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Community College

The Commercial Energy Code: Session 6

IECC vs. ASHRAE

Instructor: Matt Belcher

Tuesday, February 7, 6-8p.m.

Housekeeping

- Attendees are muted upon entry
- Questions? Enter them in the chat box
- Webinar is being recorded – slides and recording will be sent to attendees
- CEUs available for AIA and ICC
- Email canderson@mwalliance.org with questions
- Course information available at: https://www.mwalliance.org/metropolitan-community-college-energy-code-course

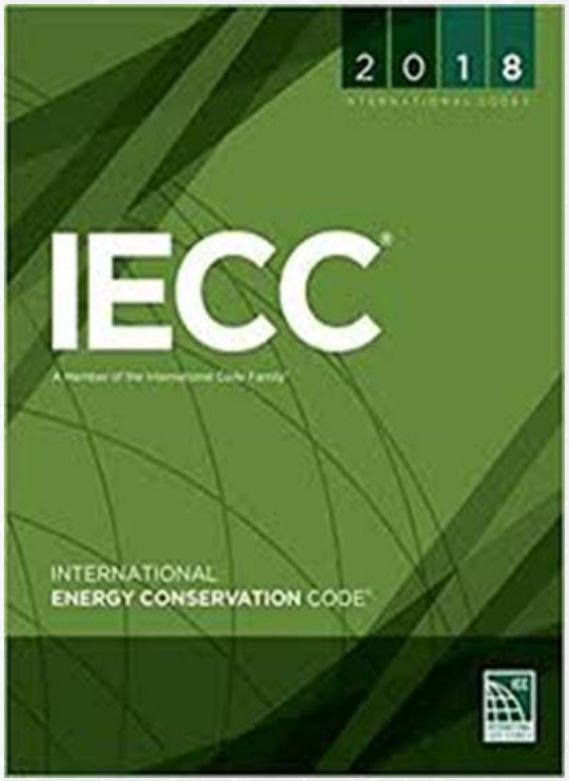
Today's Agenda

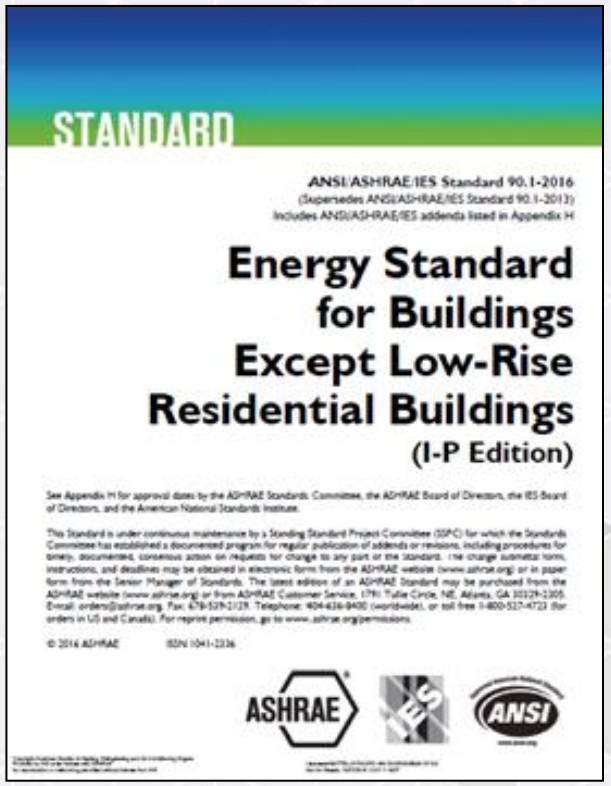
We will focus on the big picture items:

1. ASHRAE 90.1- 2016 vs. IECC Overview
2. Envelope
3. HVAC Systems
4. Lighting and Power
5. Appendix G

Two Commercial Compliance Options

We are going to discuss ASHRAE 90.1-2016 and its application with 2018 IECC**!**





Two Commercial Compliance Options

ASHRAE 90.1-2016 is identified in Section C-401.2 and referenced in Chapter 6 (Referenced Standards) of the 2018 IECC as an alternative.

C-401.2: Application. Commercial buildings shall comply with one of the following:

1. The Requirements of ANSI/ASHRAE/IESNA 90.1

ASHRAE 90.1-2016 Overview

Why an “alternate universe” (Standard)?

