Nebraska's Energy Code: The Intersection of Building and Energy Codes

Nebraska Energy Code Training Program

Instructor: Matt Belcher

January 12, 2023: 10 a.m. – 11:30 a.m. CST

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Housekeeping

- Attendees are muted upon entry
- Enter questions in the chat box
- This training is being recorded
- Slides and recording will be emailed to attendees and posted on the MEEA website
- CEUs are provided (ICC and AIA)
- Email Corie at canderson@mwalliance.org with any questions

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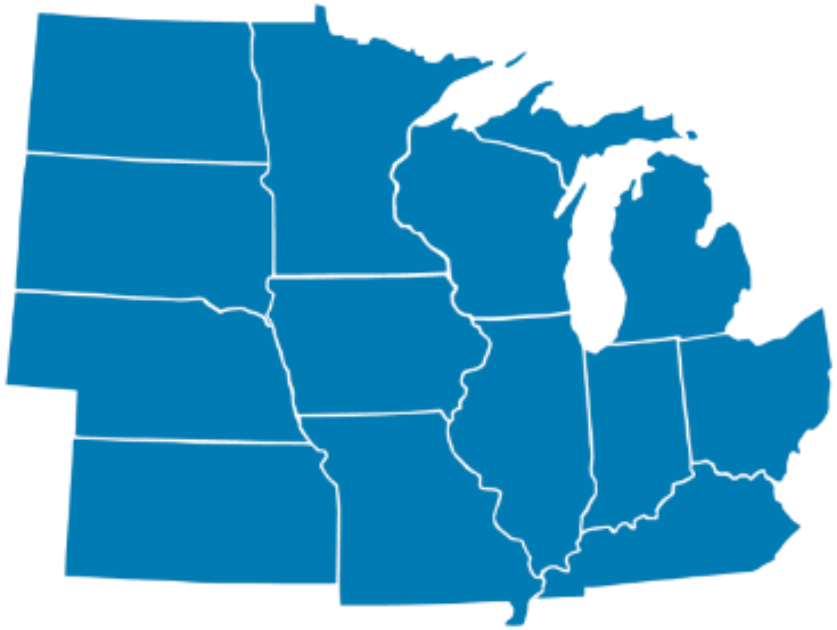
Our Instructor

Matt Belcher
matt@verda-solutions.com

About MEEA

The Trusted Source on Energy Efficiency

- Nonprofit membership organization with 160+ members
- Serves 13 Midwest states
- Resource and champion for energy efficiency
- Our mission: advancing energy efficiency in the Midwest for sustainable economic development and environmental stewardship



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Nebraska Energy Codes Training Program

- Goal: prepare the Nebraska workforce for upcoming changes in construction best practices
- Residential and Commercial Energy Code
- Focused on providing training to builders, code officials, design professionals, public officials and students
- For more information, visit: https://www.mwalliance.org/nebraska-energy-codes-training-program

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Poll Question #1

- What is your profession?
  - Student
  - Academic
  - Residential Builder
  - Commercial Builder
  - Energy Rater/Consultant
  - Code Official
  - State/Local Government
  - Non-profit
  - Utility
  - Other (type in chat)

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Poll Question #2

- How much experience do you have in the construction industry?
  - 0-5 years
  - 6-10 years
  - 11-15 years
  - 16-20 years
  - 21+ years

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Poll Question #3

- How familiar are you with the commercial provisions in the 2018/21 IECC?
  - Extremely Familiar
  - Somewhat Familiar
  - Somewhat Unfamiliar
  - Not familiar at all

Building Code History

"Legacy Codes"

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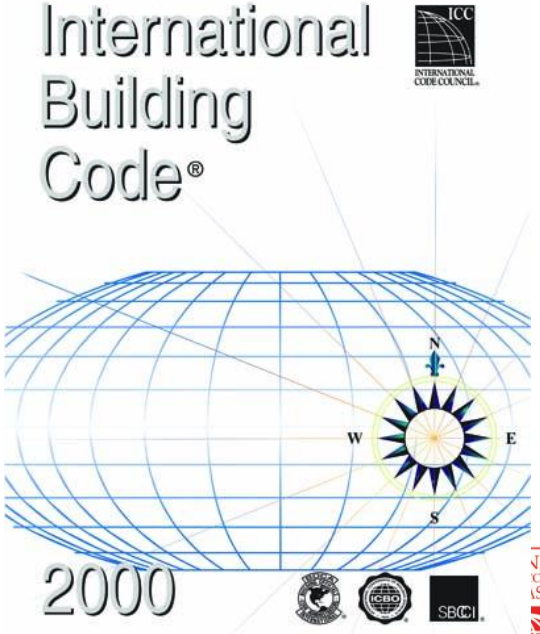
Building Code History

- The first edition of the International Building Code (IBC) was published in 2000 by the International Code Council (ICC)
- Combines the three model building codes published by BOCA, ICBO and SBCCI



Nebraska Residential Field Study

- Conducted in 2017 by **Nebraska Department of Environment and Energy.** 2009 IECC was the baseline.
- Collected and analyzed several data points for new homes, including:
  - Envelope air leakage
  - Efficacy in lighting
  - Duct leakage
  - Ceiling & exterior wall insulation
  - Basement & slab insulation
  - Windows

For More Information and Data:

https://www.energycodes.gov/sites/default/files/documents/Nebraska_Residential_Compliance_Evaluation_final.pdf

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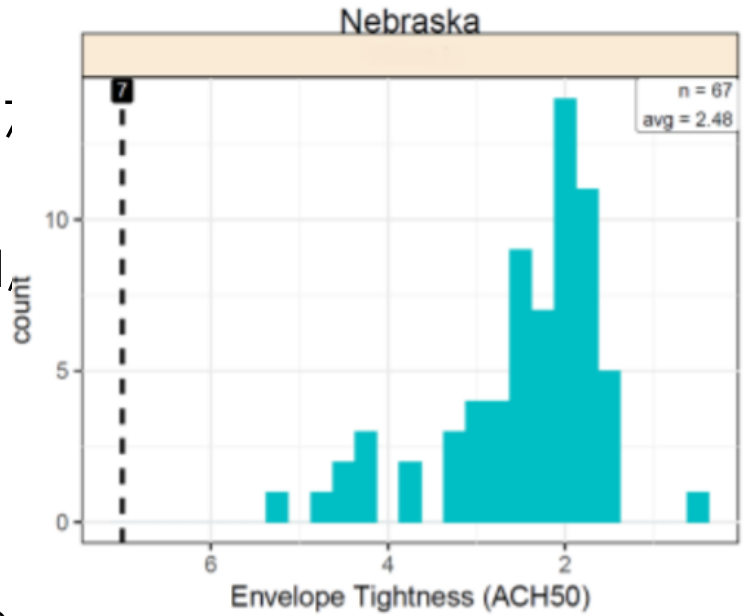
Nebraska Residential Field Study - Results

