

2021 IECC: Simplifying Energy Code Compliance

April 9, 2024



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Providing effective energy strategies for buildings and communities



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Presenters:

Shawn Maurer



Robert Schlorff



Learning Objectives

By the end of the presentation, participants will be able to:

1. Analyze preliminary project decisions for impact on compliance difficulty.
2. Identify how common design decisions can increase complexity and project costs.
3. Identify how reduced compliance complexity within the 2021 IECC improves resiliency.
4. Explain how certain measures have expected energy impacts that can be alternately achieved through the measure exceptions to maintain overall efficiency.

Who We Are



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Our mission: Reduce the energy footprint of Illinois and beyond



What We Do

We are an applied research program at the University of Illinois.

We assist buildings and communities in achieving energy efficiency, saving money, and becoming more sustainable.

We help facilities become more energy efficient.

We educate.

We research.

We advocate for a greener future.



SEDAC is the Illinois Energy Conservation Code Training Provider



This training program is sponsored by **Illinois State Energy Office**

SEDAC is a Preferred Education Provider with the International Code Council (ICC). Credits earned on completion of this program will be reported to ICC for ICC members. Certificates of Completion will be issued to all participants.



This workshop is approved for 1 LU/HSW CES credits from the American Institute of Architects (AIA). Credits earned on completion will be reported for AIA members.



Energy Code Training Program

- Technical support

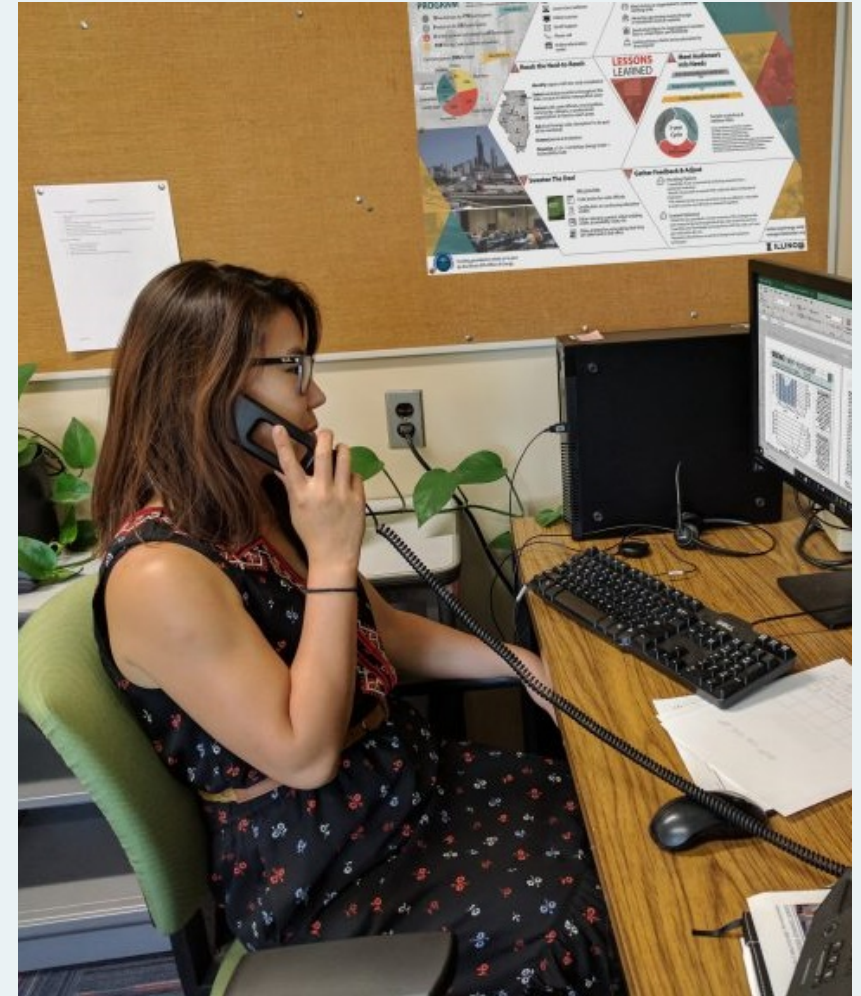
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- Online resources at

smartenergy.illinois.edu/energy-code

- Workshops
- Webinars
- Online on-demand training modules



SEDAC Energy Code Training Series

Energy Code Webinar Schedule

Archived – Energy Code Basics: How to Use the IECC

Archived – Existing Residential Buildings

Archived – Residential Stretch Code

Archived – Q&A Review – How We Answer Energy Code Questions

Archived – Commercial Stretch Code

Today – Simplified Code Compliance

05.21.24 – Existing Commercial Buildings

Registration: <https://smartenergy.illinois.edu/events>

SEDAC Energy Code In-person Workshops

Archived – Workshop 1 – Energy Code Basics, Simplifying Code Compliance & Q&A Review – Location: Springfield, IL

06.11.24 – Workshop 2 – Energy Code Basics, Simplifying Code Compliance & Q&A Review – Location: Rockford, IL

Registration: <https://smartenergy.illinois.edu/events>

Illinois Energy Conservation Code

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Illinois Energy Conservation Code

[Home](#) > [Energy Code Training](#) > [Illinois Energy Conservation Code](#)

Click [here](#) for the [2022 Chicago Energy Transformation Code](#).

