None	
Interior Finish	Drywall/Latex Paint	



ScreenShot

Vinyl wallpaper “cold side VR” retrofit

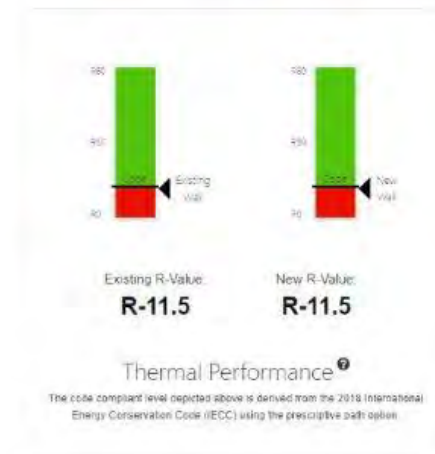


Retrofit Performance

The indicators below show the thermal performance and moisture durability of the new construction. Areas in green indicate good thermal performance (R-value above code and mold index of 2 or less). Floor thermal and moisture performance are reflected in the red and orange regions respectively.

Vinyl wall paper in hot-humid climate

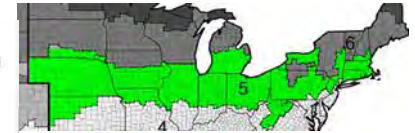
	Existing Wall	New Wall
Exterior Cladding	Brick/Stone	Brick/Stone
Air Space	Drained/Ventilated	Drained/Ventilated
Continuous Insulation	None	None
Insulation Thickness	None	None
WRB Air Barrier	Housewrap/Building Paper (≤ 10 perm)	Impermeable Coating/Membrane (< 1 perm)
Exterior Sheathing	F Plywood/GS/Fiberboard/Wood Plank	Plywood/GS/Fiberboard/Wood Plank
Wall Structure	2 x 4 16 Inch o.c. Wood Frame	2 x 4 16 Inch o.c. Wood Frame
Cavity Insulation	Fiberglass (R-11/R-13)	Fiberglass (R-11/R-13)
Interior Continuous Insulation	None	None
Interior Continuous Insulation Thickness	None	None
Interior Vapor Retarder	None	None
Interior Finish	Drywall/Glue Fabric/Vinyl Wallpaper	Drywall/Latex Paint



Add CI and drainage – 2x6 R19 retrofit

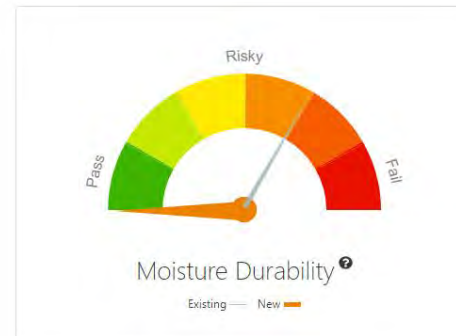
Retrofit Performance

The indicators below show the thermal performance and moisture durability of the new construction. Areas in green indicate good thermal performance (R-value above code and mold index of 2 or less). Poor thermal and moisture performance are reflected in the red and orange regions respectively.



Add Continuous Insulation

	Existing Wall	New Wall
Exterior Cladding	Mineral Stucco	Mineral Stucco
Air Space	None	Drained/Ventilated
Continuous Insulation	None	Extruded Polystyrene
Insulation Thickness	None	1 in.
WRB Air Barrier	Permeable Coating/Membrane (>= 1 perm)	Permeable Coating/Membrane (>= 1 perm)
Exterior Sheathing	Plywood/OSB/Fiberboard/Wood Plank	Plywood/OSB/Fiberboard/Wood Plank
Wall Structure	2 x 6 24 inch o.c. Wood Frame	
Cavity Insulation	Fiberglass (R-11/R-19)	Fiberglass (R-11/R-19)
Interior Continuous Insulation	None	
Interior Continuous Insulation Thickness	None	
Interior Vapor Retarder	Kraft Paper	
Interior Finish	Drywall/Latex Paint	