- Overall, not too bad! But room to improve.
  - **Envelope Air Leakage**: Better than code(7 ACH50)
    - Not all would meet 2018 IECC
  - **Efficacy in Lighting**: Average; some good, some not
  - **Duct Leakage**: Ugh!
    - Needs significant improvement to meet 2018 IECC
  - **Ceiling Insulation**:
    - Amount: Good+ (Average: R-42.5)
    - Install: Not as good. Reduces compliance (R-factor)



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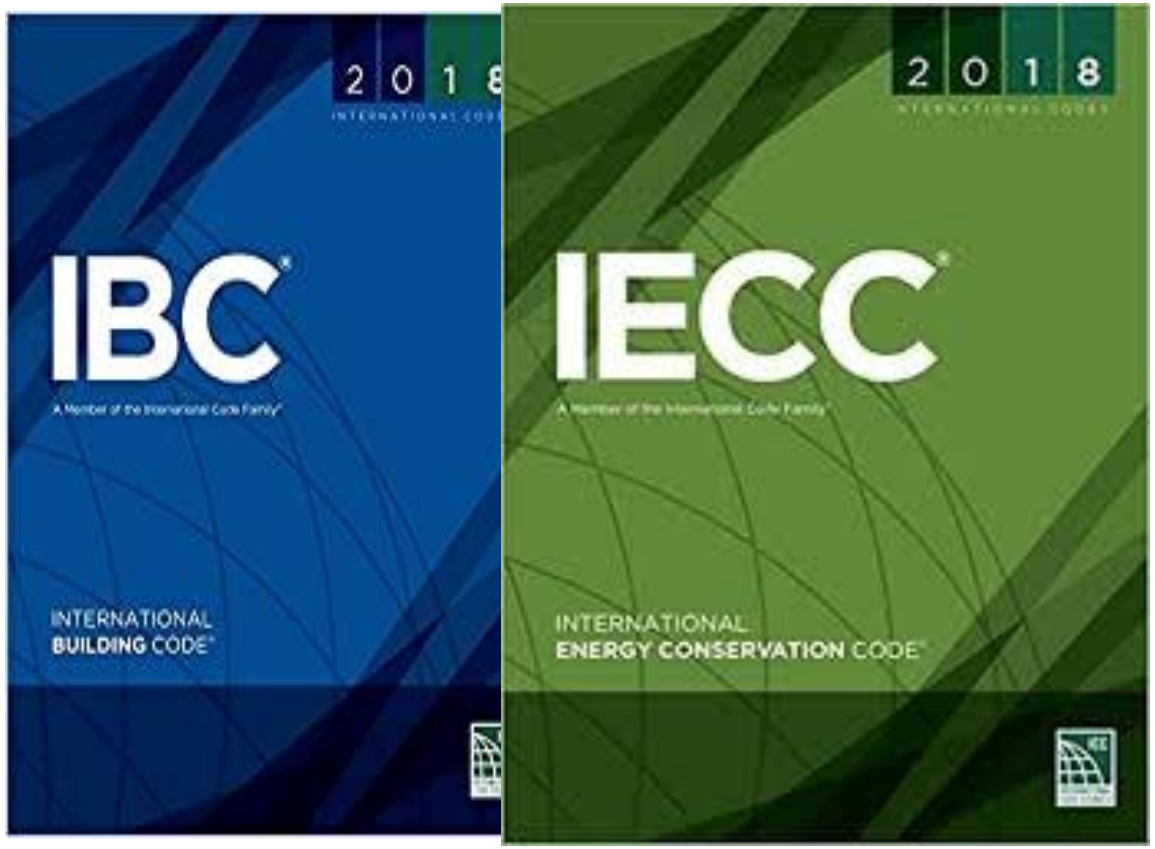
IECC and IBC

- Chapter 13 in the International Building Code (IBC) references the energy efficiency requirements found in the IECC



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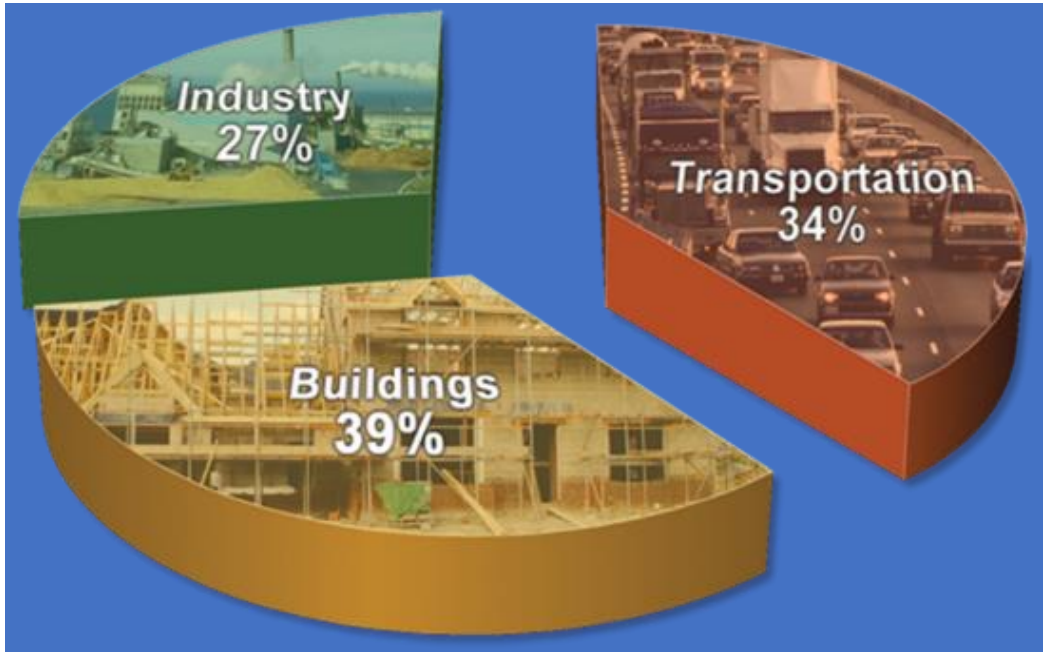
Why are Energy Codes Important?