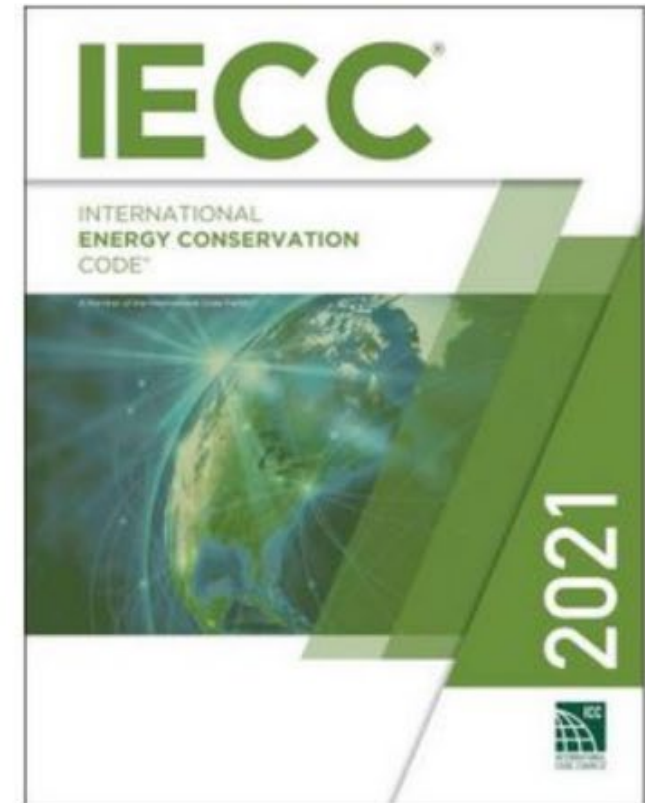
New Energy Code Coming to Illinois January 1, 2024

In accordance with the [Energy Efficient Building Act](#), the [Capital Development Board](#) (CDB) is required to review and adopt the most current version of the International Energy Conservation Code (IECC) within one year of its publication date. The Code will then become effective in Illinois within 6 months following its adoption by the CDB. The CDB, in conjunction with the [Illinois Environmental Protection Agency](#) and the [Illinois Energy Conservation Advisory Council](#), initiates the cycle for the Illinois Energy Conservation Code to be updated every three years.

At its November 7 meeting, JCAR approved the new rules to update the Illinois Energy Conservation Code from the 2018 IECC with amendments to the 2021 IECC with amendments. On November 14, the Capital Development Board set the effective date for the changes as January 1, 2024. Any projects applying for a permit on or after January 1, 2024 will need to comply with the new code.

The 2021 Illinois Energy Conservation Code can be accessed here:

- [2021 IECC](#)
- [Illinois Amendments](#)



Access to 2021 IECC & IL Amendments

Menu Search all of Digital Codes

All Codes <

Legend Information

CODE SECTIONS MY NOTES

2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

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PREFACE

▶ ARRANGEMENT AND FORMAT OF THE 2021 IECC

ABBREVIATIONS AND NOTATIONS

IECC—COMMERCIAL PROVISIONS

▶ CHAPTER 1 [CE] SCOPE AND ADMINISTRATION

▶ CHAPTER 2 [CE] DEFINITIONS

▶ CHAPTER 3 [CE] GENERAL REQUIREMENTS

▶ CHAPTER 4 [CE] COMMERCIAL ENERGY EFFICIENCY

2021 International (IECC) Add to Favorites

The 2021 IECC® addresses energy efficiency on several resources and the impact of energy usage on the environment.

Related Titles

2021 Complete Revision History to the 2021 I-Codes - IECC: Successful Changes and Public Comments >

2021 Significant Changes to the International Energy Conservation Code >

<https://cdb.illinois.gov/business/codes/illinois-energy-codes/illinois-energy-conservation-code.html>

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Illinois Energy Codes

Illinois Energy Conservation Code

Illinois Stretch Energy Code

Advisory Council Meetings

Illinois Energy Conservation Code (20 ILCS 3125/15)

State Funded Facilities must comply with the IECC per 20 ILCS 3125. See Subpart B of the [Illinois Energy Conservation Code](#) for more information. The 2021 edition of the IECC as amended went into effect on 1/1/24.

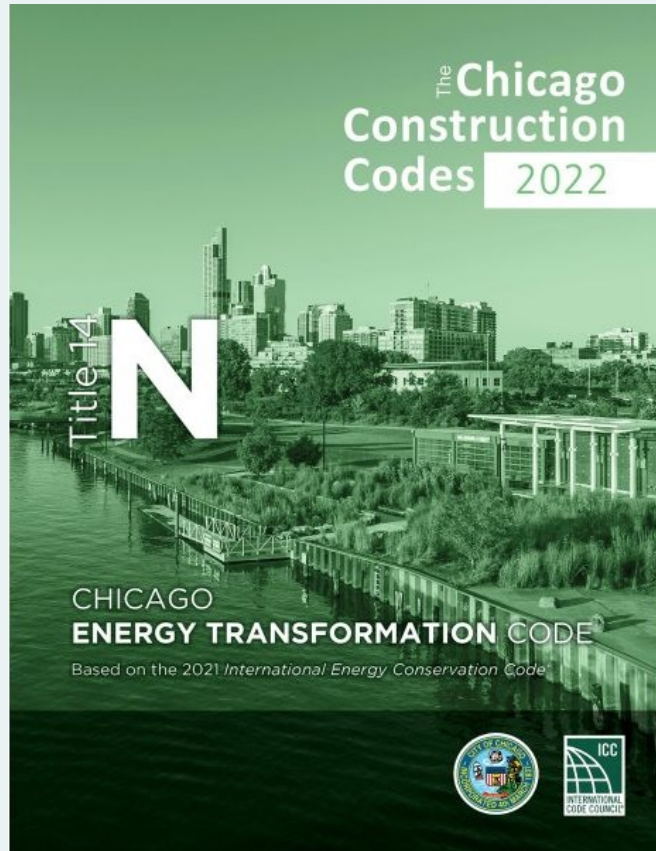
Privately Funded Commercial Facilities must comply with IECC per 20 ILCS 3125. See Subpart C of the [Illinois Energy Conservation Code](#) for more information. The 2021 edition of the IECC as amended went into effect on 1/1/24.

