Building America Webinar Series

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building Science Education

Taming the Wild West Show

SAM RASHKIN, DOE
CHERYN METZGER, PNNL
SARA FARRAR, NREL

August 24, 2016

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http://energy.gov/eere/buildings/building-america-meetings#current

Why Building Science Education

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Supply System:
Workforce Competent in Building Science

Product on Shelf:
Better Buildings
> Comfort
> Health
> Safety
> Durability

Market Demand:
Consumers and Transaction Process That Value Better Buildings

Better Buildings Big Prize:
- **$100s B** Savings
- **Millions** MMTCe
- **100,000s** of Jobs
- National Security

Webinar Agenda

Building Science Education

- Timeline
- Guidelines for Building Science Education
  - Consistent Framework
  - Building Science Education Solution Center
  - Collective Impact Campaign
  - Self Certification Process
  - Actions:
    - Self Certify!
    - Provide Content!
- Race to Zero Student Design Competition
  - Join us in 2017!
- Sales Tool

Building Science Education Timeline

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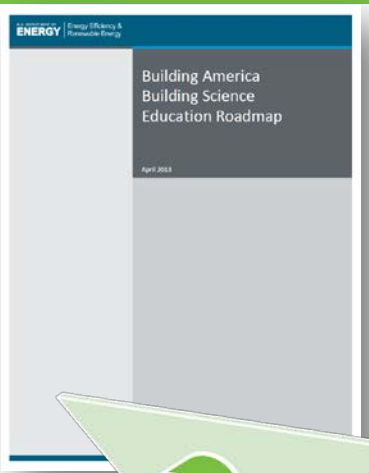
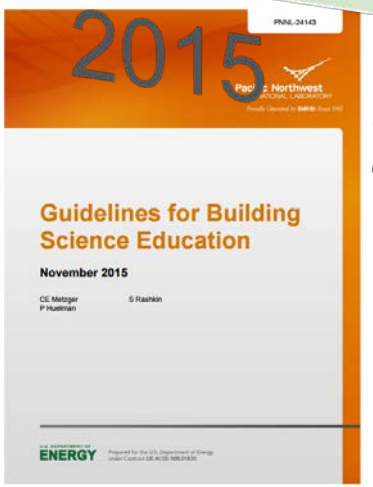


2013

2014

2015



2016

Building Science Education Strategy

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Framework for Consistent Competency	DOE Guidelines for Building Science Education
Full Integration with Degree Programs	DOE '**Race to Zero**' Student Design Competition
Value Understood in the Market	DOE Sales Tool

Career Classifications

1 High-School Ed.	2 Builder/ Remodel Pros	3 Program/ Project Manager	4 Transact. Process Pros	5 Design/ Construc. Pros	6 Building Science Pros	7 Home Energy Pros	8 Building Depart.
Physics	Builder	Utllity	Realtor	A/E Degree	Forensics	Auditors	Code Offic.
	GC/Forem.	Energy Eff.	Appraiser	Lic. Arch.	QA Envel.	Perf Assess	
	Remodeler	Maint. Pro	Home Insp	Mech. Eng.	QA M&E		
	Insulater	Facil. Man.	Insurers	Civil/Struc.			
	HVAC		Lenders	Mat. Sci.			
	Plumber			Designers			
	Home Perf.			Landscape			
				Const. Man			

Consistent Framework – Building Science Skills

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Building Science Skills

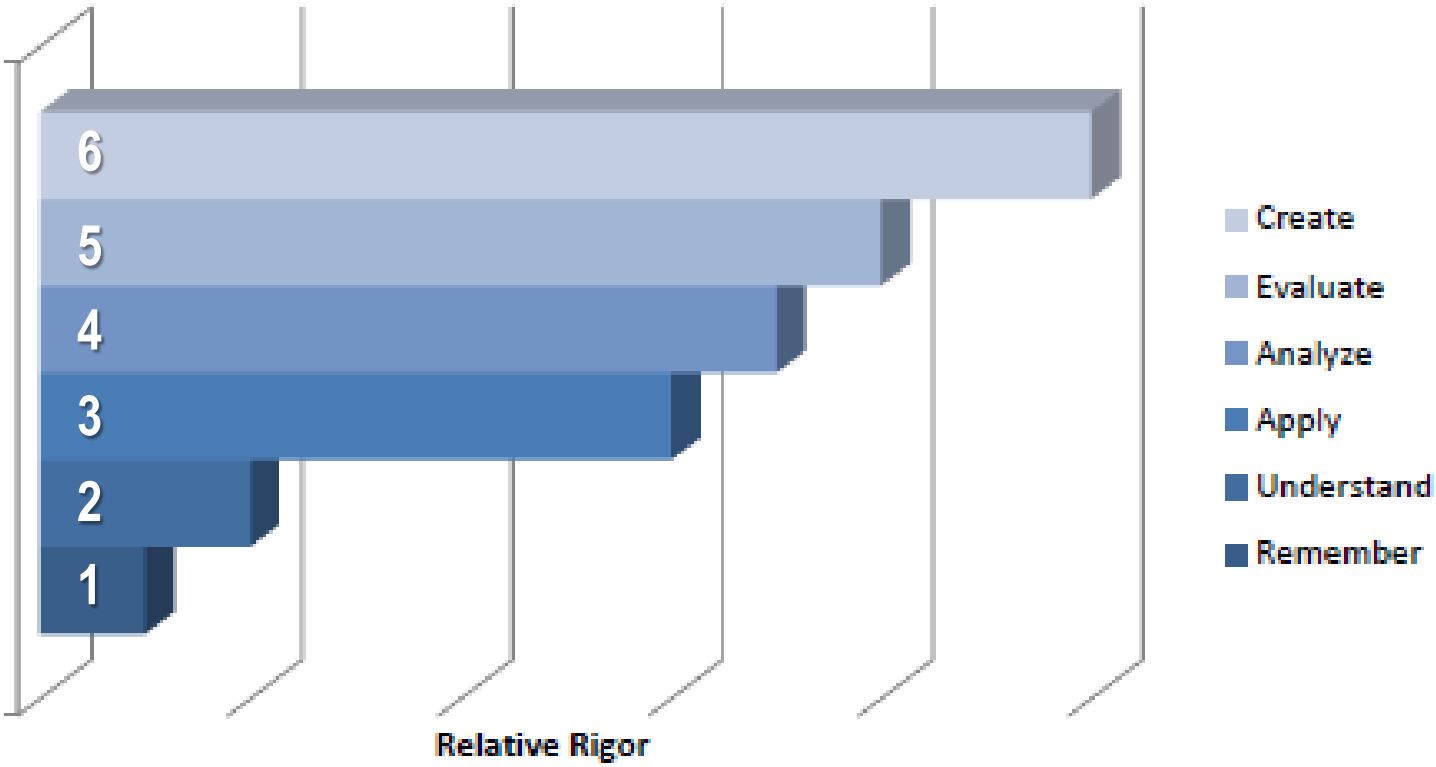
1 Integration of Whole-Bldg. Sys.	2 Building Science Principles	3 Operations & Maintenance	4 Building Testing
1.1 Performance	2.1 Heat Transfer	3.1 User Interface/Cont.	4.1 Commissioning
1.2 Life-Cycle Cost Eff.	2.2 Material Selection	3.2 Preventative Maint.	4.2 Diag. & Forensics
1.3 Disaster Resistance	2.3 Moisture Transport	3.3 Replacement/Renov.	4.3 Perf. Mon./Assess.
I.4 Int. Design & Const.	2.4 Control Layers		4.4 Ntl. Codes & Stds
1.5 Quality Management	2.5 Convective Transprt.		4.5 Cert. Programs
1.6 Bldg/Energy Model'g	2.6 Hygrothermal Anal.		
1.7 Cost Trade-Off Anal.	2.7 HVAC Systems		
	2.8 HVAC Inter. w/Struc.		
	2.9 Fenestration		
	2.10 Plumbing Systems		
	2.11 Electrical Systems		
	2.12 Lgting & Appliances		
	2.13 Indoor Air Quality		
	2.14 Control/Automation		

Consistent Framework – Proficiency Levels

Building Science Proficiency Based on Blooms Taxonomy

6	**Create** (Design)
5	**Evaluate** (Synthesis)
4	**Analyze** (Analysis)
3	**Apply** (Application)
2	**Understand** (Comprehension)
1	**Remember** (Knowledge)