IECC vs. ASHRAE

- It provides established, codified guidance for Design and Construction Professionals using (or wanting to use) alternate at or above code methods a guideline to do so and code officials means to approve.

ASHRAE 90.1-2016 Overview

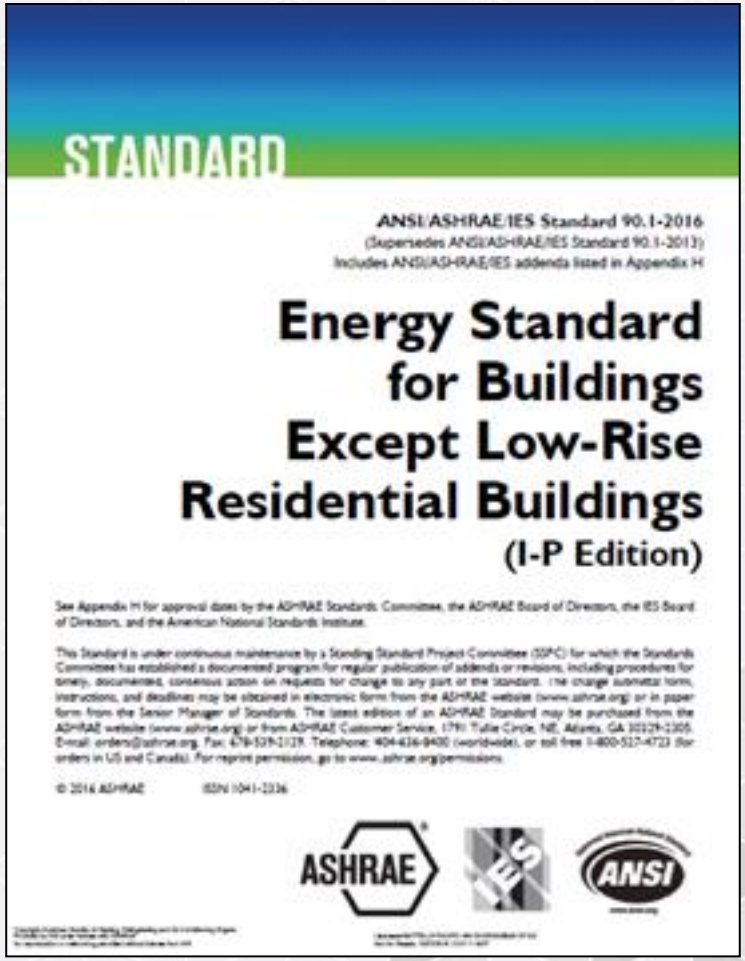
- Applies to:
  - New, and new portions of, *buildings* and their *systems*
  - New *systems* and *equipment* in *existing buildings*, and
- Does not apply to:
  - Single-family houses, low-rise multi-family ≤ 3 stories above *grade*, manufactured houses (mobile or modular)
  - *Buildings* that use neither electricity nor *fossil* fuel
- Does not circumvent any safety, health, or environmental requirements

Structure of Standard 90.1-2016

1. Purpose
2. Scope
3. Definitions, Abbreviations, and 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

Normative Appendices A-H

Appendix G – is a new compliance path!



Some of the Key Updates in 90.1-2016

- ✓ Major format changes
- ✓ New climate maps
- ✓ New performance-based compliance path
- ✓ Significant energy savings
- ✓ Increased HVAC equipment efficiency
- ✓ Requirements for replacement equipment

For this presentation, text in red indicates a new requirement in ASHRAE 90.1-2016

More Key Updates

- Comprehensive update to the fenestration prescriptive requirements in Tables 5-5-0 through 5-5-8
- Orientation requirements for vertical fenestration were tightened
- SHGC credit for shading by permanent projections was modified to correct how it addressed north-facing fenestration
- Whole building air leakage testing added as an option
- Thresholds for conditioned space were lowered