- Reduces energy use of buildings
- Impacts energy use for the life of a building
  - Most cost-effective to implement during initial design and construction
- Benefits building owners and operators by guaranteeing a minimum of efficiency
- Health and resilience benefits to building owners and occupants



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The Energy Code and Building Energy Efficiency

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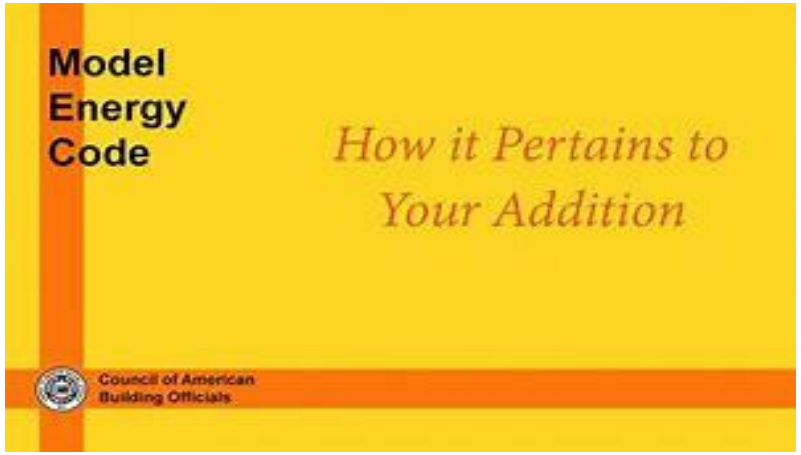
The Energy Code

- Model Energy Code (MEC) developed in 1983 under a U.S. Dept of Energy Contract
- Editions of the MEC released from 1983-1995
- Title changed to International Energy Conservation Code in 1998



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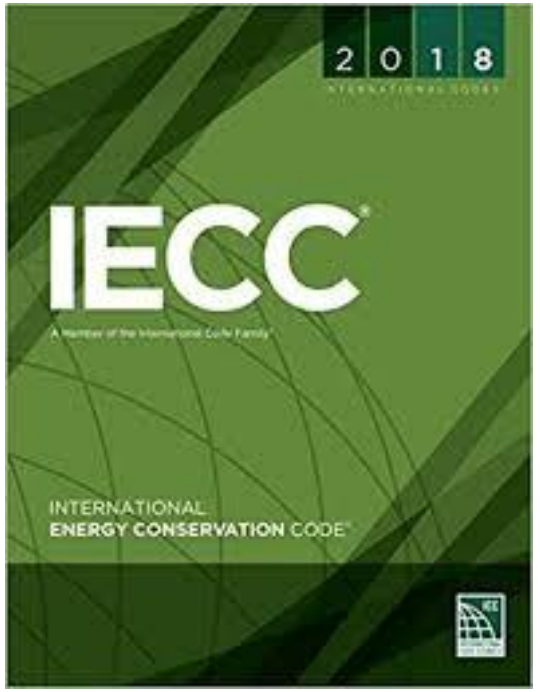
International Energy Conservation Code (IECC)

- Developed by the International Code Council
  - Robust stakeholder process
  - Proposed changes accepted from all parties
- New editions published every 3 years



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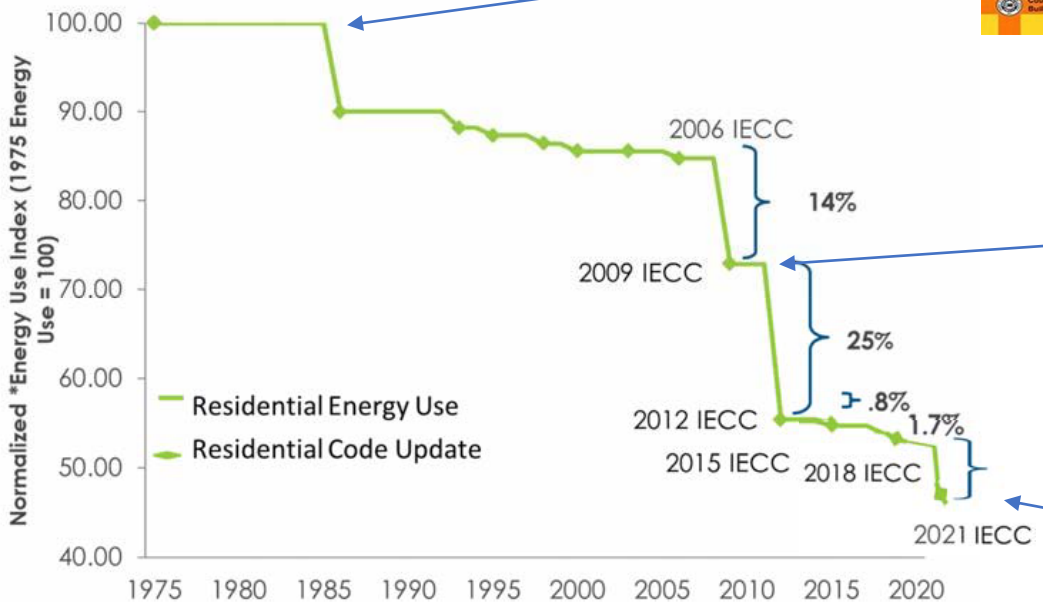
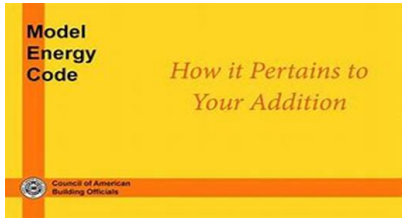
Energy Code Background