Consistent Framework – Proficiency Level Relative Rigor



Consistent Framework - Building Science Education Matrix

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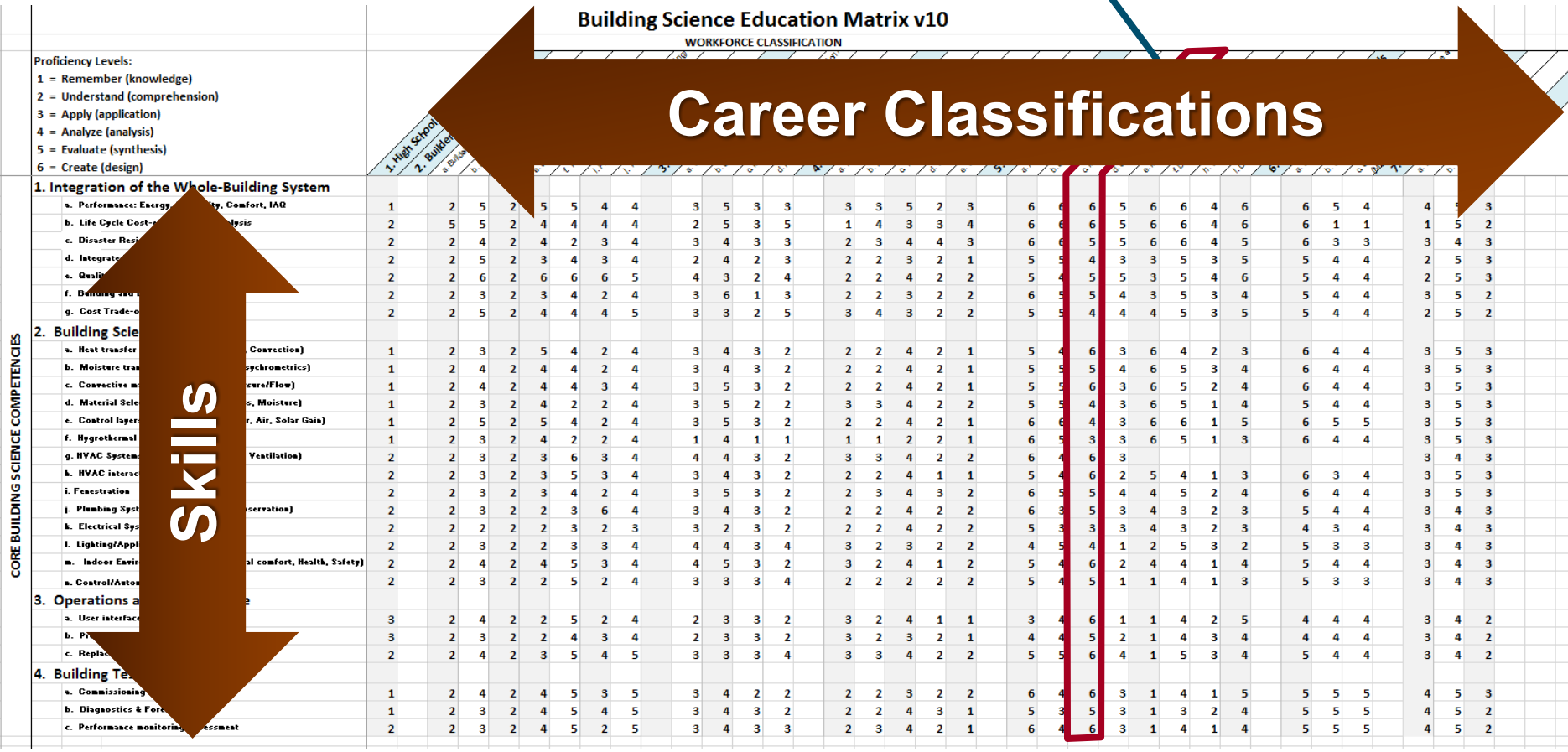
Mechanical Engineer Guideline

Work in Progress

Career Classifications

Skills

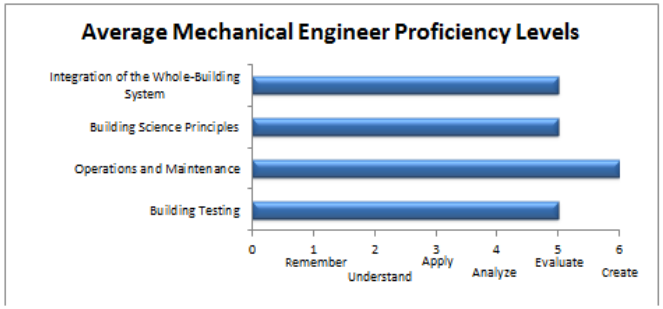


Consistent Framework – Sample Guideline

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building Science Education Guidelines for Mechanical Engineers

A summary of the proficiency levels[1] for the core competencies are displayed in the graphic below. For each core competency level described in this checklist, it is assumed that the organization or student is proficient in the level described, as well as all the cognitive levels below that level.



As the entity responsible for managing home energy certifiers, a mechanical engineer should be proficient in the following categories:

Topic	Proficiency Level	Checkbox
Integration of the whole-building system	Average = 5	
Simultaneous consideration of energy, durability, comfort and IAQ	6	☐
Annualized cash flow	6	☐
Building techniques related to natural and man-made disasters	5	☐
Integrated design and construction	4	☐
Quality management	5	☐
Building energy modeling	5	☐
Cost trade-off analysis (optimized first costs)	4	☐
Building science principles related to the enclosure	Average = 5	
Heat transfer (convection, conduction and radiation)	6	☐
Moisture transport of liquid	5	☐
Convective air transport due to pressure differences	6	☐
Material selection (IAQ, thermal mass, moisture)	4	☐
Controls layers (heat, vapor, water, air and solar gain)	4	☐
Hygrothermal analysis	3	☐
HVAC systems (heating, cooling and ventilation)	6	☐
HVAC interactions with the enclosure	6	☐
Fenestration considerations	5	☐
Plumbing systems (heating, distribution, conservation)	5	☐
Electrical systems	3	☐
Lighting/appliances and miscellaneous loads	4	☐
Indoor environmental quality (temperature uniformity and indoor pollutants)	6	☐
Control/automation systems	5	☐
Operations and maintenance	Average = 6	
User controls (ex: thermostat)	6	☐
Preventative maintenance (ex: cleaning air filters)	5	☐
Determination of appropriate replacement choices	6	☐
Building testing and certification	Average = 5	
Commissioning	6	☐
Diagnostics and forensics	5	☐
Monitoring	6	☐
National codes and standards	3	☐
Certification programs	3	☐

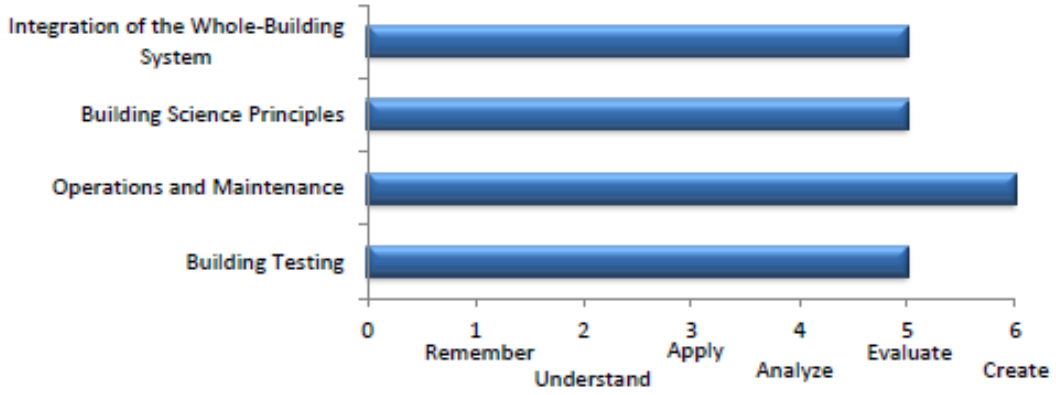
The _____ mechanical engineer certification body has incorporated all of the relevant information in the above checklist into their training materials.