Appendix G

- **NEW COMPLIANCE OPTION: PERFORMANCE RATING METHOD**
- The 2016 edition contains a new compliance path, known as the **Performance Rating Method**, which is included in Appendix G.
- **Appendix G now can be used as a path for compliance.** (Previously it was used only to rate “beyond code” performance of buildings.)
- It now serves as an alternative to the traditional performance path (Chapter 11: Energy Cost Budget), and creates a singular path to demonstrate both minimum code compliance and above-code performance.
- A new metric, the Performance Cost Index (PCI), accommodates various climate zones and prominent commercial buildings types.
- Appendix G baseline is now fixed at a specific level of performance, which is not expected to change with subsequent editions of the Standard, and will allow a building of any era to be rated using a single method.
- Source:energy.gov/eere

Compliance Paths

Building System

- Envelope
- HVAC
- SWH
- Power
- Lighting
- Other

Mandatory Provisions

Must be met for all compliance options

Compliance Options

- Prescriptive Option
- Trade Off Option (only envelope)
- Energy Cost Budget
- **Performance Rating Method**

Energy Code Compliance

New Compliance Path – Appendix G

Appendix G (Performance Rating Method) uses a stable baseline approach with set efficiency levels

- Values are not updated with each new edition of the code
- Proposed energy performance needs to exceed baseline by an amount commensurate with the efficiency of the code year being evaluated.

Appendix G credit is available for strategies not credited in ECB

- Optimized window area and orientation
- More efficient HVAC and SWH equipment
- Right sizing HVAC equipment
- Efficient use of thermal mass

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Section 5: Building Envelope
(IECC C-402)

Building Envelope Data

- Building Orientation
- Materials
- Construction Assemblies
- Roofs
- Exterior Wall
- Exterior Floors
- Doors
- Fenestration
- Below Grade Walls and/or Slabs

Correlation IECC and 90.1

(IECC Section/90.1 Section)

- Prescriptive and Alternative Envelope and component information/Tables; 402 / Section 5
- Mechanical Systems; 403 / Section 6
- Service Water Heating; 404 / Section 7
- Electrical Power and Lighting; 405 / Sections 8,9
- Additional Energy Efficiency Options: 406 / 11, App G
- Total Building Performance; 407 / Per Section
- Building Maintenance and Commissioning; 408 / Per Section

Space Conditioning Categories & Basis - 5.1.2

Envelope Requirements Are Specified by Space-Conditioning Categories

- Conditioned space must be
  - a *cooled space* with a cooling system sensible cooling output capacity larger than 3.4 Btu/h·ft^2 of floor area
  - a *heated space* with a heating system output capacity larger than that specified in table below
  - Or, an *indirectly conditioned space*

Heating Output, Btu/h·ft^2	Climate Zone
>5	0, 1, 2
>9	3A, 3B
>7	3C
>10	4A, 4B
>8	4C
>12	**5**
>14	6
>16	7
>19	8

Air Leakage &Continuous Air Barrier - 5.4.3.1

- Continuous Air Barrier Required
  - Three Compliance Options
    - Whole building testing (blower door)
    - Materials testing
    - Assemblies of materials testing

Image: energyconservatory.com

Commissioning: Building Envelope Data Points

- Building Orientation
- Materials
- Construction Assemblies
- Roofs
- Exterior Wall
- Exterior Floors
- Doors
- Fenestration
- Below Grade Walls and/or Slabs

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Section 6: Heating, Ventilating and Air Conditioning

HVAC Scope – 6.1.1

- New Buildings
- Additions to Existing Buildings
- Alterations in Existing Buildings

- Throughout Section 6, when referring to controls requirements, replaces the words “capable of” with “capable of and configured to” so that controls will be set up at time of inspection.

Replacement Equipment - 6.1.1.3

Replacement equipment now needs to meet many of the requirements formerly for new equipment.

For example:

- Various controls requirements
- Economizer requirements
- Fan efficiency
- Boiler turndown

Image: US DOE

Automatic Control of HVAC in Hotel/Motel Guest Rooms - 6.4.3.3.5

- Hotels and motels with > 50 guest rooms to have automatic HVAC controls to apply within 30 minutes of all occupants leaving the room
- Captive key cards are permitted to be used for compliance