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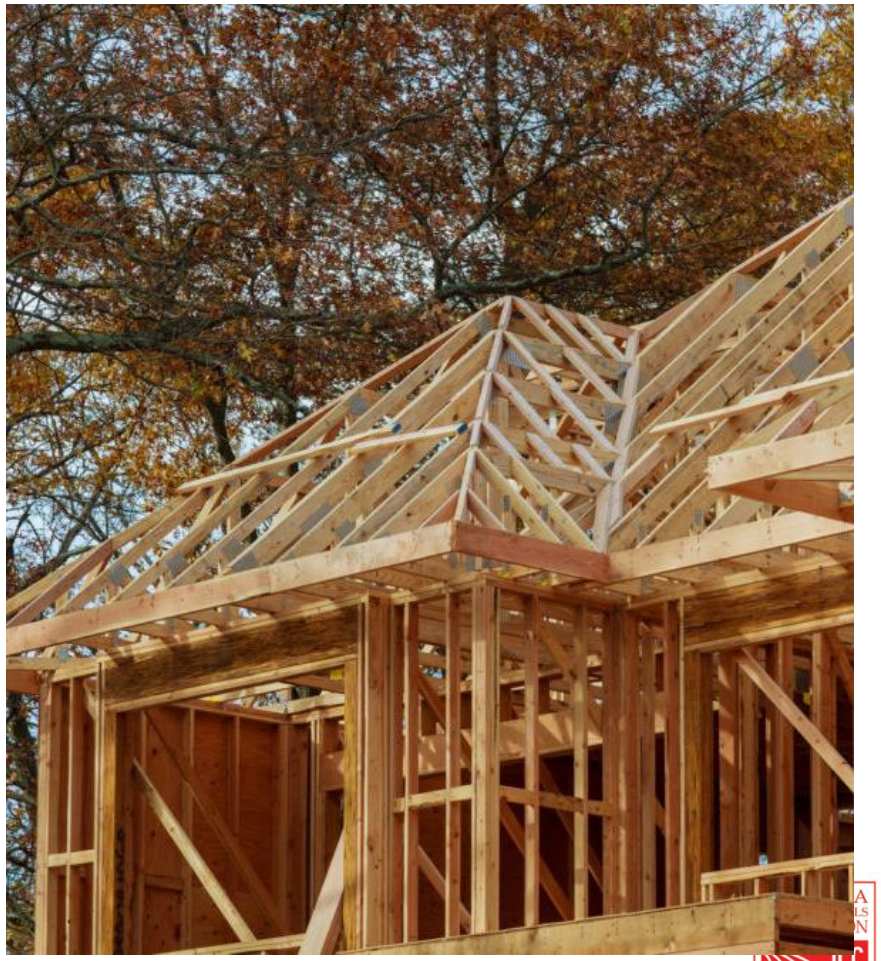
The Energy Code is Everywhere

- Unlike most other codes, the energy code directly impacts the work of many disparate building trades and systems, including:
  - Framing/Envelope
  - Plumbing
  - HVAC
  - Electric
  - Moisture management
  - Concrete
  - Caulking



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Advanced Framing

- Everything lines up!
- 2x6 framing @ 24" centers
- **Fewer studs = more insulation = better efficiency**

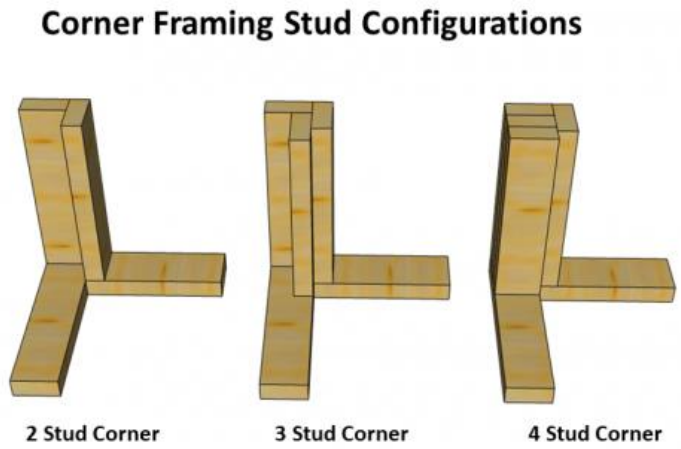
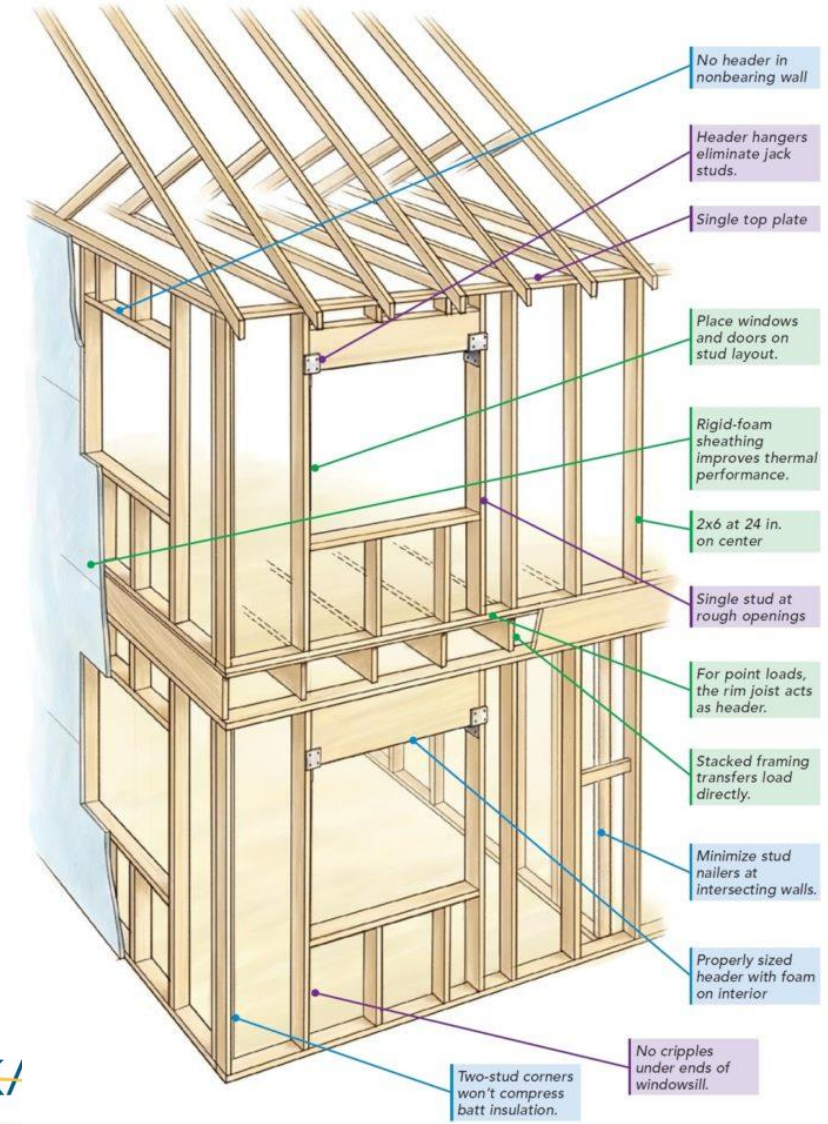


Image: greenbuildingadvosor.com; builderscalculator.com



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Continuous Insulation - Typical Framing

- Typical wall with continuous insulation on the exterior
- Be sure to **seal all seams** in continuou insulation
- Stud cavity can accommodate various types of insulation