Signature _____

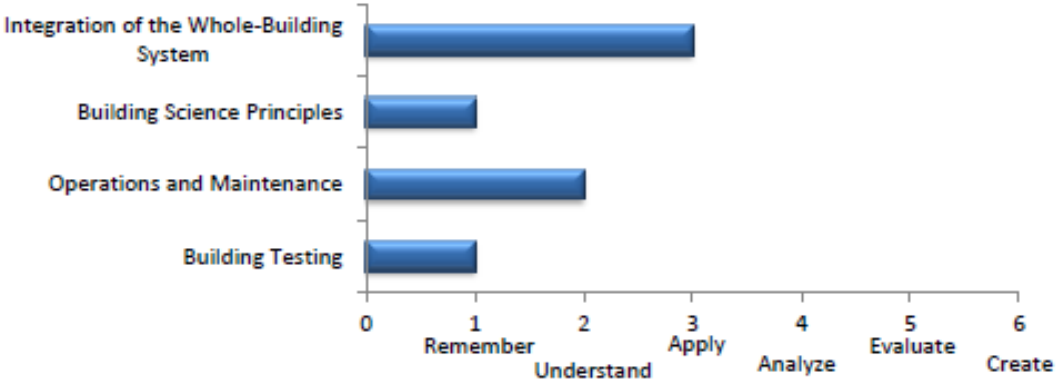
[1] The average level shown here is the whole number that best represents the combination of individual scores from each sub-category

Consistent Framework – Sample Guideline Comparison

Average Mechanical Engineer Proficiency Levels



Average Appraiser Proficiency Levels



Moving Forward

1. Online Solution Center

- Audience: professors and trainers
- Easy access to consistent, peer reviewed training materials

2. Collective Impact Campaign*

- Target Partners: Educational Institutions (small programs to big universities)
- Easy access to official partners for students

*Kania and Kramer, Stanford Social Innovation Review, 2011

Skills		Proficiency					
		1	2	3	4	5	6
1 Integration of Whole-Building System	1.1: Performance: Energy, Durability, Comfort, IAQ						
	1.2: Life-Cycle Cost-Effectiveness Analysis						
	1.3: Disaster Resistance/Resiliency						
	1.4: Integrated Design and Construction						
	1.5: Quality Management						
	1.6: Building and Energy Modeling						
	1.7: Cost Trade-Off Analysis						
Bu	2.1: Heat Transfer (Conduction, Radiation, Convection)						
	2.2: Moisture Transport (Liquid, Vapor, Pxychrometri						
	2.3: Convective Mass (air) Transport (Pressure/Flow)						
	2.4: Material Selection (IAQ, Thermal M... oisture)						
Op							
Bu							

Content

Level 1: Identify and state the units for: heat flux, heat rate, thermal conductivity, temperature gradient, emissivity, heat transfer coefficient

Level 2: Define key terms including conduction, convection, radiation, energy, steady state.

Level 3: Calculate heat transport, conductivity, area or temperature difference through a solid using Fourier's law.

Level 4: Draw a heat transfer diagram that shows each mode of heat transfer in context with the geometry

Level 5: Determine the mode of heat transfer most important or likely to occur in a system if given information about the substances/ processes involved.

Level 6: Design an integrated hybrid thermal envelope

2. Building Science Principles - 2.1 Heat Transfer

Content

Skills		Proficiency					
		1	2	3	4	5	6
1 Integration of Whole-Building System	1.1: Performance: Energy, Durability, Comfort, IAQ						
	1.2: Life-Cycle Cost-Effectiveness Analysis						
	1.3: Disaster Resistance/Resiliency						
	1.4: Integrated Design and Construction						
	1.5: Quality Management						
	1.6: Building and Energy Modeling						
	1.7: Cost Trade-Off Analysis						
2 Building Science Principles	2.1: Heat Transfer (Conduction, Radiation, Convection)						
	2.2: Moisture Transport (Liquid, Vapor, Pxychrometrics)						
	2.3: Convective Mass (air) Transport (Pressure/Flow)						
	2.4: Material Selection (IAQ, Thermal Mass, Moisture)						
	2.5: Control Layers (Thermal, Vapor, Water, Air, Solar Gain)						
	2.6: Hygrothermal Analysis						
	2.7: HVAC Systems (Heating, Cooling, and Ventilation)						
	2.8: HVAC Interactions with Enclosure						
	2.9: Fenestration						
	2.10: Plumbing Systems (Heating, Distribution, Conservation)						
	2.11: Electrical Ssytems						
	2.12: Lighting/Appliances and Miscellaneous Loads						
	2.13: Indoor Envir. Quality (Thermal Comfort, Health, Safety)						
	2.14: Control/Automation Systems						
3 Operation & Maint.	3.1: User Interface and Controls						
	3.2: Preventive Maiantenance						
	3.3: Replacement and Renovation						
4 Building Testing	4.1: Commissioning						
	4.2: Diagnostics and Forensics						
	4.3: Performance Monitoring/Assessment						

Career-Specific Content Per Guideline: Mechanical Engineer

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Job Classification

Click on the image above to find content organized by job classification. Examples include mechanical engineer, appraiser, home performance contractor, code official and many more!

READ MORE

The Building Science Education Solution Center provides complete, accurate training material and curriculum for a full range of building-related professions. New to the BSE Solution Center? Visit our webinar for detailed information and a tour of the BSE Solution Center.

As a community-driven tool, we welcome your comments on how to continuously improve the Solution Center. Educators and professors should register to unlock assessment questions and practice problems.

RECENTLY UPDATED

AUGUST 17, 2015
Disaster Resilience - Analysis

AUGUST 17, 2015
Cost Trade-Off Analysis - Knowledge

AUGUST 17, 2015
Commissioning - Understand

More Guides

RECENTLY ADDED CONTENT

AUGUST 17, 2015
Removable Interior Storm Windows

AUGUST 17, 2015
Taped Insulating Sheathing Drainage Panes

AUGUST 17, 2015
Job Classification

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Click on the component for a list of corresponding component subcategories. Select on subcategory to display a list of related Guides.

DESIGN & CONSTRUCTION PROFESSIONALS

- Architect
- Mechanical Engineer
- Civil Engineer
- Landscape Architect
- Material Science Engineer

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Mechanical Engineer Checklist

- ▶ Building Science Principles
- ▶ Integration of the Whole-Building System
- ▶ Operations and Maintenance
- ▶ Building Testing and Certification

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Mechanical Engineer Checklist

▶ Building Science Principles

▶ Integration of the Whole-Building System

Heat Transfer
Moisture Transport
Convection Mass (air) Transport
Material Selection
Control Layers
Hygrothermal Analysis
HVAC Systems
HVAC Interactions with the Enclosure
Fenestration
Plumbing Systems
Electrical Systems
Lighting, Appliance, and Miscellaneous Loads
Indoor Environmental Quality
Control/Automation systems

▶ Operations and Maintenance

▶ Building Testing and Certification

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Fenestration

Learning Objectives | Lecture Notes | Teaching Materials | Problem Sets

Proficiency Level 1: Remember

Define key terms including u-factor, NFRC label, SHGC, VT, air leakage, and LSG.

Describe different window operation methods and be prepared to comment on air leakage implications.

Proficiency Level 2: Understand

Describe types of window frames and glazing including low-e, tinting, and reflective coatings

Describe ways that sunlight transmittance is measured and rated.

Explain distinguishing features of each of the primary glazing types including tints, low-e, etc.

Proficiency Level 3: Apply

Sketch the primary components of a window and describe the role that each plays (frame, panes, sill, etc.).

Proficiency Level 4: Analyze

Classify window performance for specific regions using information from the NFRC label.

Explain the importance of u-factors in predicting window performance.

Proficiency Level 5: Evaluate

Select the best window system for specific orientations and geography.

Automatic or manual proficiency level filter

Fenestration (i.e. windows and skylights) provide our homes with light, warmth, and ventilation. When properly designed, selected and installed, energy-efficient windows can help minimize heating, cooling, and lighting costs, while improving comfort for building occupants.

Level 1: Remember
Level 2: Understand
Level 3: Apply
Level 4: Analyze
Level 5: Evaluate
Level 6: Design

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Fenestration

Learning Objective | Lecture Notes | Teaching Materials | Problem Sets

Proficiency Level 1: Remember

Fenestration – Key Terms - Remember

Fenestration – Primary Window Components - Remember

Proficiency Level 2: Understand

Fenestration – Window Types - Understand

Fenestration – Physical Measurements and Rating Labels - Understand

Fenestration – Distinguishing Features - Understand

Proficiency Level 3: Apply

Fenestration – Correct Window Installation Methods -- Apply

Proficiency Level 4: Analyze

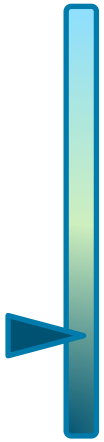
Fenestration – Window Performance - Analyze

Fenestration – Importance of U-Factors - Analyze

Proficiency Level 5: Evaluate

Fenestration – Primary Window Components - Evaluate

Fenestration (i.e. windows and skylights) provide our homes with light, warmth, and ventilation. When properly designed, selected and installed, energy-efficient windows can help minimize heating, cooling, and lighting costs, while improving comfort for building occupants.