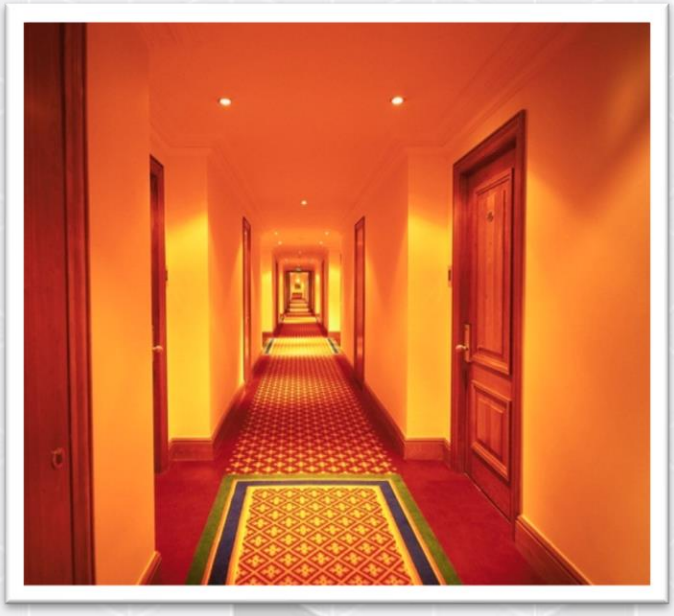

Image: US DOE

There are some exceptions so see the standard for further details.

Demand Control Ventilation– 6.4.3.8 (6.3.2q)

Demand control ventilation (DCV):

- a ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy.

Image: US DOE

Image: US DOE

Demand Control Ventilation– 6.4.3.8 (6.3.2q)

DCV must be provided for each zone with an area > 500 ft² and the design occupancy **> 25 people**/1000 ft² where the HVAC system has:

- air-side economizer,
- automatic modulating control of OSA dampers
- design outdoor airflow > 3,000 cfm

There are exceptions.

Heating and Cooling in Vestibules – 6.4.3.9

Include automatic controls to

- Shut off vestibule heating system when
  - OA temps are > 45°F
  - Also controlled by a thermostat in the vestibule with setpoint limited to maximum of 60°F

  Note: a single heating thermostat in the vestibule limited to 45°F would meet the requirements
- Shut off vestibule cooling system when controlled by a thermostat in the vestibule with setpoint limited to minimum of 85°F

Exceptions, vestibules:

- heated or cooled by site-recovered energy
- tempered with transfer air that would otherwise be exhausted

Image: US DOE

Economizers – 6.5.1

- Large non-fan cooling systems now require a water economizer
- If an air economizer is installed, air-cooled direct-expansion cooling units to include a Fault Detection and Diagnostic system
- Controls to not false load the mechanical cooling systems by limiting or disabling the economizer or any other means (e.g., hot gas bypass) except at lowest cooling stage

Ventilation Air – DOAS 6.5.2.6

Ventilation Air (DOAS) Heating Control

Units that provide *ventilation* air to multiple zones and operate in conjunction with zone heating and cooling *systems* shall not use heating or heat recovery to warm supply air above 60°F when:

- representative *building* loads or *outdoor air* temperature indicate that the majority of zones require cooling

This saves energy use by taking advantage of "free cooling"

- *Uses cool outside air when there is a benefit to many zones in the building*
- *Avoids mechanically cooling air that was preheated at the DOAS unit*

Ventilation Design – 6.5.3.7

The required minimum *outdoor air* rate is the largest of the following:

- The minimum *outdoor air* rate
- The minimum exhaust air rate required by:
  - Standard 62.1
  - Standard 170
  - Applicable codes or accreditation standards.

Outdoor air ventilation systems shall comply with one of the following:

- Design minimum *system outdoor air* provided shall not exceed 135% of the required minimum *outdoor air* rate.
- Dampers, *ductwork*, and *controls* shall be provided that allow the *system* to supply no more than the required minimum *outdoor air* rate with a single *set-point* adjustment.
- The *system* includes exhaust air *energy* recovery complying with Section 6.5.6.1.