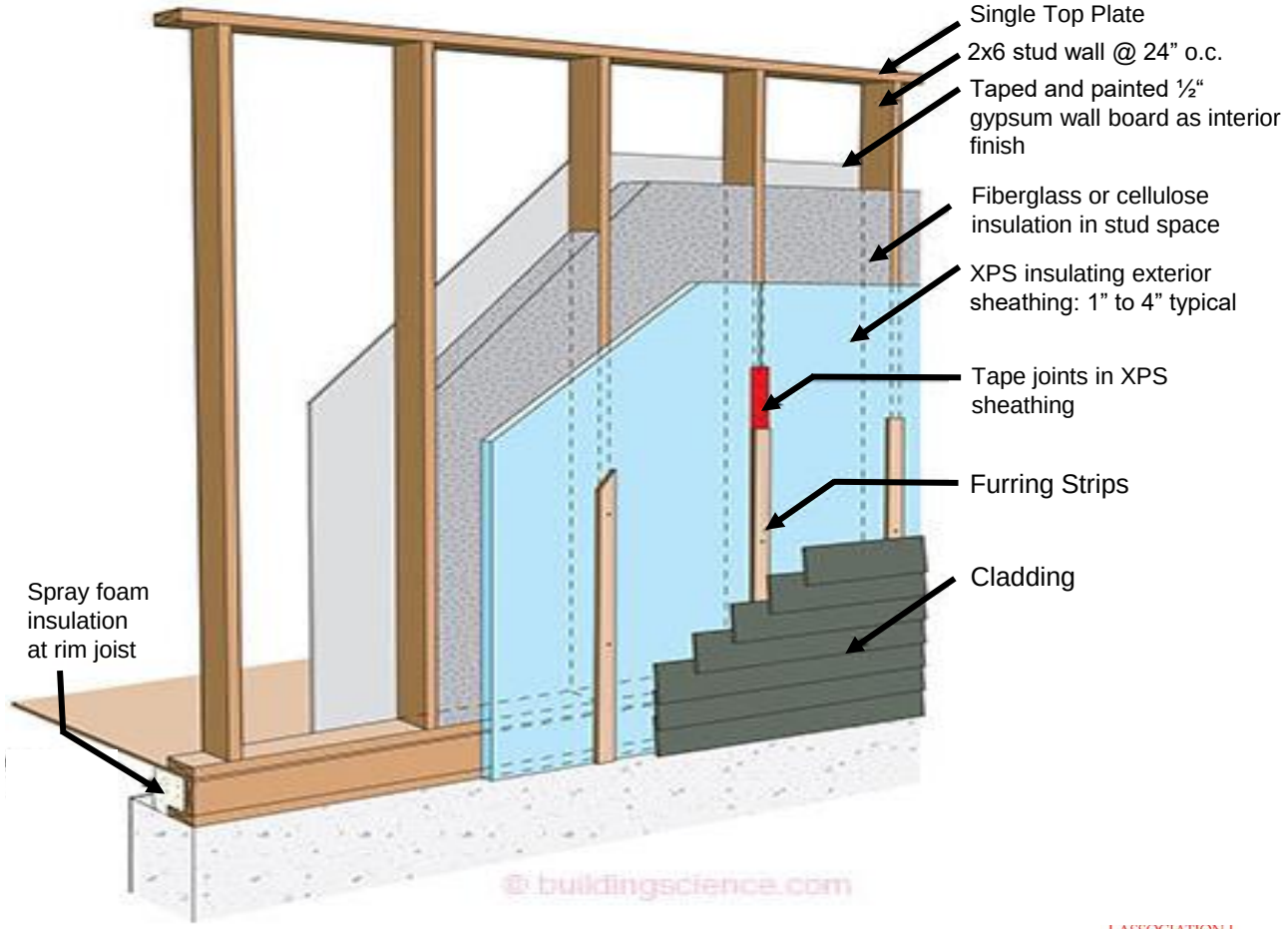

Image: buildingscience.com

Key Energy Code Components

- Insulation R-value (ceiling, wall, foundation)
- Insulation installation quality
- Continuous air barrier/sealing and testing
- Efficient windows
- Mechanical ventilation
- HVAC system sizing location detailing
- Envelope testing
- Efficient lighting & verification testing

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2018 IECC

- Advances Energy Code approximately 28% over the 2009 IECC
- Residential and Commercial provisions
- Testing and verification required
- Equipment details and location identified.
- Design/performance verification of lighting controls
- Adds an appendix for “Solar Ready Zones”

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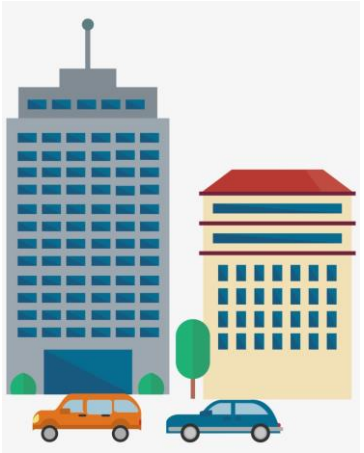
Commercial Buildings in the IECC

Under the Purview of the Commercial Code

- ✓ Buildings with commercial use
- ✓ Multifamily residential buildings four stories or greater in height



Not Under the Purview of the Commercial Code

- × One- and two-family residential
- × R-2, R-3, R-4 three stories or less in height

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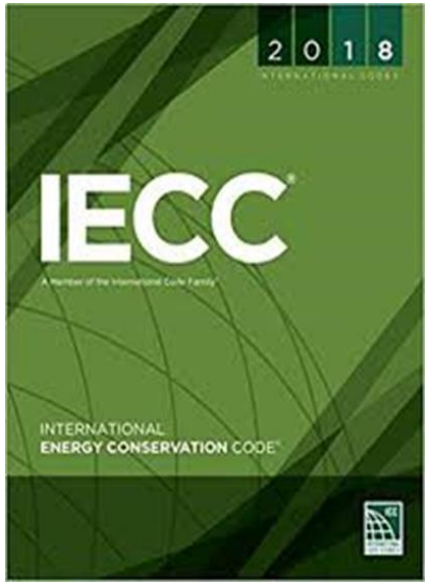
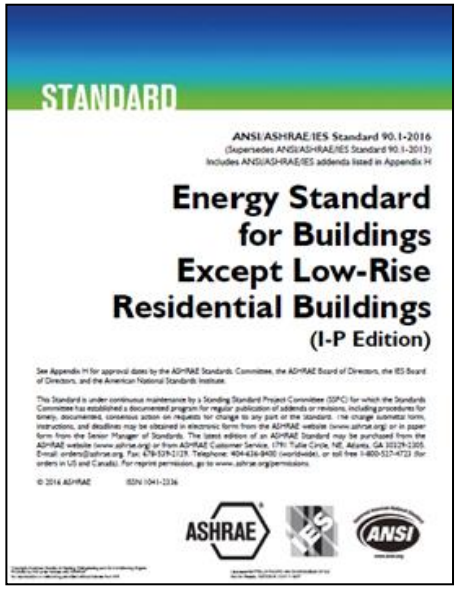
New in 2018: *Two* Commercial Compliance Options