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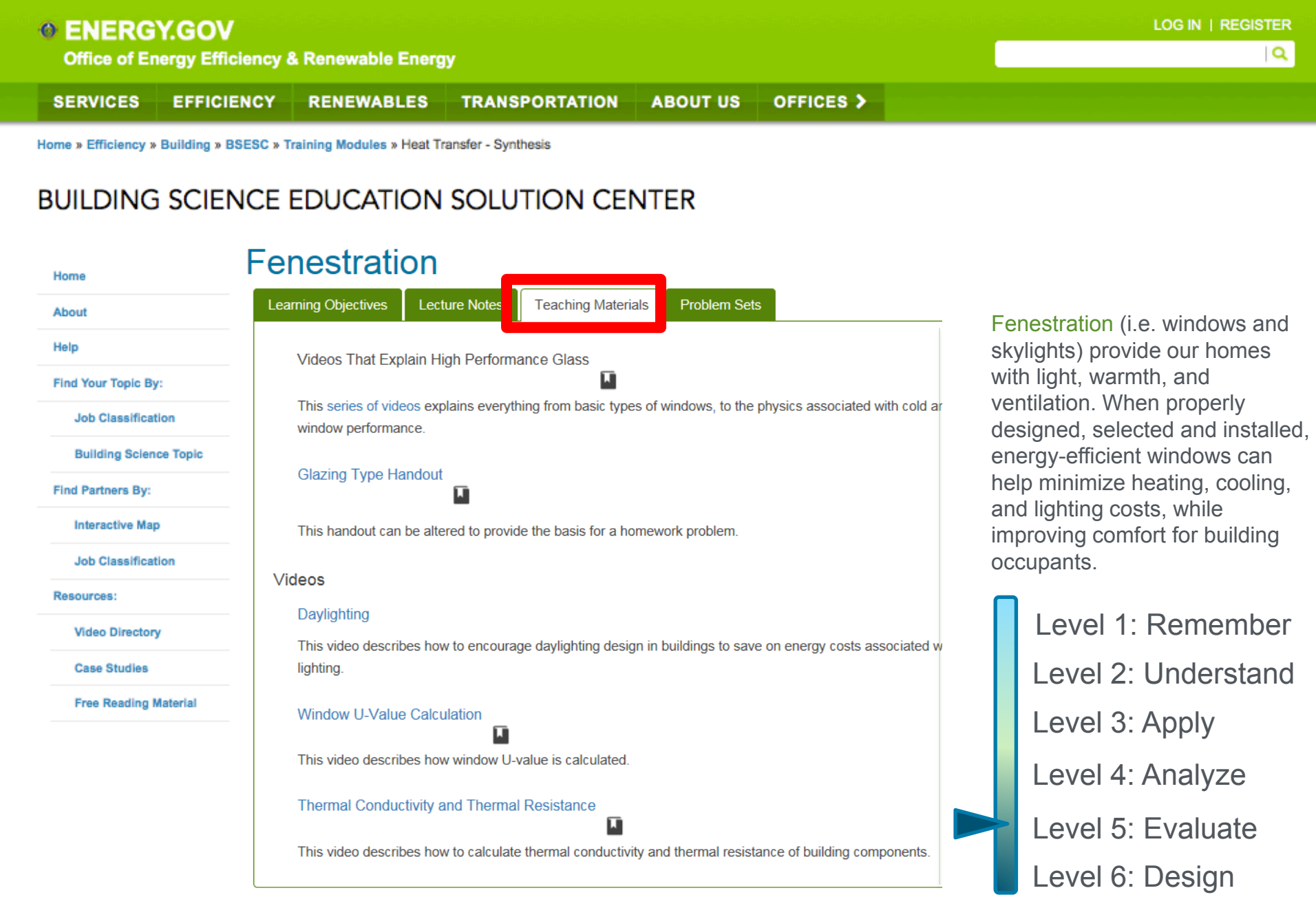
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Problem Sets
Videos That Explain High Performance Glass
This series of videos explains everything from basic types of windows, to the physics associated with cold ar
window performance.
Glazing Type Handout
This handout can be altered to provide the basis for a homework problem.
Videos
Daylighting
This video describes how to encourage daylighting design in buildings to save on energy costs associated w
lighting.
Window U-Value Calculation
This video describes how window U-value is calculated.
Thermal Conductivity and Thermal Resistance
This video describes how to calculate thermal conductivity and thermal resistance of building components.
Fenestration (i.e. windows and skylights) provide our homes with light, warmth, and ventilation. When properly designed, selected and installed, energy-efficient windows can help minimize heating, cooling, and lighting costs, while improving comfort for building occupants.
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Fenestration

Learning Objectives | Lecture Notes | Teaching Materials | Problem Sets

Appropriate Use of Low-E Coatings

Should Low-E coatings be used in a hot climate area?

Improving Window Performance

Which of the following options would NOT improve the performance of a window?

(a) Increase airtightness of a window

(b) Increase the number of glass panes.

(c) Increase the thermal performance of the window frame.

(d) Increase the thickness of glass.

NFRC Label Information

List 3 window performance measures that appear on an NFRC label?

Advantage of Inert Gas in Windows

Type of Problem: Homework

One of the advantages of a window assembly that uses an inert gas in the air gap is:

(a)Inert gases are not explosive.

(b)The inert gas acts as an insulator and reduces the heat transfer through the window.

(c)These windows can use single pane glazing.

(d)Windows with inert gases are low cost.

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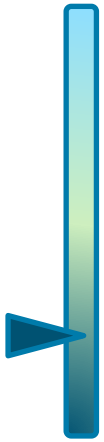

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Material Selection
Control Layers
Hygrothermal Analysis
HVAC Systems
HVAC Interactions with the Enclosure
Fenestration
Plumbing Systems
Electrical Systems
Lighting, Appliance, and Miscellaneous Loads
Indoor Environmental Quality
Control/Automation systems

▶ Operations and Maintenance

▶ Building Testing and Certification

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Moving Forward

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- Audience: professors and trainers
- Easy access to consistent, peer reviewed training materials

2. Collective Impact Campaign*

- Target Partners: Educational Institutions (small programs to big universities)
- Easy access to official partners for students

*Kania and Kramer, Stanford Social Innovation Review, 2011

Collective Impact:

The commitment of a group of important actors from different sectors to a common agenda for solving a specific social problem.

"Collective Impact" by John Kania and Mark Kramer
Stanford Social Innovation Review, Winter 2011

Types of Partnerships

Trade Associations

- Licensing Exams
- Continuing Education

Universities/Colleges

- Existing curriculum infusion
- New classes
- Structured minor
- State Licensing Exams

General Public

- High Schools

What Does Success Look Like?

Silver Level Partnerships

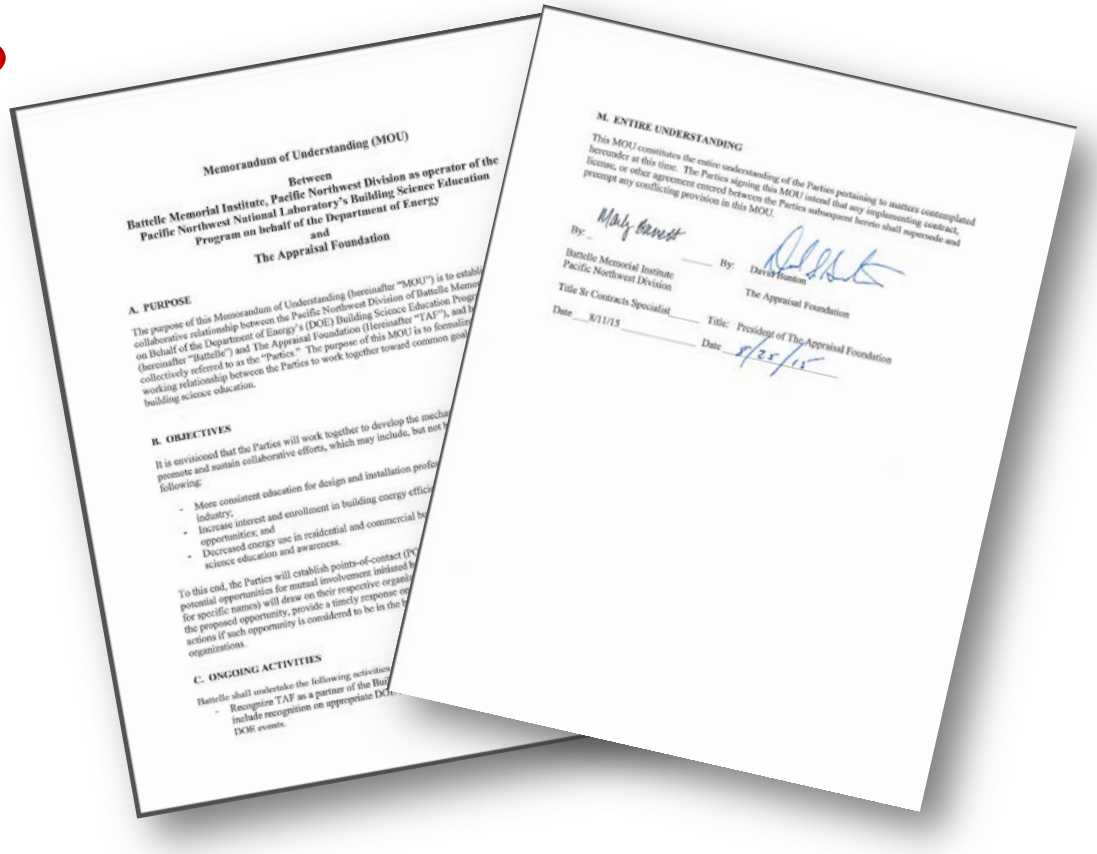
- Memorandums of Understanding with various trade associations and higher level education institutions
- Integrated guideline content into one class
- Content used on website

Gold Level

- MOUs
- Integrated guideline content In at least three classes

Platinum Level

- MOUs
- Fully integrated Guidelines
- Self-certified program
- New minor for a program



Memorandum of Understanding (MOU)

Between

Battelle Memorial Institute, Pacific Northwest Division as operator of the Pacific Northwest National Laboratory's Building Science Education Program on behalf of the Department of Energy

and

The Appraisal Foundation

A. PURPOSE

B. OBJECTIVES

C. ONGOING ACTIVITIES

M. ENTIRE UNDERSTANDING

This MOU constitutes the entire understanding of the Parties pertaining to matters contemplated hereunder at this time. The Parties signing this MOU intend that any implementing contract, license, or other agreement entered between the Parties subsequent hereto shall supersede and preempt any conflicting provision in this MOU.