System Commissioning – 6.7.2.4

Assure control elements are calibrated, adjusted, and in proper working condition

> 50,000 ft^2 conditioned area

- Except warehouses and semi heated spaces
- Requires commissioning instructions

Table 6.8.1 – 11 Computer Room Units

Table 6.8.1-11 Air Conditioners and *Condensing Units* Serving *Computer Rooms*—Minimum *Efficiency* Requirements

Equipment Type	Net Sensible Cooling Capacity	Standard Model	Minimum Net Sensible COP_C Return Air Dry-Bulb Temperature/Dew-Point Temperature			Test Procedure
			Class 1	Class 2	Class 3	
			75°F/52°F	85°F/52°F	95°F/52°F	
Air cooled	<65,000 Btu/h	Downflow unit		2.30		AHRI 1360
		Upflow unit—ducted		2.10		
		Upflow unit—nonducted	2.09			
		Horizontal-flow unit			2.45	
	≥65,000 and <240,000 Btu/h	Downflow unit		2.20		
		Upflow unit—ducted		2.05		
		Upflow unit—nonducted	1.99			
		Horizontal-flow unit			2.35	
	≥240,000 Btu/h	Downflow unit		2.00		
		Upflow unit—ducted		1.85		
		Upflow unit—nonducted	1.79			
		Horizontal-flow unit			2.15	

Table 6.8.1 – 11 Computer Room Units

- Table 6.8.1-11 was totally revised to add 3 classifications of computer units
  - Class 1 – 75 F DB/52 F WB
  - Class 2 – 85 F DB/52 F WB
  - Class 3 – 95 F DB/52 F WB
- New COP_C values were then defined for the various products and new categories
- This goes along with revisions to the AHRI 1360 rating standard

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Section 9: Lighting (and a Little Power)

Summary of Changes - Interior Lighting Power Density (LPD) Limits

Interior Power Density limits (LPD) were revised for 90.1-2016 primarily because of improved efficacy of LED lighting. All space type models used for LPD development were reviewed and where applicable, LED technology was included as part of the technology mix.

Space-by-Space LPDs – Most were **reduced** but a few went up based on revised design criteria and current practice for that space type

Building area LPDs – Almost all were reduced

Building Area Compliance Method

Part of Table 9.5.1 shown below.

Complete table in the Standard has 32 different building types

Building Type	Lighting Power Density (W/ft^2)
Automotive Facility	**0.71**
Convention Center	**0.76**
Court House	**0.90**
Dining: Bar Lounge/Leisure	**0.90**
Dining: Cafeteria/Fast Food	**0.79**
Dining: Family	**0.78**
Dormitory	**0.61**
Exercise Center	**0.65**

Space-by-Space Compliance Method – 9.6.1

There are numerous lighting exceptions that do not have to be included in the installed lighting power calculation!

Table 1 – Gradual Change of Code Lighting Power Densities

Space Type	ASHRAE 90.1 (Space-by-space LPD in W/ft^2)			
	2016	2013	2010	2007
Conference, multi-purpose and meeting rooms	**1.07**	1.23	1.23	1.23
Lounge/Breakroom in a healthcare facility	**0.78**	0.92	1.07	1.07
Healthcare – exam treatment room	**1.68**	1.66	1.66	1.66
Enclosed offices	**0.93**	1.11	1.11	1.11
Office open	**0.81**	0.98	0.98	0.98

Daylight Areas– 9.4.1.4

Documentation to identify daylight areas on floor plans, including:

- Primary sidelighted areas
- Secondary sidelighted areas
- Daylight area under skylight
- Daylight area under roof monitors