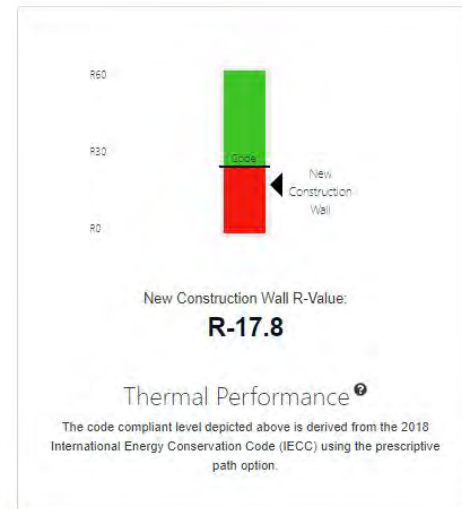
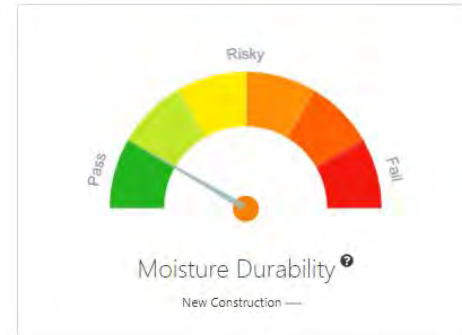
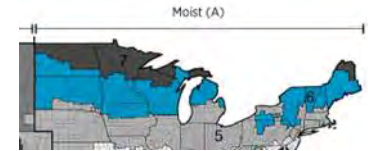


No CI 2x6 R19 w/drainage - New

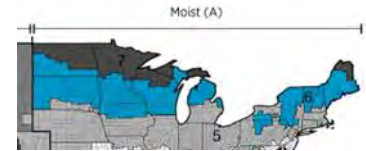
[New - 6a. R19 2x6, no CI, w/drainage, kraft](#)

Climate Zone: 6A - Cold

New Wall Construction	
Exterior Cladding	Vinyl/Metal Siding
Air Space	Drained/Ventilated
Continuous Insulation	None
Insulation Thickness	None
WRB Air Barrier	Housewrap/Building Paper (>= 10 perm)
Exterior Sheathing	Plywood/OSB/Fiberboard/Wood Plank
Wall Structure	2 x 6 16 inch o.c. Wood Frame
Cavity Insulation	Fiberglass/Cellulose/Open Cell Foam (R-13/R-21)
Interior Vapor Retarder	Kraft Paper
Interior Finish	Drywall/Latex Paint



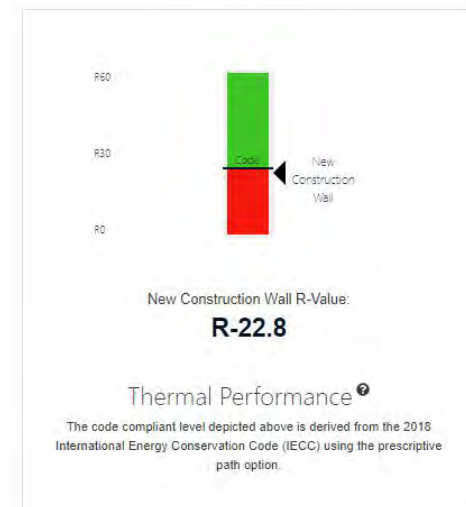
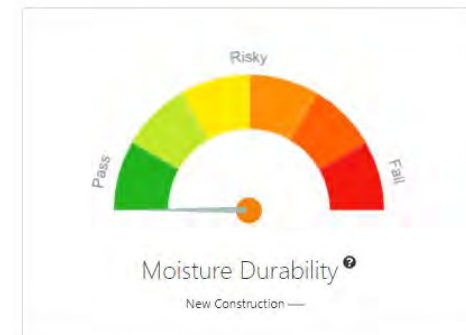
R5 CI 2x6 R19 w/drainage - New