Residential Buildings must comply with IECC per 20 ILCS 3125. See Subpart D of the [Illinois Energy Conservation Code](#) for more information. The 2021 edition of the IECC as amended went into effect on 1/1/24.

- 2021
 - [Illinois Specific Amendments](#)
 - [Illinois Specific Amendments with Modifications Shown](#)

<https://codes.iccsafe.org/content/IECC2021P2>

Access to Chicago Energy Transformation Code



<https://codes.iccsafe.org/codes/illinois/Chicago>

ARTICLE XIII. **CHICAGO ENERGY CONSERVATION CODE**

SECTION 1. The Municipal Code of Chicago is hereby amended by inserting a new Title 14N, as follows:

TITLE 14N ENERGY CONSERVATION CODE

PART I – COMMERCIAL PROVISIONS

CHAPTER 14N-C1 SCOPE AND PURPOSE

14N-C1-C001 Adoption of the commercial provisions of the International Energy Conservation Code by reference.

The commercial provisions of the *International Energy Conservation Code*, 2018 edition, second printing, and all erratum thereto identified by the publisher (hereinafter referred to as "IECC-CE"), except Appendix CA, are adopted by reference and shall be considered part of the requirements of this title except as modified by the specific provisions of this title.

If a conflict exists between a provision modified by this title and a provision adopted without modification, the modified provision shall control.

14N-C1-C002 Citations.

Provisions of IECC-CE which are incorporated into this title by reference may be cited as follows:

14N-C[IECC-CE chapter number]-[IECC-CE section number]

14N-C1-C003 Global modifications.

The following modifications shall apply to each provision of IECC-CE incorporated into this title:

1. Replace each occurrence of "*International Codes*" with "*Chicago Construction Codes*."
2. Replace each occurrence of "*International Building Code*" with "*Chicago Building Code*."
3. Replace each occurrence of "ASME A17.1" or "ASME A17.1/CSA B44" with "the *Chicago Conveyance Device Code*."
4. Replace each occurrence of "NFPA 70" with "the *Chicago Electrical Code*."

Simplifying Code Compliance – Envelope Measures

Passive Strategies reduce HVAC size/loads

Buildings are systems of systems

Simplifying one area may simplify another

Better envelopes generally reduce HVAC needs

Smaller HVAC loads reduce system complexity, size, and upfront costs.



Low Energy Buildings (C402.1.1 & R402.1Ex 1.1)

Low Energy Building: Those with a peak energy for space conditioning of less than 3.4 Btu/SF or 1.0 W/SF

Exempts envelope from Section C402/R402

Generally applies to semi-heated storage buildings and warehouses



U-Factor vs R-value Tables

R-value Tables Specify assemblies

Table C402.1.3

Table R402.1.3

U-value Tables Specify limits

Table C402.1.4

Table R402.1.2

U-value enables more flexibility

CLIMATE ZONE	WOOD FRAME WALL U-FACTOR	CLIMATE ZONE	WOOD FRAME WALL R-VALUE ⁹
0	0.084	0	13 or 0& 10ci
1	0.084	1	13 or 0& 10ci
2	0.084	2	13 or 0& 10ci
3	0.060	3	20 or 13& 5ci ^h or 0& 15ci ^h
4 except Marine	0.045	4 except Marine	30 or 20&5ci ^h or 13& 10ci ^h or 0&20ci ^h
5 and Marine 4	0.045	5 and Marine 4	30 or 20&5ci ^h or 13& 10ci ^h or 0&20ci ^h
6	0.045	6	30 or 20&5ci ^h or 13& 10ci ^h or 0&20ci ^h
7 and 8	0.045	7 and 8	30 or 20&5ci ^h or 13&10ci ^h or 0&20ci ^h

Keep Fenestration <30% C402.4.1.1

Exceeding 30% (up to 40%) requires:

- At least 50% floor area in daylight zone for buildings up to 2 stories above grade
- At least 25% floor area in daylight zone for buildings greater than 2 stories above grade
- Requires daylight responsive controls
- Visible Transmittance at least 110% of SHGC

DENCo.
EUROPEAN WINDOWS & DOORS

ENERGY PERFORMANCE RATINGS

U-Factor (USA)	Solar Heat Gain Coefficient (SHGC)	Air Permeability (Euro)	Visible Transmittance
0.26			
U-Factor (Metric)	0.61	Class C2	0.82
1.45			

ENERGY STAR Certified in Highlighted Regions
ENERGY STAR certificado en regiones seleccionadas

JELD-WEN
WINDOWS & DOORS
Brickmould Vinyl Horizontal Slider
Double-glazing with Grid, LowE and Argon fill
JEL-A-538-02573-00000

ENERGY PERFORMANCE RATINGS
EVALUACIÓN DE RENDIMIENTO ENERGÉTICO

U-FACTOR (Factor U)	SOLAR HEAT GAIN COEFFICIENT (COEFICIENTE GANANCIA DE ENERGÍA SOLAR)
0.30 (U.S./J-P) 1.70 (Métrico/SI)	0.46

ADDITIONAL PERFORMANCE RATINGS
EVALUACIÓN SUPLEMENTARIA DE RENDIMIENTO

VISIBLE TRANSMITTANCE (TRANSMISIÓN DE LUZ VISIBLE)	AIR LEAKAGE (INFILTRACIONES DE AIRE)
0.55	≤ 0.3 (U.S./J-P) ≤ 1.5 (Métrico/SI)