By: _____

Battelle Memorial Institute
Pacific Northwest Division

Title Sr Contracts Specialist

Date 8/11/15

By: _____

David Hanson

The Appraisal Foundation

Title: President of The Appraisal Foundation

Date 8/25/15

Silver Level Partners

EEBA

THE APPRAISAL FOUNDATION
Authorized by Congress as the Source of Appraisal Standards and Appraiser Qualifications

UNIVERSITY OF MINNESOTA

University of Portland
Shiley School of Engineering

MOU's in Progress

- Virginia Tech
- RESNET

BUILDING SCIENCE EDUCATION SOLUTION CENTER

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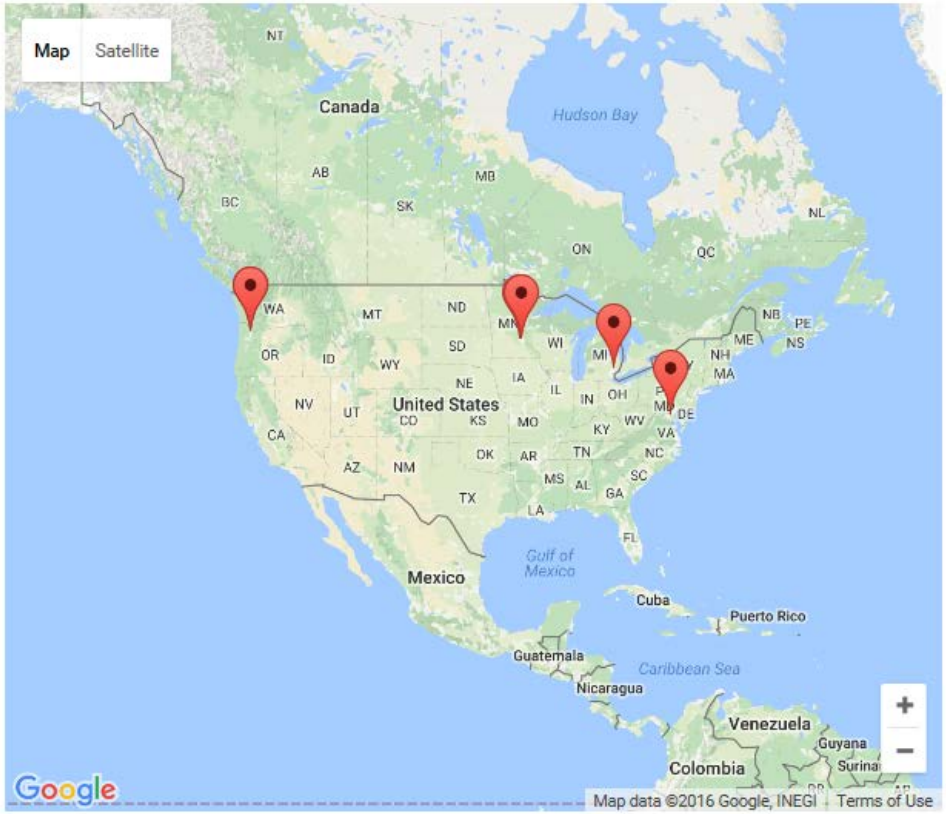

BUILDING TYPE

Residential (6)
Both (4)
Commercial (4)

JOB CLASSIFICATION

Material Science Engineers (2)
Mechanical Engineers (2)
Appraisers (1)
Builders/Remodelers (1)
Civil and Structural Engineers (1)

PARTNERSHIP LEVEL

Silver (4)

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Partners A-Z

Cold Climate Housing Program - University of Minnesola

The Cold Climate Housing Program (CCH) is an information and education program that promotes the idea of the "house as a system."

Dr. Heather Dillon

Heather Dillon is a professor at the University of Portland, in Portland, OR. She teaches building science to undergraduate mechanical engineering students.

Guardian Industries Corporation

Shiley School of Engineering - University of Portland

The University of Portland is a thriving community of over 5,000 students, faculty and staff located on a bluff overlooking the booming metropolitan city of Portland, Oregon.

The Appraisal Foundation

The Appraisal Foundation (Foundation) is the nation's foremost authority on the valuation profession.

The Energy and Environmental Building Alliance

The Energy & Environmental Building Alliance (EEBA) provides an invaluable platform for insight, collaboration and education.

BUILDING TYPE
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Shiley School of Engineering - University of Portland

The University of Portland is a thriving community of over 5,000 students, faculty and staff located on a bluff overlooking the booming metropolitan city of Portland, Oregon.

Featured Story:

"The University of Portland's Shiley School of Engineering recognizes that the high performance building industry is a growing field. Our School is excited to partner with the Pacific Northwest National Laboratory to bring awareness to these job opportunities and support the Department of Energy's Guidelines for Building Science Education. Thanks to Dr. Heather Dillon of the Mechanical Engineering program, who helped develop this partnership, our students will be some of the first in the country to have access to the world-class teaching materials available through PNNL and DOE."

Dean Sharon Jones – Shiley School of Engineering

Partner Website: http://engineering.up.edu/

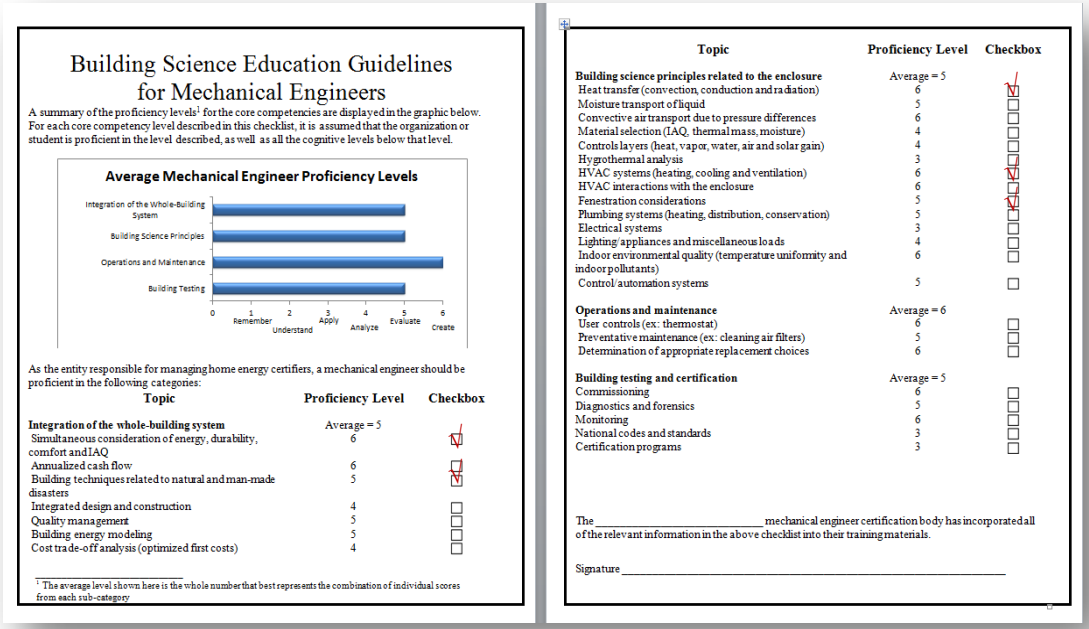
Action: Self Certify! (Beta Launch)

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- Step 1 – Find the appropriate checklist in the Guidelines for Building Science Education

  http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-24143.pdf

- Step 2 – Compare your program against this checklist



Building Science Education Guidelines for Mechanical Engineers

A summary of the proficiency levels[1] for the core competencies are displayed in the graphic below. For each core competency level described in this checklist, it is assumed that the organization or student is proficient in the level described, as well as all the cognitive levels below that level.