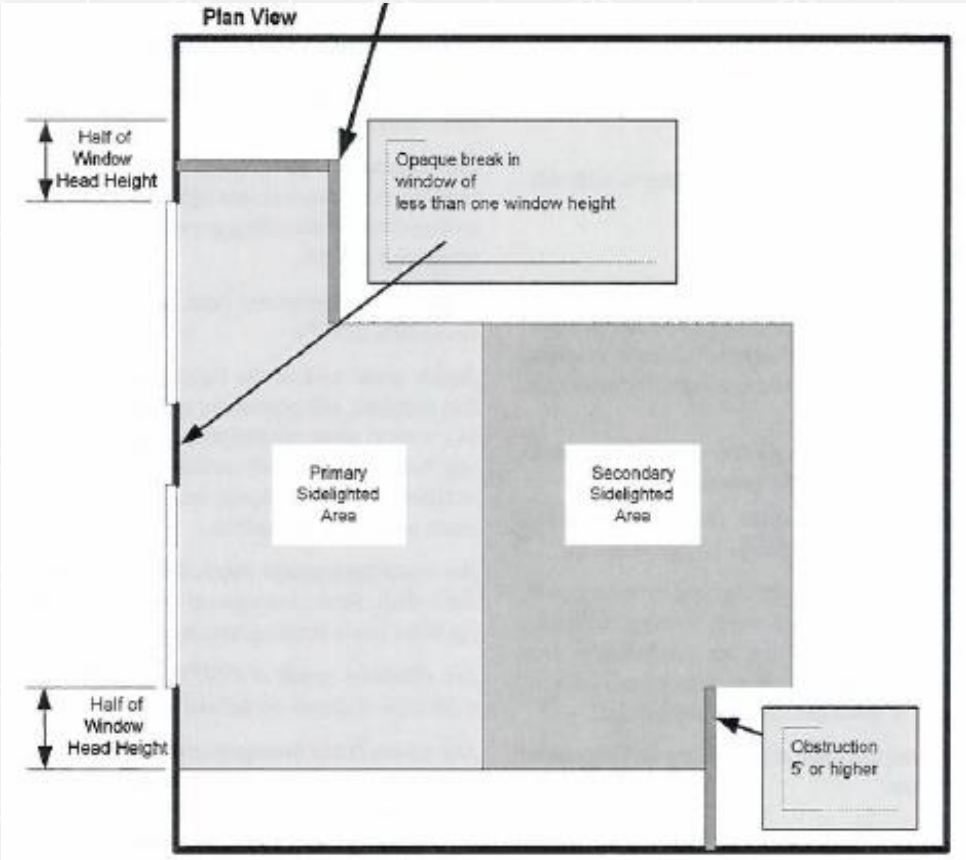

Image: US DOE

Lighting Alterations

- Lighting alterations (retrofits) section revised to add interior and exterior controls
  - ***Interior*** *retrofits must now also comply with occupancy and scheduled full and partial shutoff and bi-level switching where specified.*
  - ***Exterior*** *retrofits must now also comply with astronomical control and/or scheduled shutoff control where specified for each application.*
- Application threshold changed to 20% of lighting load before requirements are applied.
- Lamp plus ballast retrofits and one-for-one fixture replacements need only comply with LPD limits.

Automatic Receptacle Control – 8.4.2

Automatically Controlled Receptacles

≥ 50% of all 125 volt 15- and 20-amp receptacles in:

- Private offices
- Conference rooms
- Rooms used primarily for printing and/or copying functions
- Break rooms
- Classrooms
- Individual workstations

≥ 25% of branch circuit feeders installed for modular furniture not shown on construction documents

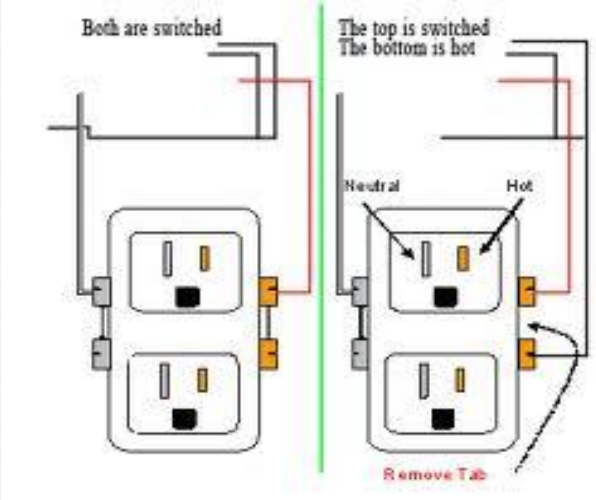

Image: US DOE

Resources

- 90.1-2016 Overview: energy.gov/eere/buildings/articles/new-energy-code-commercial-buildings-standard-901-2016
- DOE Presentation: energycodes.gov/resource-center/training-courses/ansiashraeies-standard-901-2016
- Performance Rating Method Reference Manual: pnnl.gov/main/publications/external/technical_reports/PNNL-26917.pdf

QUESTIONS?

Upcoming Trainings (Free and Online)

- Nebraska's Residential Energy Code: Air Sealing and Insulation
  - Thursday February 9
  - 1p.m.-2:30p.m.

- Nebraska's Commercial Energy Code: Air Infiltration, Lighting, and HVAC
  - Wednesday, March 15
  - 10a.m.-11:30a.m.

Next Week

- February 14, 6-8p.m.
- Topic: Electrical: Lighting and Power Systems with Thomas Yarbrough
- Contact Matt with Questions:

matt@verda-solutions.com

SEE YOU NEXT WEEK!