American Architectural Manufacturers Association
Manufacturer of Certified Products

Avoid Mandatory Skylights C402.4.2

Limiting general lighting power to <math><0.5\text{ W/SF}</math> avoids required skylights:

- Applies to office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, manufacturing area, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation depot or workshop
- Spaces at least 2,500 SF with at least 75% of ceiling height greater than 15 feet



Simplify air barrier compliance C402.5.3

New Commercial Buildings Require Envelope Testing:

- 0.4 CFM/SF Envelope to pass
- 0.4-0.6 CFM/SF Envelope allowed to pass with diagnostic testing and remediation



Sealed combustion or alternative appliances C402.5.5

Spaces with combustion air supplied through openings in an exterior wall for a space conditioning appliance:

- Requires room to be thermally isolated from the conditioned space
- Gasketed doors
- Water lines and ducts insulated



Operable Openings Interlocking C402.5.11

Avoiding operable openings to the outdoors larger than 40 sf. avoids needing to install opening interlocks, which in turn avoids requiring:

- Operable openings to be interlocked with heating and cooling systems
- Raising cooling setpoint to 90 °F and lowering heating setpoint to 55 °F

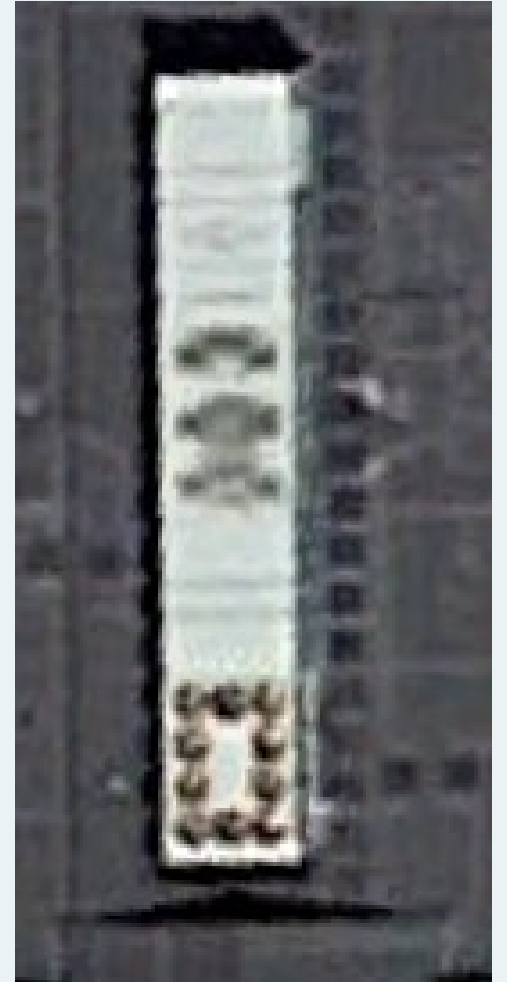


Simplifying Code Compliance – HVAC Measures

Zone isolation C403.2.1

Avoiding having HVAC system zones over 25,000 SF or covering multiple floors requiring isolation areas avoids:

- Installing isolation devices and controls
- Easier system balancing
- Reduced points for commissioning



Fault Detection and Diagnostics C403.2.3

Fault detection and diagnostics systems that monitor HVAC System's performance could be avoided by keeping gross conditioned area under 100,000 SF.

Avoids:

- Installing sensors and monitoring devices
- Additional programming and commissioning costs
- Need for authorized personnel to monitor FDD system



Two-position Valve C403.4.3.3

Limiting hydronic heat pump system pumping capacity to 10hp or less avoids the need for two-position automatic valves

- *Consider upsizing piping and using low head loss designs to reduce pressure drop*
 - *Low head loss design includes avoiding 90° bends, and using Y-fittings instead of T's*



Typical install – SEDAC Assessment

Image courtesy www.rmi.org, A.B. Lovins

Part Load Controls C403.4.4

Installing hydronic systems less than 300,000 Btu/h in power avoids installing controls for:

- Automatic reset of the water supply temperatures based on building heating and cooling demand
- Automatic variation of fluid flow for hydronic systems
- Installation of VFD pumps



Need of Economizers C403.5

Installing small cooling systems avoids the need to install economizers

- Install small chilled water systems with capacity below climate zone limits

Climate Zone	Local CHW	Air-Cooled or District CHW
4A	720,000 Btu/h	940,000 Btu/h
5A	1,320,000 Btu/h	1,720,000 Btu/h

- Install individual fan systems with cooling capacity $\leq 54,000$ Btu/h in buildings with occupancy other than *Group R*
- Install individual fan systems with cooling capacity $\leq 270,000$ Btu/h in buildings with *Group R* occupancy



Energy Recovery Systems C403.7.4.2

Limit ventilation air to avoid the need to install energy recovery systems

- Limits range from 40-26,000 CFM depending on % ventilation air and operating hours per year

Alternatively:

Install ERVs to avoid the requirement for demand control ventilation per C403.7.1 Exception #1.

Depending on facility, a few ERVs may be easier to install and control than DCV controls.