Average Mechanical Engineer Proficiency Levels

As the entity responsible for managing home energy certifiers, a mechanical engineer should be proficient in the following categories:

Topic	Proficiency Level	Checkbox
Integration of the whole-building system	Average = 5	
Simultaneous consideration of energy, durability, comfort and IAQ	6	☑
Annualized cash flow	6	☐
Building techniques related to natural and man-made disasters	5	☑
Integrated design and construction	4	☐
Quality management	5	☐
Building energy modeling	5	☐
Cost trade-off analysis (optimized first costs)	4	☐

[1] The average level shown here is the whole number that best represents the combination of individual scores from each sub-category

Topic	Proficiency Level	Checkbox
Building science principles related to the enclosure	Average = 5	
Heat transfer (convection, conduction and radiation)	6	☑
Moisture transport of liquid	5	☐
Convective air transport due to pressure differences	6	☐
Material selection (IAQ, thermal mass, moisture)	4	☐
Controls layers (heat, vapor, water, air and solar gain)	4	☐
Hygrothermal analysis	3	☐
HVAC systems (heating, cooling and ventilation)	6	☑
HVAC interactions with the enclosure	6	☐
Fenestration considerations	5	☑
Plumbing systems (heating, distribution, conservation)	5	☐
Electrical systems	3	☐
Lighting/appliances and miscellaneous loads	4	☐
Indoor environmental quality (temperature uniformity and indoor pollutants)	6	☐
Control/automation systems	5	☐
Operations and maintenance	Average = 6	
User controls (ex: thermostat)	6	☐
Preventative maintenance (ex: cleaning air filters)	5	☐
Determination of appropriate replacement choices	6	☐
Building testing and certification	Average = 5	
Commissioning	6	☐
Diagnostics and forensics	5	☐
Monitoring	6	☐
National codes and standards	3	☐
Certification programs	3	☐

The _____ mechanical engineer certification body has incorporated all of the relevant information in the above checklist into their training materials.

Signature _____

Action: Self Certify! (Beta Launch)

- Step 3 – Determine if there is anywhere you can add building science content to one class or many?

- Step 4 – Choose your desired partnership level
  - Silver: Guideline content in one class or content used on website
  - Gold: Guidelines content in three classes
  - Platinum: Fully integrated Guideline content

- Step 5 – Contact Cheryn Metzger (cheryn.metzger@pnnl.gov) with a scanned copy of the filled out guideline. If both parties agree to mutually appropriate partnership, a process will be started to sign MOU with DOE and add partnership content to website.

Action: Provide Content!

- **Preferred Submission:**
  All aspects of a core competency subject (ex. Fenestration), and a given proficiency level (ex. Level 5 – Evaluate) as it appears on the website.
  - Learning objectives
  - Lecture notes
  - Teaching materials
  - Problem sets
  - “Primary Image”
- **Priority:**
  Lecture notes and problem sets are particularly needed
- **Caution:**
  !!!Videos, images, tables, text, and problem sets from published textbooks are not allowed!!!

DOE Building Science Ed. Program

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Framework for Consistent Competency	DOE Guidelines for Building Science Education
Professional Degree Program Integration	DOE '**Race to Zero**' Student Design Competition
Value Understood in the Market	DOE Sales Tool

Race to Zero (RTZ) Vision

Inspire and develop the next generation of building science professionals

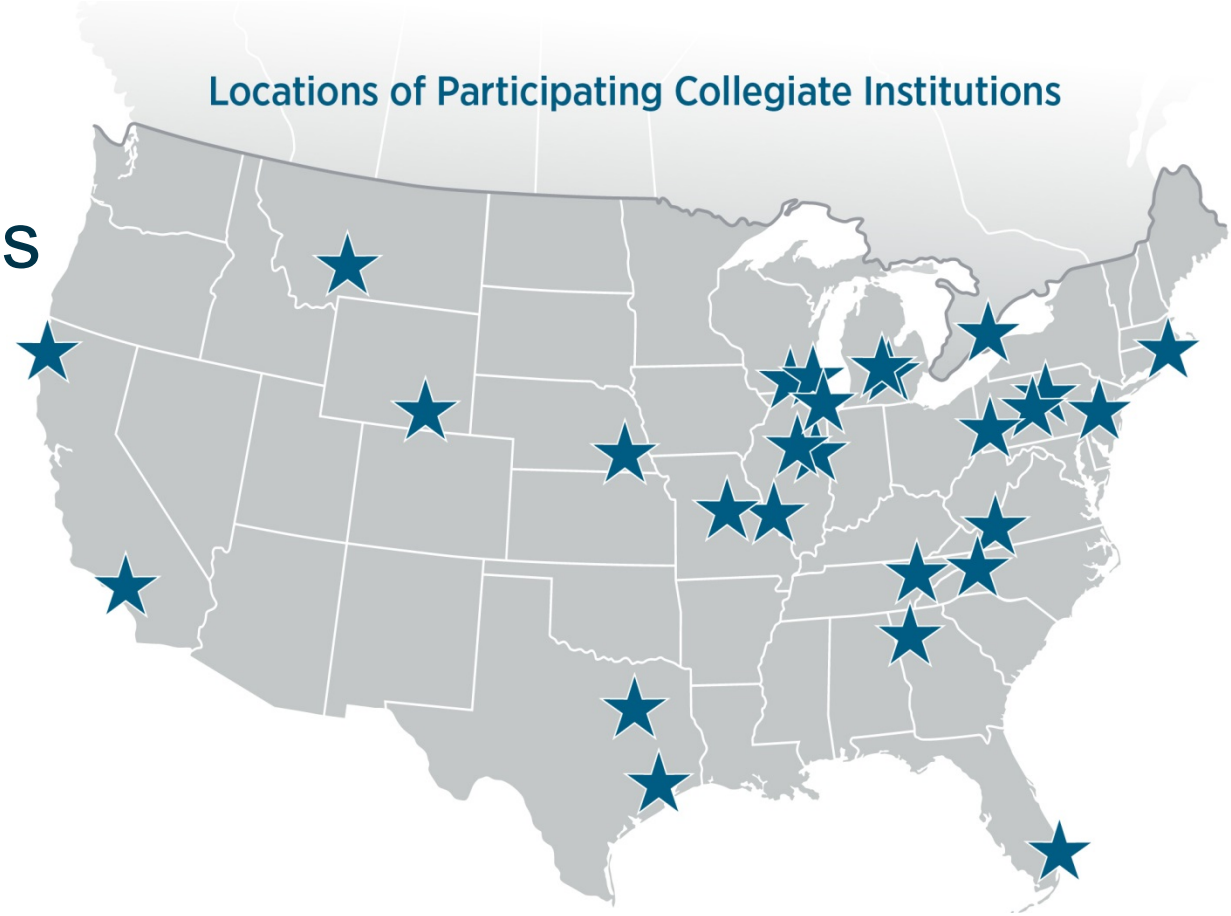
Advance and enhance building science curriculum at universities

Race to Zero Overview

- **Configuration:**
  - Annual Competition (Starting 2014)
  - Designed for Easy Integration in Existing Courses
  - Collaborative Teams
- **Goals:**
  - Building Science Training
  - Market Ready Solutions (Design + Cost)
  - Comprehensive Building Science Integrated Design
- **Event:**
  - NREL Two-Day Event
  - Expert Juror Presentations
  - Career Connections

RTZ 2016 Team Distribution

- 301 Students
- 25 Universities
- 31 Teams



Race to Zero 2016 Grand Winner

Prairie View A&M University

Urban Single-Family Contest

RTZ 2016 Grand Winner Design

Affordable zero ready home for a historically significant, low income neighborhood.