ASHRAE 90.1-2016

Alternative Method to IECC



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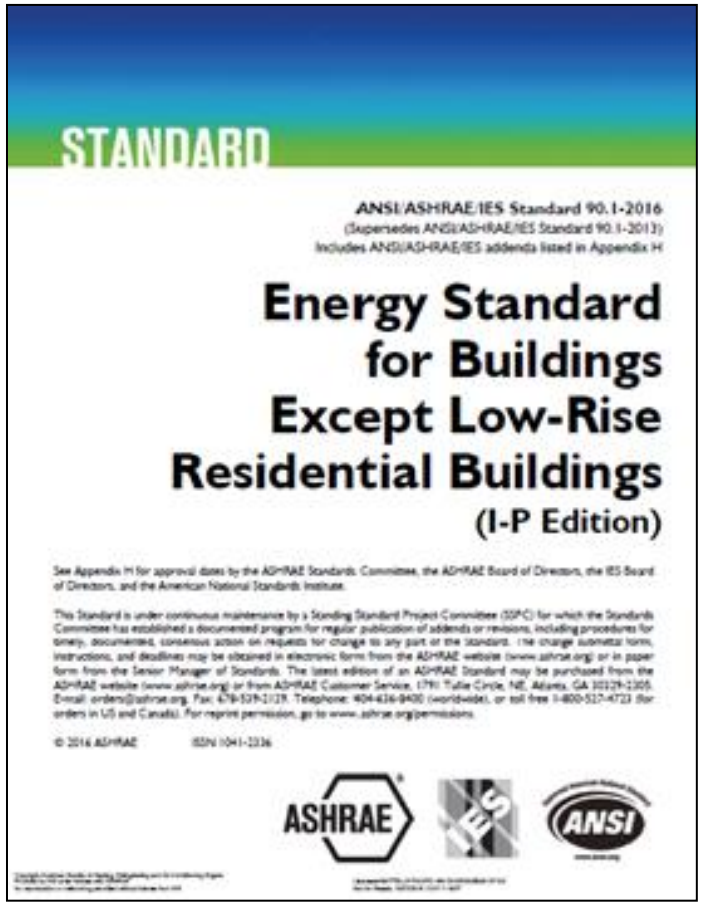
Structure of Standard 90.1-2016



1. Purpose
2. Scope
3. Definitions, Abbreviations & Acronyms
4. Administration and Enforcement
5. Building Envelope
6. Heating, Ventilating and Air Conditioning
7. Service Water Heating
8. Power
9. Lighting
10. Other Equipment
11. Energy Cost Budget Method
12. Normative References

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Moisture Management

It Connects EVERYTHING!

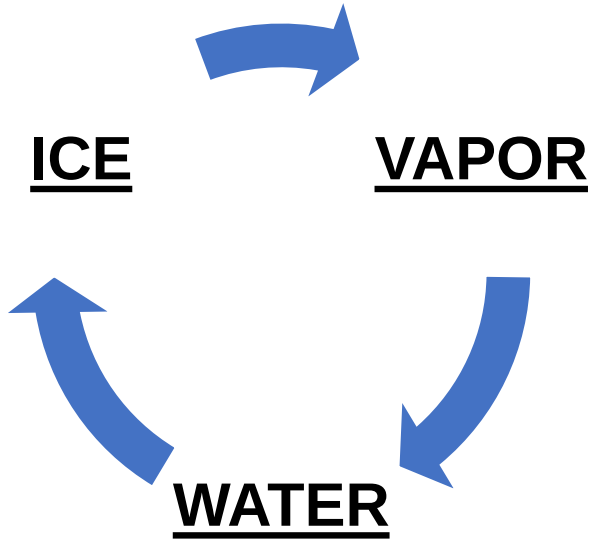
Prioritizing Moisture Movement

#1 – Bulk Water

#2 – Capillary Water

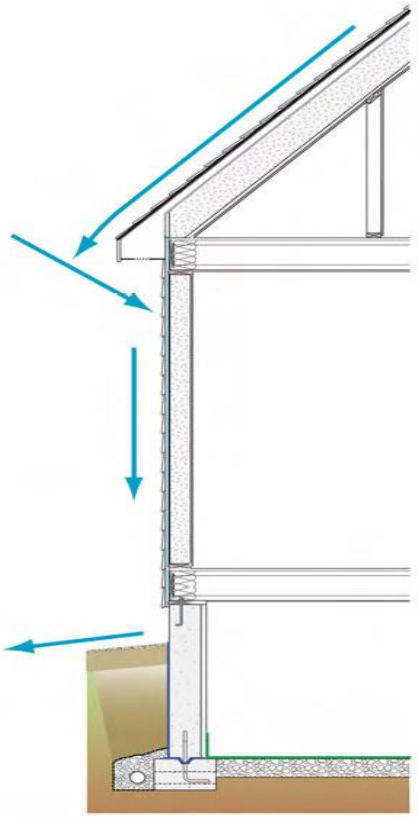
#3 – Air-Transported Moisture

#4 – Diffusive Moisture Movement



Bulk Water Management – Priority #1

The key is proper **drainage!**



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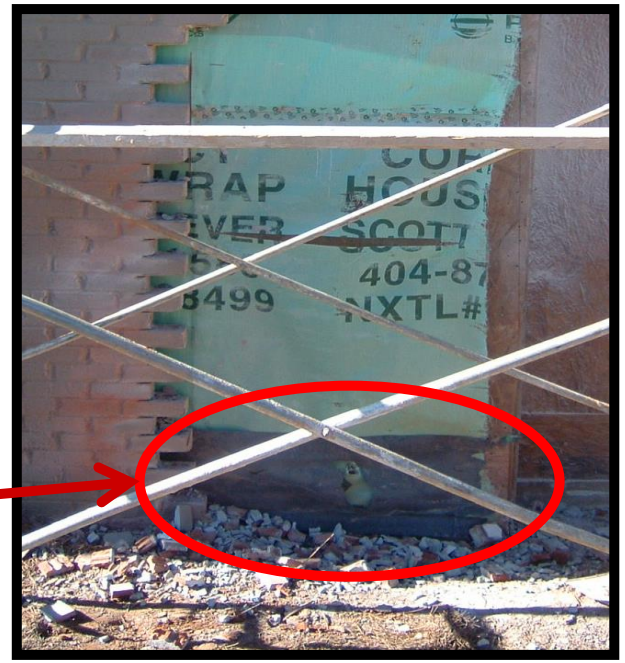
Properly Lap Flashing

- The mason's flashing (black) was installed after and in front of the house wrap (green). This is reverse flashing that will trap any drain water that gets past the brick veneer.