High pressure duct systems C403.12.2.3

Avoid designing/installing ducts and plenums operating at static pressure 3" or more to avoid the need for leak testing

Reduce duct static pressure with:

- Oversized filter banks (lower velocity = lower pressure drop and longer service life)
- Large-radius bends
- Low-friction take-offs like Y's instead of T's
- AVOIDING FLEX-DUCT



Heated Water Supply Piping Length C404.5.1

Use point of use water heating to avoid complex domestic water circulation controls

- Use high performance water fixtures to limit demand/circuit size



Image courtesy of SupplyHouse.com

Images courtesy of Grainger.com

Simplifying Code Compliance – Lighting Measures

Occupant sensor controls C405.2.1

Limit room size to enable use of wall switch type occupant sensors

- Easier to commission and lower cost



Open Plan Office Controls (C405.2.1.3)

Controlling all fixtures in a control zone avoids the need to interlace sensors or have multiple circuits/controls in space



Time-switch Controls (C405.2.2)

Use occupant sensing controls in spaces that otherwise require time switch controls to avoid complicated time-switches



Light Reduction Controls (C406.3)

Getting general lighting power density **<0.45 W/SF** avoids the need to install light reduction controls

- Also likely to qualify for C406.3



Daylight-responsive controls (C405.2.4)

Reducing lighting power by **at least 40%** avoids need to install daylight responsive controls

- Per C405.2.4 Exception #3
- Can also help qualify for C406.3



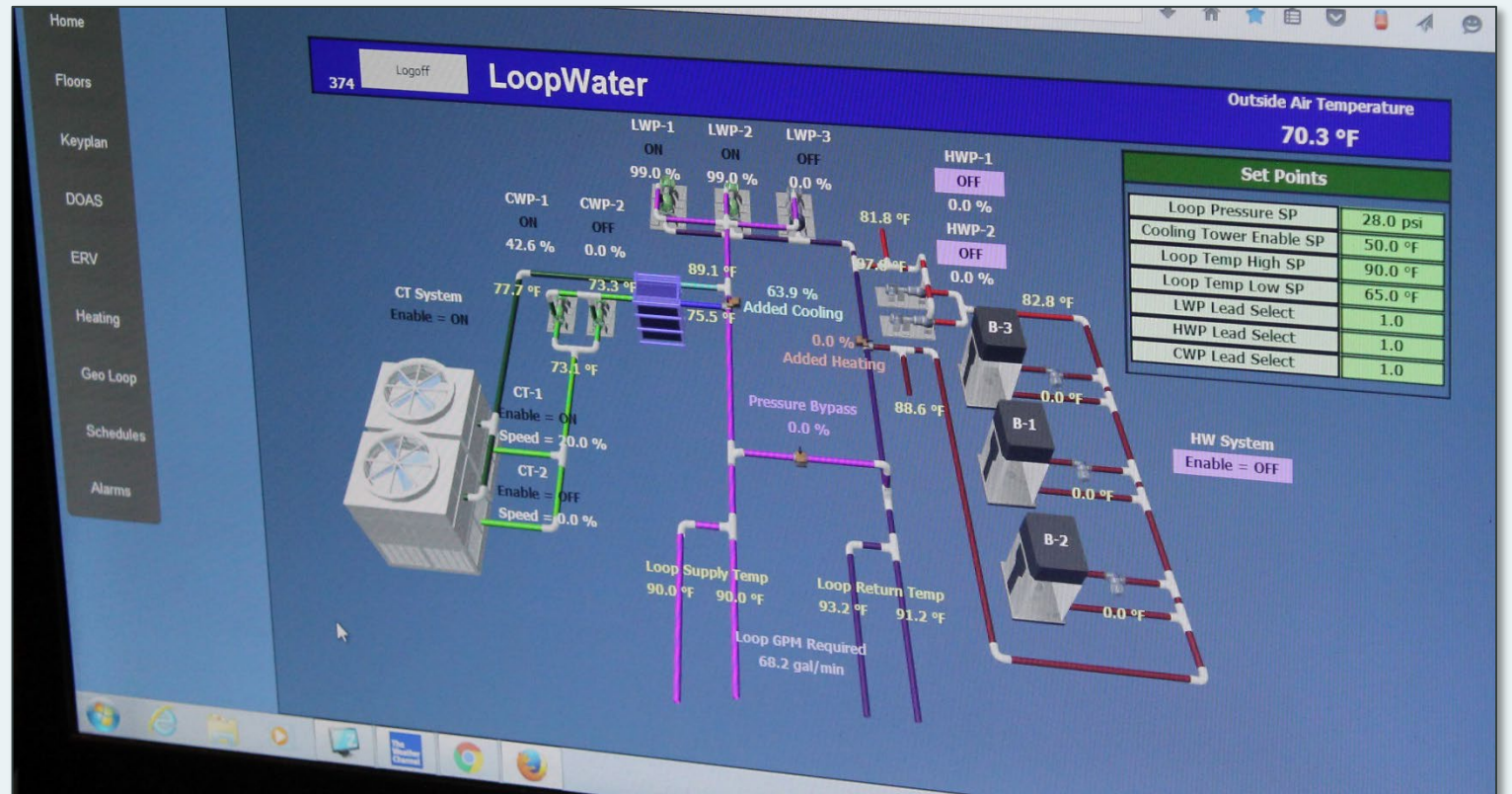
Consolidate Time Switch Controls (C405.2.7.2 & C405.2.7.3)

Using the 1 hr after closing/1 hr before opening for both decorative lighting shutoff and other exterior lighting setbacks enables a single time switch to serve both



Simplify Commissioning (C408)

Simplifying controls simplifies commissioning



Simplifying Code Compliance – Residential

Passive House (R401.9)

Passive House Certifications simplifies Energy Code Compliance

- PHIUS staff review plans drawings and energy models
- PHIUS provides corrective recommendations