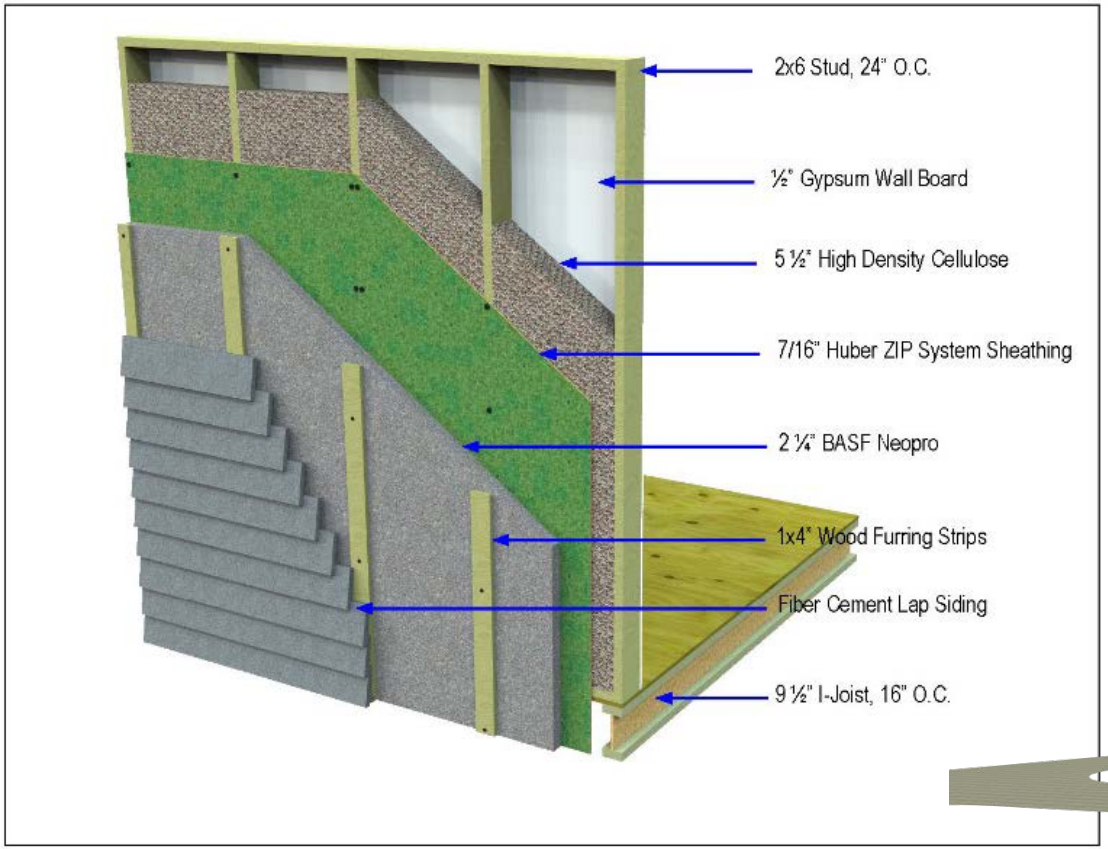
Building Science: Control Layers

Figure 37. Thermal Barrier

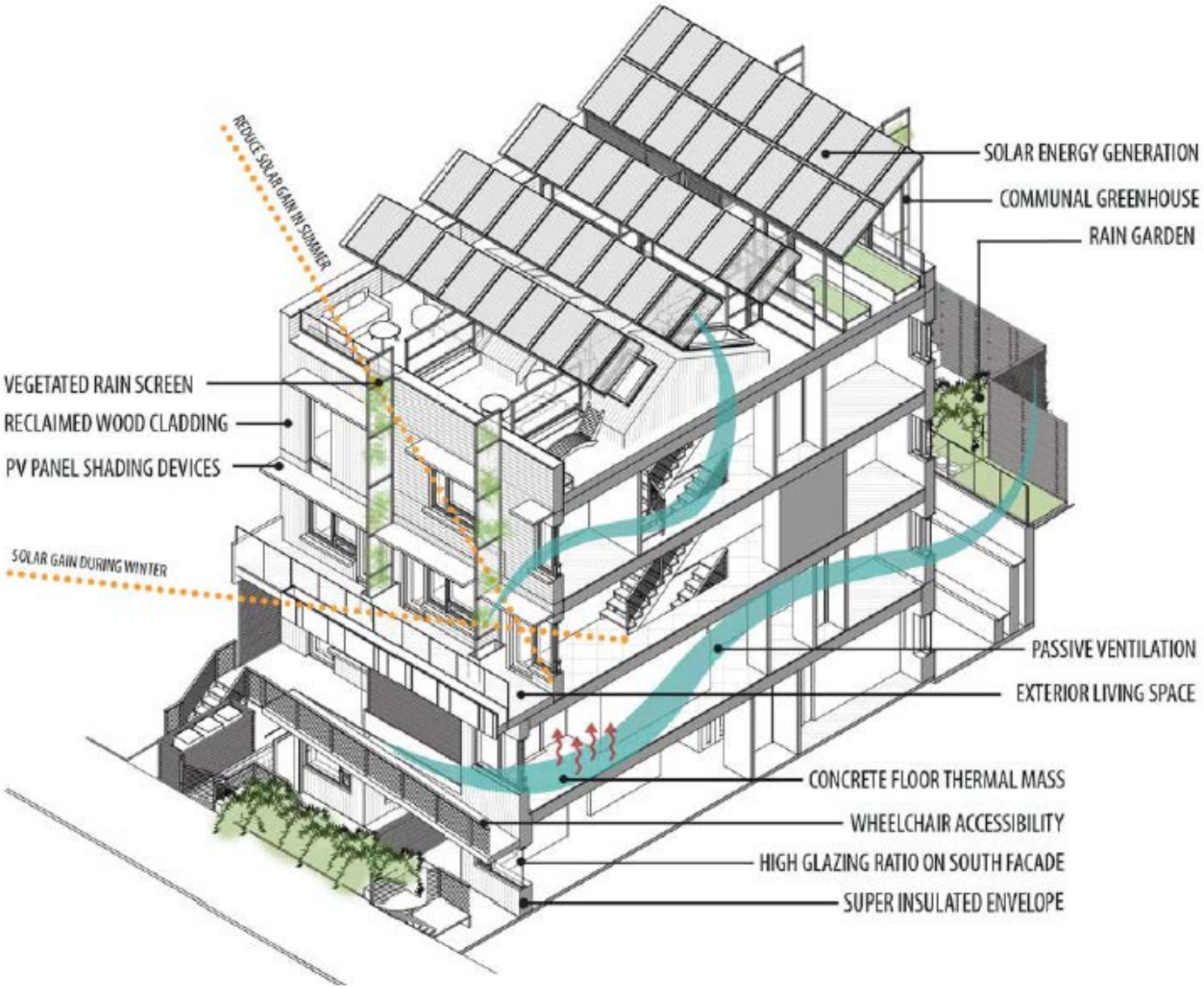
FIgure 38. Vapor Barrier

Figure 39. Water Barrier

Building Science: Design Integration



Creative Solutions



Race to Zero Experience

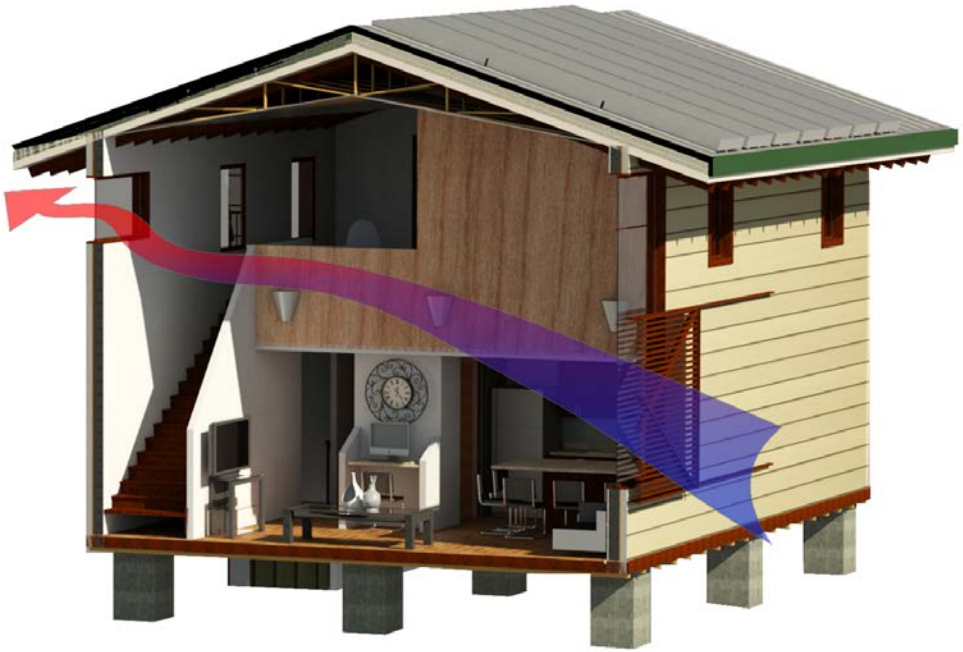
"This required me to work with industry professionals and to design with a different mindset than usual school projects."

2016 Race to Zero Participant

Race to Zero Experience

"I had almost zero knowledge in everything I had to do for this project. Learning the material in class then getting to apply it in a real world application was amazingly helpful…"

2016 Race to Zero Participant



Race to Zero Experience

"I am going to be looking for a job in building science/high performance building. I found out that this is exactly what I want to do because of the Race to Zero."