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Always Allow For Drying

Exterior Conditions
Temperature: 80° F
Relative Humidity: 75%
Vapor Pressure: 2.49 kPa

Conditions Within Cavity
Temperature: 120° F
Relative Humidity: 100%
Vapor Pressure: 11.74 kPa

Interior Conditions
Temperature: 75° F
Relative Humidity: 60%
Vapor Pressure: 1.82 kPa

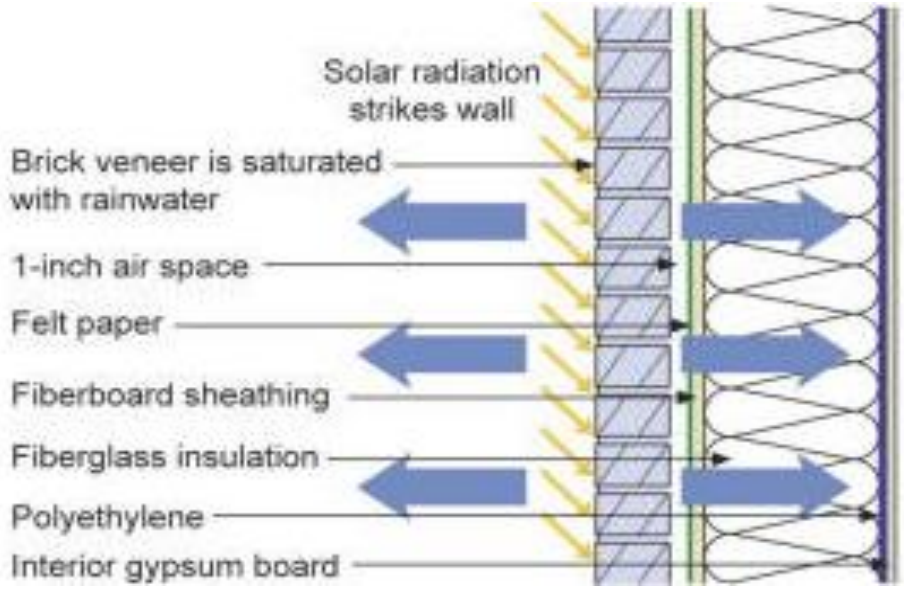

Image by Building Science Corp.

Vapor is driven both inward and outward by a high vapor pressure differential between the brick and interior and the brick and exterior

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IECC and IMC

- Whole-house mechanical ventilation required by energy code
- Ventilation rate and equipment requirements in the International Mechanical Code (IMC)

HVAC Design and Loads

Oversized systems:

- Less comfort
- Less efficient
- Poorly handles moisture
- Premature equipment failure

Right-sized systems:

- Better operating efficiencies
- Greater comfort
- Healthier indoor environments
- Better moisture control

HVAC Design and Loads

- Properly designed HVAC systems rely on scientific criteria and a systematic method to match the loads required for health and comfort:
  - *ACCA Manual J – Residential Load Calculation*
  - *ACCA Manual S – Residential Equipment Selection*
  - *ACCA Manual D – Residential Duct Systems*
- Reports should be submitted with permit application

HVAC Load Calculations
Section C403.1.1 (Mandatory)

Heating and cooling load sizing calculations required:

- ASHRAE/ACCA Standard 183

- OR -

- Other approved computation procedures – defined in Chapter 3
  - Interior design conditions specified by Section C302
    - ≤ 72°F for heating load
    - ≥ 75°F for cooling load
- Loads reduced from energy recovery systems utilized in the HVAC system shall be accounted for in accordance with the ASHRAE HVAC Systems and Equipment Handbook

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Ventilation
Section C403.2.2 (Mandatory)

- Natural and mechanical ventilation to be provided in accordance with Chapter 4 of the IMC
- If mechanical: system to provide the capability to reduce outdoor air supply to minimum required by IMC Chapter 4

Equipment and System Sizing
Section C403.3.1 (Mandatory)

- Output capacity of heating and cooling equipment only SHALL NOT be greater than calculated loads

- Select the system which serves the greater load – heating or cooling

Holistic Approach to Building

- Site Planning and Design
- Resource Efficiency
- Energy Efficiency
- Water Efficiency
- Indoor Environmental Quality
- Homeowner Education
- Global Impact

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Establishing a Knowledgeable Team

- Begins with /Builder/Design Professional
- Customer/Client
- Building Trades
- Suppliers/Sub-contractors
- Certifications
  - LEED-AP
  - ICC