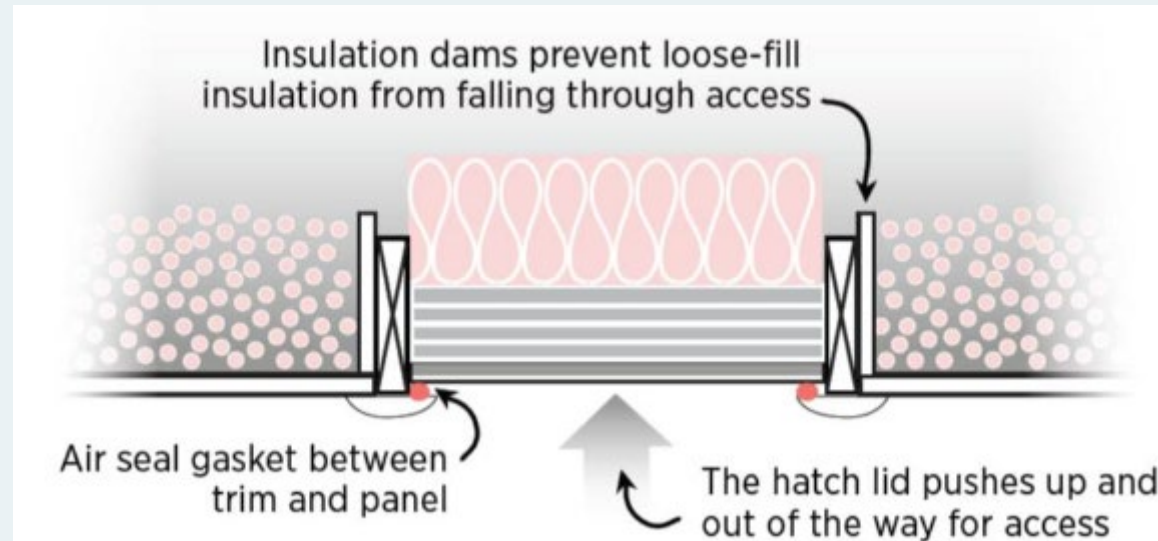
Code officials only responsible for obtaining PHIUS compliance reports and any on-site inspections.



Image source: https://passivehouse.com/03_certification/02_certification_buildings/05_wallplaque/05_wallplaque.html

Attic Access (R402.2.4)

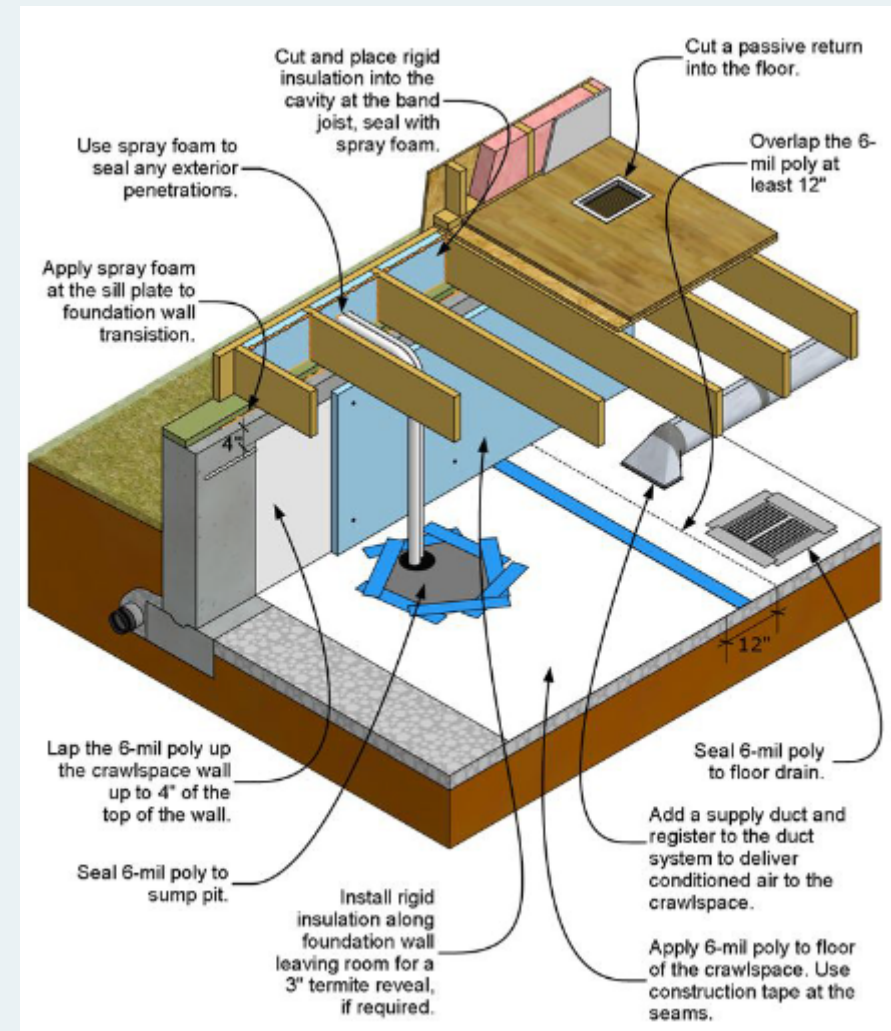
Installing unconditioned attic access outside thermal envelope avoids needing to insulate and air sealed the access hatch.