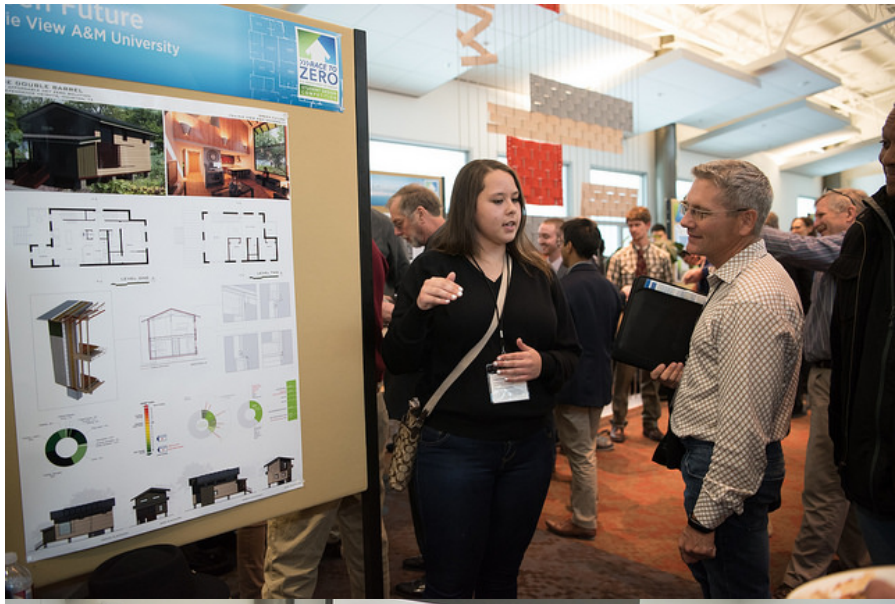
2016 Race to Zero Participant

Race to Zero Experience

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

"This competition is a great opportunity to go beyond regular materials and resources that are introduced in the typical classroom."

2016 Race to Zero Participant



Join Us in 2017!

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Valuable Education Resources

- Monthly Webinar Series
  - ⇨ ***Partnering for Improved Building Science Education***
  - – Good Housing Design, REM/Rate, BEopt, HVAC/IAQ, + more
- Building Science Training
  - – Seminar: Principles of high-performance homes taught by renowned industry leaders
- REM/Rate software
- Expertise from industry sponsors
- Financial analysis tools
- Past winning presentations and designs
- Competition Guide

2017 Race to Zero Timeline

July 1, 2016

2017 Competition Guide released and team application open

November 1, 2016

Team application deadline: roster, $200, and 3-page design concept

August 2016 – February 2017

Webinars and building science training available

February 28, 2017

Project Progress Report and Building Science Training complete

April 4, 2017

Final Project Report Submittals due

April 22-23, 2017

Invited teams compete with presentations to jurors at NREL

Join Us in 2017!

- Participate as a Team – Applications Due November 1, 2016

  http://energy.gov/eere/buildings/us-department-energy-race-zero-student-design-competition
- Serve as Juror
- Participate in Career Connections
- Promote the Competition

- Contact: RaceToZero@ee.doe.gov

RACE TO ZERO
U.S. DEPARTMENT OF ENERGY
STUDENT DESIGN COMPETITION

Thank you to our 2016 Sponsors!

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DOE Building Science Ed. Program

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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Value Understood in the Market	DOE Sales Tool

World-Class Expert Guidance…

Building America Solution Center

BASC.energy.gov

…At Your Fingertips

BASC Simple Interface

BASC Sales Tool

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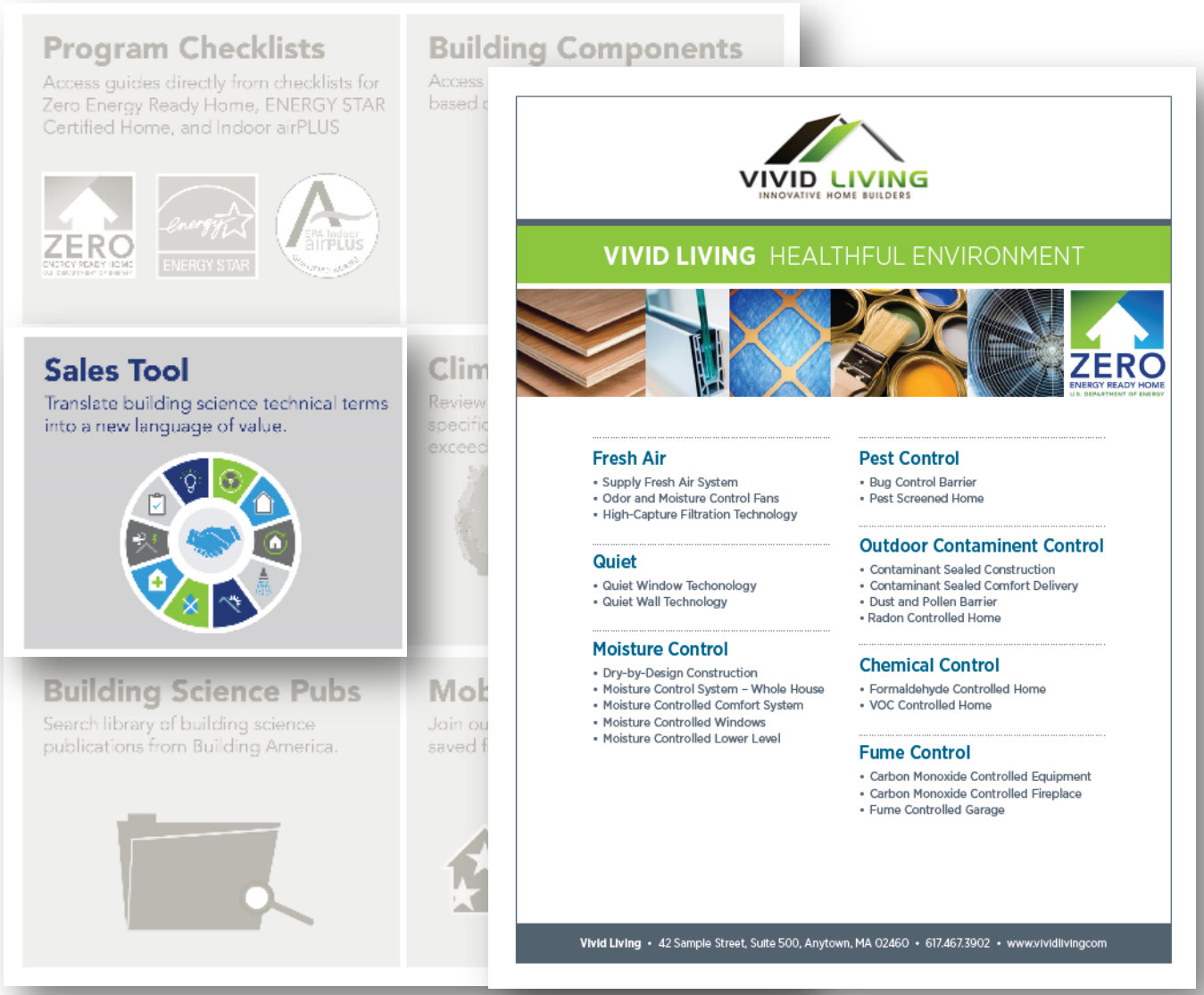

Thank you!

Sam Rashkin
Samuel.Rashkin@ee.doe.gov

Cheryn Metzger
Cheryn.Metzger@pnnl.gov

Sara Farrar
Sara.Farrar@nrel.gov

Question & Answer Session

Building America Website:

- Program information
- Top Innovations
- Climate-specific case studies
- *Building America Update* newsletter
- Building America Solution Center
- Publications Library

www.buildingamerica.gov

Building America

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http://energy.gov/eere/buildings/building-america-meetings#current

Subscribe to notices about webinars and other news at:
http://energy.gov/eere/buildings/subscribe-building-america-updates

High Performance HVAC: Low-load and Plug-n-Play HVAC Systems

Time: September 21, 2016, 3 p.m. ET

Building AMERICA
U.S. Department of Energy

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Building AMERICA U.S. Department of Energy

Thank You!

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

PDF copies of the presentations in this webinar are available at: http://energy.gov/eere/buildings/building-america-meetings#current

Visit *www.buildingamerica.gov*

Building AMERICA U.S. Department of Energy

Common Question…

How do the Guidelines for Building Science Education Compare to the Workforce Guidelines?

Similarities

- **Goals:**
  - Improving Building Performance
  - Better Credentials for a Better Workforce
  - Critical mass of knowledgeable workforce

- **Collective Impact Process:**
  - Industry involvement
  - Many input opportunities for stakeholders
  - Partnering with education programs for alignment
  - Aligning with other private and federal efforts
  - Adoption of guidelines by education programs

Differences

Workforce Guidelines

Framework	Means	End Goal
4 Specific Residential Workforce Classifications	Specific Tasks	Specific Knowledge, Skills & Abilities Related to Those Tasks

Guidelines for Building Science Education

Framework	Means	End Goal
Full Spectrum of Residential & Commercial Workforce Classifications	General Building Science Knowledge & Skills	Workforce Prepared to Integrate Building Science