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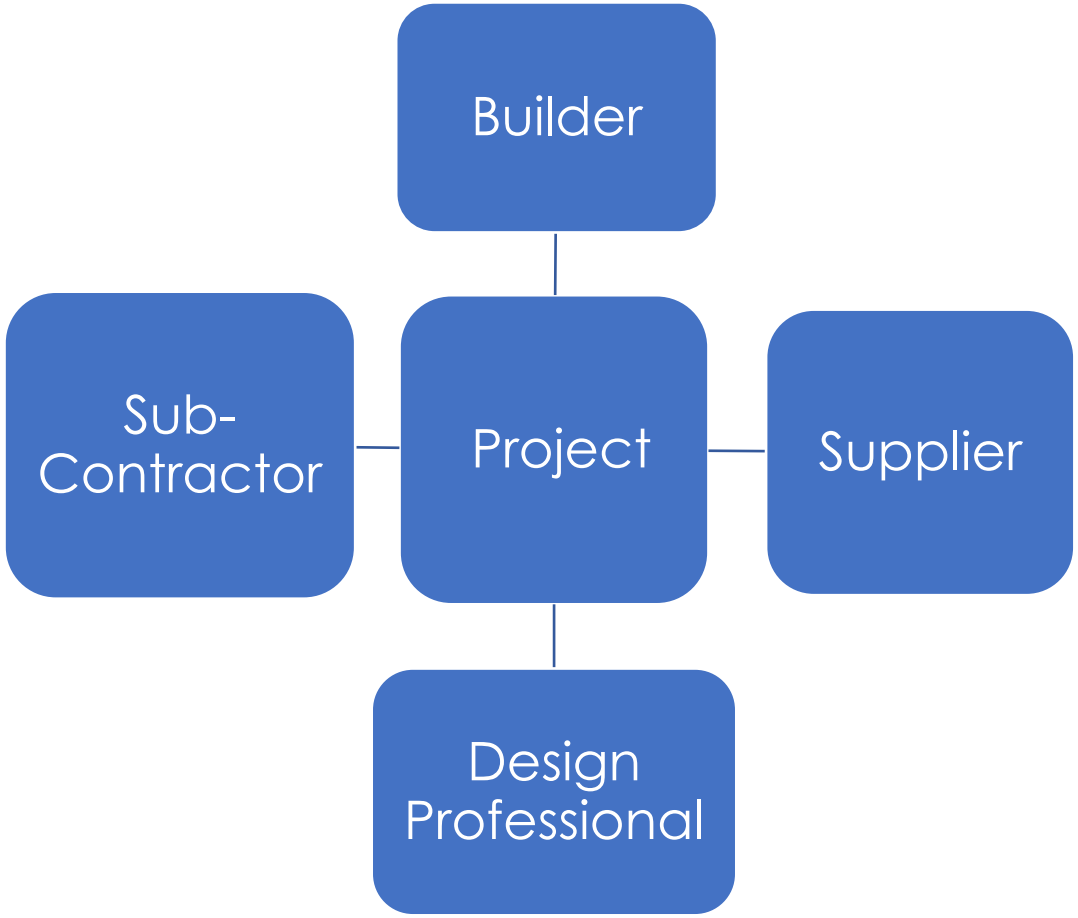
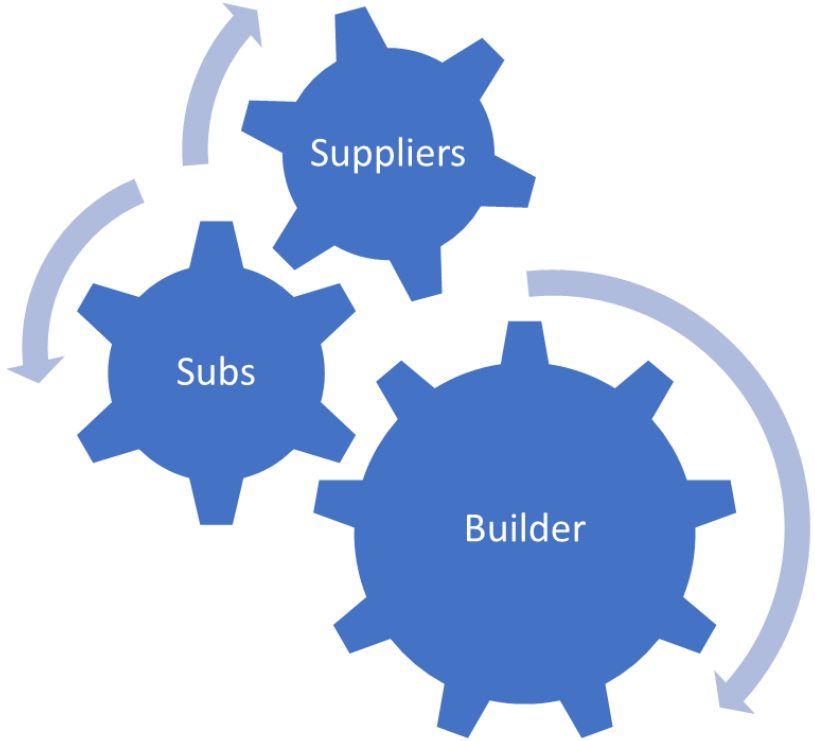
Establishing a Knowledgeable Team



Establishing a Knowledgeable Team

- It takes about 90 people directly and indirectly to construct an average building



Existing Buildings
Section C503 - Alterations

- Code applies to any new construction
  - Additions or new work in existing structures
- Unaltered portion(s) may not need to comply
- When complying via ASHRAE 90.1-2016, alterations do not need to comply with C402-C405
- Where existing building exceeds fenestration area limitations of Section C402.4.1 prior to alteration, building is exempt from C402.4.1 provided there is no increase in fenestration area

Image: montgomerycountymd.gov

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Major Building Envelope Protection Systems

- Water Barrier
- Air Barrier
- Thermal Barrier
- Vapor Profile (not just the designated vapor retarder)
- Maintenance documents

Ventilation and Air Sealing

- Both natural and mechanical ventilation provide fresh air that can dilute and remove indoor pollutant levels
- Per the IMC/IRC, mechanical ventilation is required when homes are <5 ACH 50
  - Need to do a blower door test to determine leakage rate
  - **Liability concerns when not performed**
- A blower door test measures a building's existing air leakage
- Can not design a code compliant system without knowing air leakage

Courtesy of AC Tool Supply, Inc.

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“You don’t get what you expect, you get what you inspect!”

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Looking Ahead:

- IECC changes to The National Energy Standard as of 2024.
- Uses 2021 IECC as a baseline.
- Introduces Carbon Impact into the conversation.
- On a trajectory for Net Zero Energy as of 2030.

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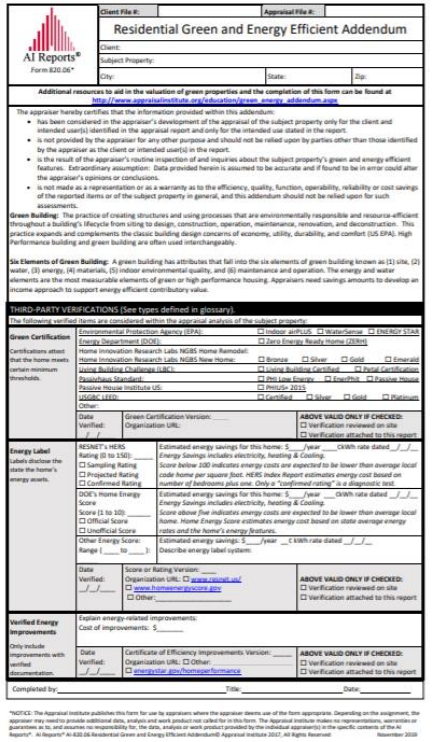
Appraisals and Resale Value

Business Impacts

Residential Green and Energy Efficient Addendum

- Resources for realtors and appraisers on properly valuing energy efficiency/green features
  - Educational materials
  - List of designated appraisers
  - Trainings

- For more information: http://www.appraisalinstitute.org/education/green_energy_addendum.aspx


Residential Green and Energy Efficient Addendum

Form 820.04

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Questions?

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Duct and Envelope Tightness (DET) Verifier Training and Train-the-Trainer

- Free
- In-person in Lincoln, NE
- Become DET certified in 2 days or learn to train others in 3 days!
- **Tuesday January 24 - Thursday 26**
- **9a.m. – 5p.m.**
- ICC/AIA CEUs and certificate provided

For more info or questions contact Corie Anderson at canderson@mwalliance.org

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Thank you!

Matt Belcher, Verdatek Solutions
matt@verda-solutions.com
Cell: (314) 749-4189

Corie Anderson, MEEA
canderson@mwalliance.org

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