Crawl Space (R402.2.10)

Treat crawl space as short basement to improve ease of insulation

- Do not vent
- Insulate walls
- Draw stale air out using ventilation system
- Install slab (easier, more permanent vapor control than installing just vapor barrier)



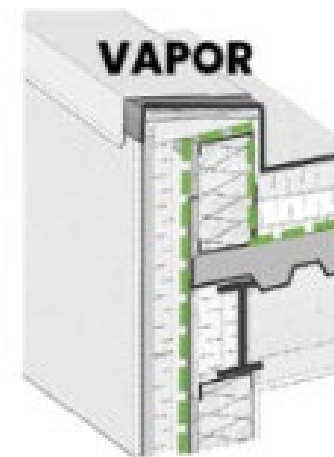
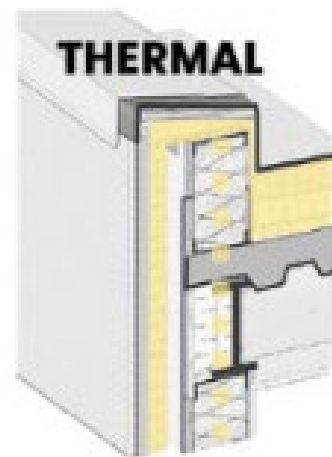
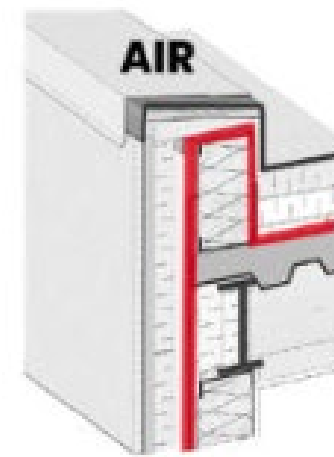
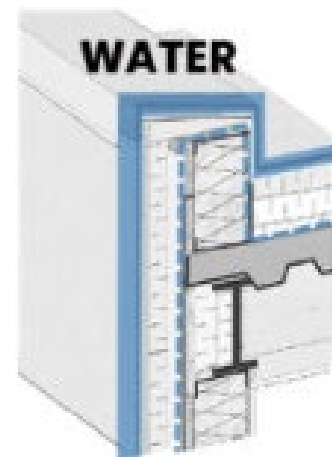
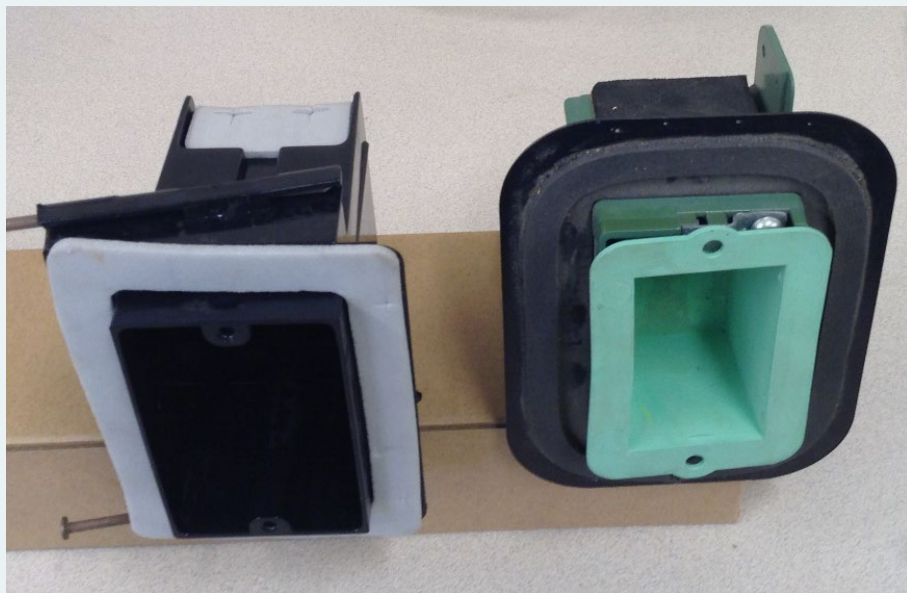
Improve Air Sealing Accuracy (R402.4.1.2)

- Test envelope to the **0.3 CFM/SF_{envelope}**
- More indicative of air sealing quality than 3 ACH
 - CFM/SF_{envelope} usually beneficial for smaller dwellings as smaller volume makes ACH target more difficult
 - Larger square footage 0.3 CFM/SF_{envelope} will be a more stringent target than 3 ACH.



Control Layer Location (R402.4.5 & R402.4.6)

Move thermal and air control layers to extreme exterior to avoid need for sealed recessed lighting & electrical/communication boxes



<https://www.buildingenclosureonline.com/articles/88782-ceu-parapetscontinuity-of-control-layers>