New - 6A R19 2x6, R5 CI with drainage, Kraft

Climate Zone: 6A - Cold

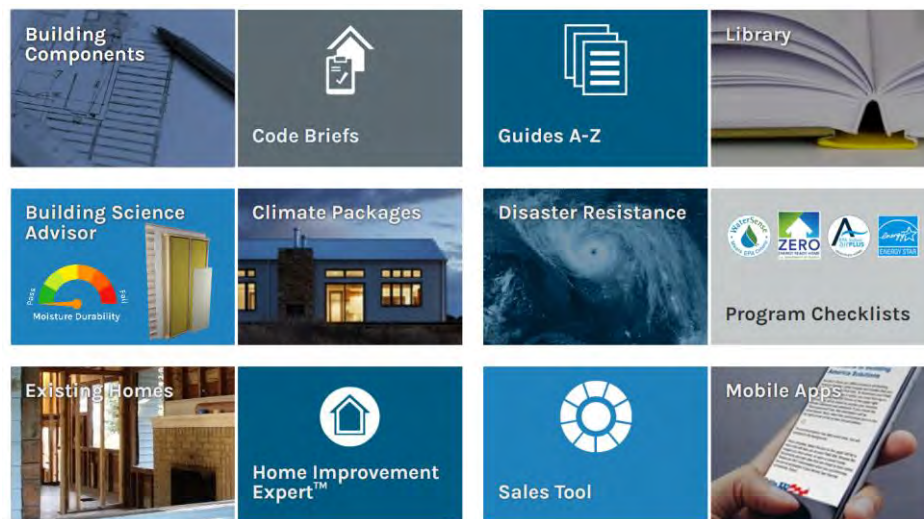
New Wall Construction	
Exterior Cladding	Vinyl/Metal Siding
Air Space	Drained/Ventilated
Continuous Insulation	Extruded Polystyrene
Insulation Thickness	1 in.
WRB Air Barrier	Housewrap/Building Paper (>= 10 perm)
Exterior Sheathing	Plywood/OSB/Fiberboard/Wood Plank
Wall Structure	2 x 6 16 inch o.c. Wood Frame
Cavity Insulation	Fiberglass/Cellulose/Open Cell Foam (R-13/R-21)
Interior Vapor Retarder	Kraft Paper
Interior Finish	Drywall/Latex Paint



BSA “best practice” via BASC

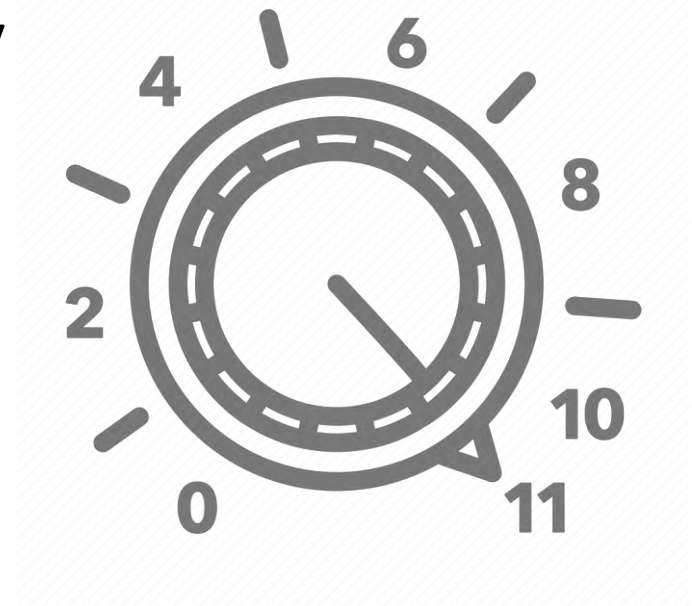
Provides advice to further reduce risk:

- Drainage & ventilated cavities “drain the rain”
- Water resistive barriers (WRBs) “w/or w/o CI”
- Vapor retarders “know your IECC perm”
- Insulation (CI and cavity installed correctly)
- Correct workmanship by all trades



Campers call to Action: Your feedback!

- What are the value propositions for using BSA?
- How can BSA benefit your clients and other users?
- BSA training opportunities suggestions?
- BSA versions suggestions?
 - User functional useability
 - Wall assembly options
 - New enhancements
 - Other



Building science boogie band: ROCK BSA

**Verse 1: Rotting walls in the city, rotting walls in your hometown
Beat up siding hiding mold, is what we've found.**

**Chorus: No rotting walls in the USA.
Go Hygrothermal wild with the BSA.
Please won't you check it out today.
Cause we want to know what you gotra say, about the BSA**

**Verse 2: Learn your perm per the ICC
No mushy was-wood walls w/OSB
Build a dumb wall and you got to pay
Or build a smart wall and use Joe's way**

Chorus: Repeats

**Verse 3: Choose your city, or TMY town
Mold free walls that don't fall down.
CI means less dew-point around
Low perm in Miami, no mold found**

Chorus: Ends

Building science boogie band: “BS Biz”

You get up in the morning, you drive your car to Logan, take a 747 to a meeting. You make a lot of money, & people think you're funny, and the crowd really takes a beating. You have great lines and like to drink fine wine cost more than your sports car you say. If you clients get annoyed, you will be self employed, an aspen vacation let's play! BSB Joe's way, BSB, what did he say;

Drain the rain on the plane
Save some cash, you better flash
No overhang, no yin just yang
Build it tight, test it on site
Ventilate right, test it on site
No virgin poly, a Canadian folly,
It don't rot & fall, that's Joes perfect wall,
No perimeter drain, Joe goes insane
Know your perm, and you will learn
Don't do stupid things, or Joe goes ching ching

BSB Joes way, BSB, It's what the BSA say!

Questions?

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