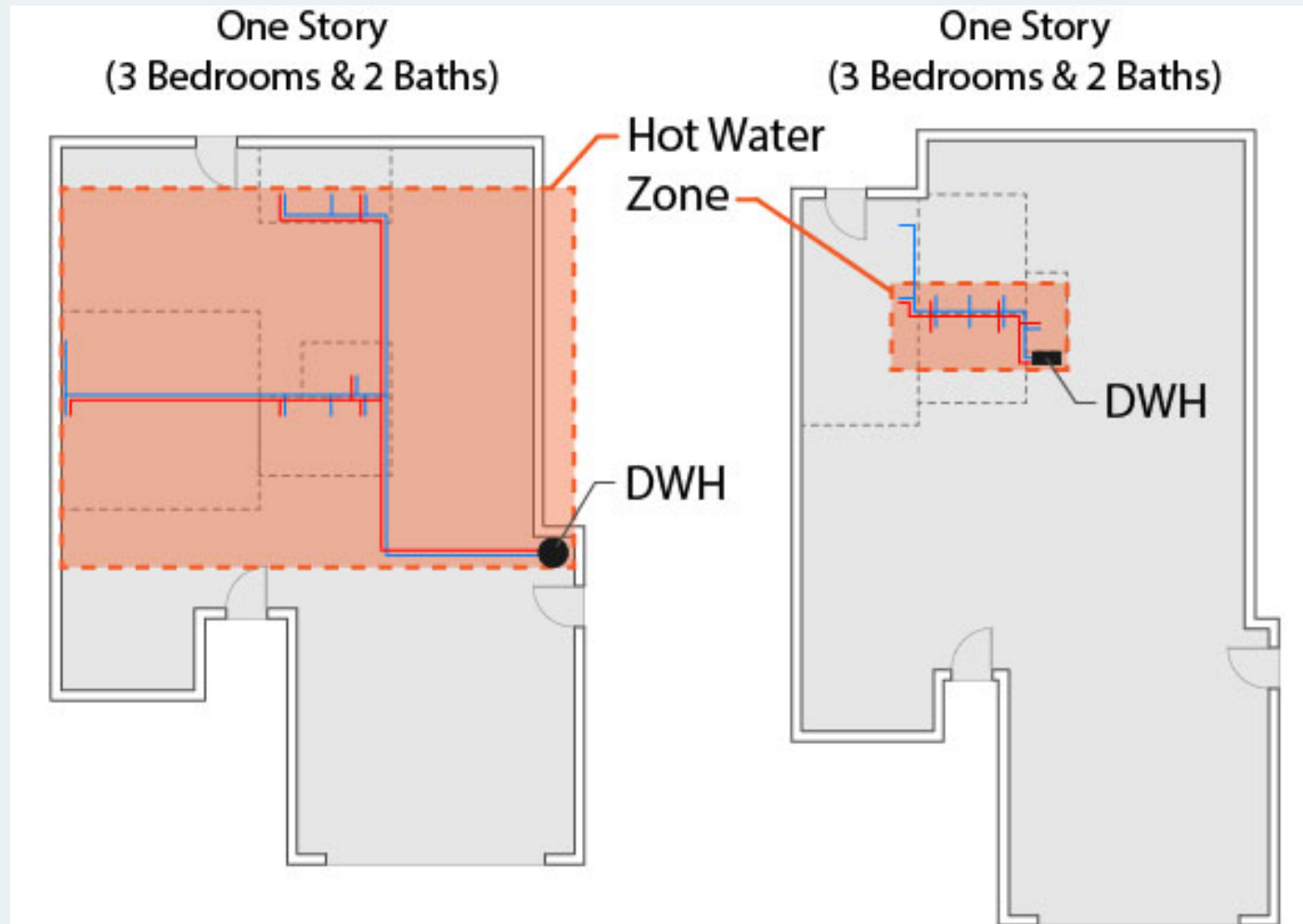
Ductwork location (R408.2.4)

Ductwork inside thermal envelope lessens air sealing stringency (8CFM/100SF vs 4CFM/100SF)
Also eliminates need to insulate ducts.



Compact Water Heating System (R403.5.1 & R408.2.3)

- Limits the desire/need for circulation or temperature maintenance systems
- Locate water heater near needs for hot water



Balanced Ventilation (R403.6.3)

Avoids the difficulty of not achieving desired ventilation rate due to tighter envelope.

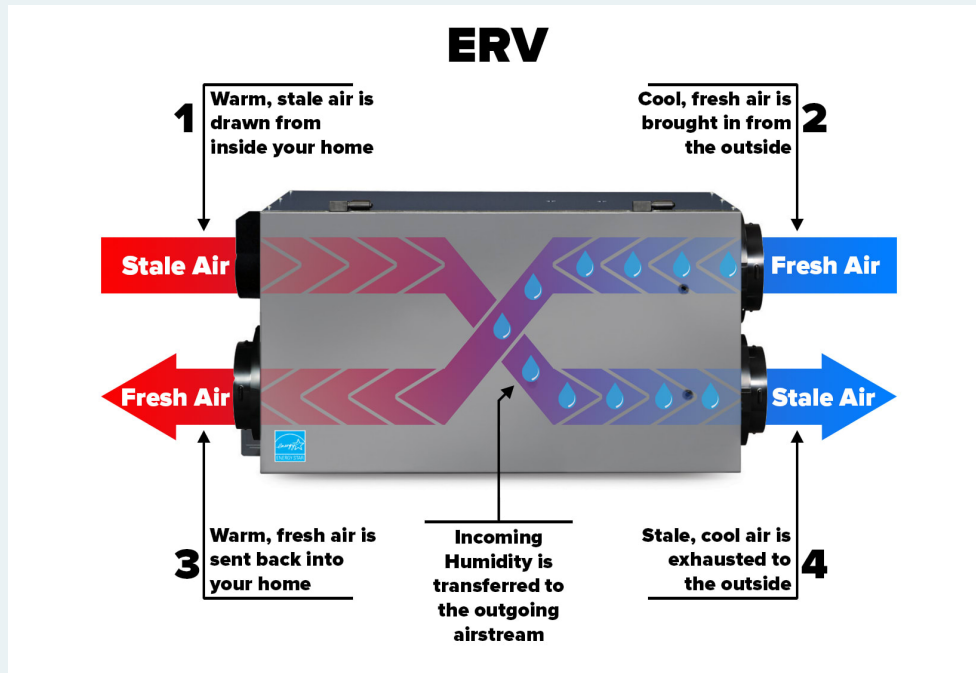


Image courtesy of Ferguson Supply

Outdoor Pool/Spa Cover (R403.10.3)

Use heat pump or on-site energy recovery heating to avoid need for cover on outdoor pool or permanent spa.



Image courtesy of DOE

Exterior Lighting Power (R404.3)

Limit total exterior lighting power to **30 watts or less** to avoid additional control requirements

- Generally easy for single-family and small multi-family
- Can be more difficult with large multi-family with pathway lighting.





Questions?

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