

Simplifying Compliance Existing Buildings & 2021 Changes

January 31, 2024



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Providing effective energy strategies for buildings and communities

Learning Objectives

1. Understand how existing buildings need to comply with the current Illinois Energy Conservation Code when undergoing alterations or additions.
2. Identify the most important Illinois Energy Conservation Code compliance issues in commercial and residential provisions.
3. Recognize opportunities to improve design and reduce reliance on complex systems to achieve energy efficiency.
4. Describe some of the common design decisions that can lead to added expense and complexity

Who We Are

The Smart Energy Design Assistance Center (SEDAC) is an applied research program at University of Illinois.

Our mission: Reduce the energy footprint of Illinois and beyond.



SEDAC is the Illinois Energy Conservation Code Training Provider



This training program is sponsored by
Illinois State Energy Office

Energy Code Training Program

Technical support

energycode@illinois.edu

800.214.7954

Online resources at

smartenergy.illinois.edu/energy-code



TRAINING & SUPPORT SERVICES



Workshops



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ENERGY CODE RESOURCES



Illinois Energy Conservation Code



Chicago Energy Transformation Code



Illinois Stretch Code



Frequently asked questions



Checklists



Energy code smart tips

Access to IECC, Illinois Amendments & CETC

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

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

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

All Codes » I-Codes

Legend Information

SECTIONS	NOTES	INSIGHTS
2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)		
COPYRIGHT		
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		
CHAPTER 5 [CE] EXISTING BUILDINGS		
CHAPTER 6 [CE] REFERENCED STANDARDS		
APPENDIX CA BOARD OF APPEALS—COMMERCIAL		



2021 International

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The 2021 IECC® addresses energy efficiency on several fronts and its use 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**
-  **2021 IECC FlashCards**

Categories

CHAPTER 1 [CE] SCOPE AND ADMINISTRATION

SECTION C101 SCOPE AND GENERAL REQUIREMENTS

C101.1 Title. This code shall be known as the Illinois Energy Conservation Code or "this Code" and shall mean: ~~of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as "this code".~~

With respect to the State facilities covered by 71 Ill. Adm. Code 600.Subpart B:

This Part, all additional requirements incorporated within Subpart B (including the 2021 International Energy Conservation Code, including all published errata but excluding published supplements that encompass ASHRAE 90.1-2019), and any statutorily authorized adaptations to the incorporated standards adopted by CDB, are effective upon adoption.

With respect to the privately funded commercial facilities covered by 71 Ill. Adm. Code 600.Subpart C:

This Part, all additional requirements incorporated within Subpart C (including the 2021 International Energy Conservation Code, including all published errata and excluding published supplements that encompass ASHRAE 90.1-2019), and any statutorily authorized adaptations to the incorporated standards adopted by CDB, are effective upon adoption.

C101.1.2 Adoption. The Board shall adopt amendments to this Code within 12 months after publication of changes to the International Energy Conservation Code. Any such update in this Code shall take effect within 6 months after it is adopted by the Board and shall apply to any new building or structure in this State for which

C101.1.3 Adaptation. The Board may appropriately adapt the International Energy Conservation Code to apply to the particular economy, population, distribution, geography and climate of the State and construction within the State, consistent with the public policy objectives of the EEB Act.

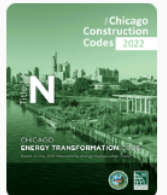
C101.5 Compliance. ~~Residential buildings shall meet the provisions of IECC-Residential Provisions. Commercial buildings shall meet the provisions of IECC-Commercial Provisions.~~ the Illinois Energy Conservation Code covered by 71 Ill. Adm. Code 600.Subpart C. The local authority having jurisdiction (AHJ) shall establish its own procedures for enforcement of the Illinois Energy Conservation Code. Minimum compliance shall be demonstrated by submission of:

- Compliance forms published in the ASHRAE 90.1 User's Manual; or
- Compliance Certificates generated by the U.S. Department of Energy's COMcheck™ Code compliance tool; or
- Other comparable compliance materials that meet or exceed, as determined by the AHJ, the compliance forms published in the ASHRAE 90.1 User's Manual or the U.S. Department of Energy's COMcheck™ Code compliance tool; or
- The seal of the architect/engineer as required by Section 14 of the Illinois Architectural Practice Act [225 ILCS 305], Section 12 of the Structural Engineering Licensing Act [225 ILCS 340] and Section 14 of the Illinois Professional Engineering Practice Act [225 ILCS 325].

All Codes » Chicago

Legend Information

SECTIONS	NOTES
2022 CHICAGO ENERGY TRANSFORMATION CODE	
COPYRIGHT	
Mayor's Message	
Commissioner's Message	
About the Chicago Construction Codes	
PREFACE TO THE MODEL CODE	
EFFECTIVE USE OF THE CHICAGO ENERGY TRANSFORMATION CODE	
CHAPTER C1 SCOPE AND PURPOSE	
CHAPTER C2 DEFINITIONS	
CHAPTER C3 GENERAL REQUIREMENTS	
CHAPTER C4 COMMERCIAL ENERGY EFFICIENCY	
CHAPTER C5 EXISTING BUILDINGS	
CHAPTER C6 CHICAGO-SPECIFIC REQUIREMENTS—COMMERCIAL	



2022

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The Chicago Energy Transformation Code addresses energy efficiency. This is a fully integrated

Categories

- Chicago
- Energy
- Topics

Why Care about Codes?

- Energy codes and standards set minimum efficiency requirements for new and renovated buildings, assuring reductions in energy use and emissions over the life of the building. Energy codes are a subset of building codes, which establish baseline requirements and govern building construction.
- Code compliant buildings are more comfortable and cost-effective to operate, assuring energy, economic and environmental benefits.

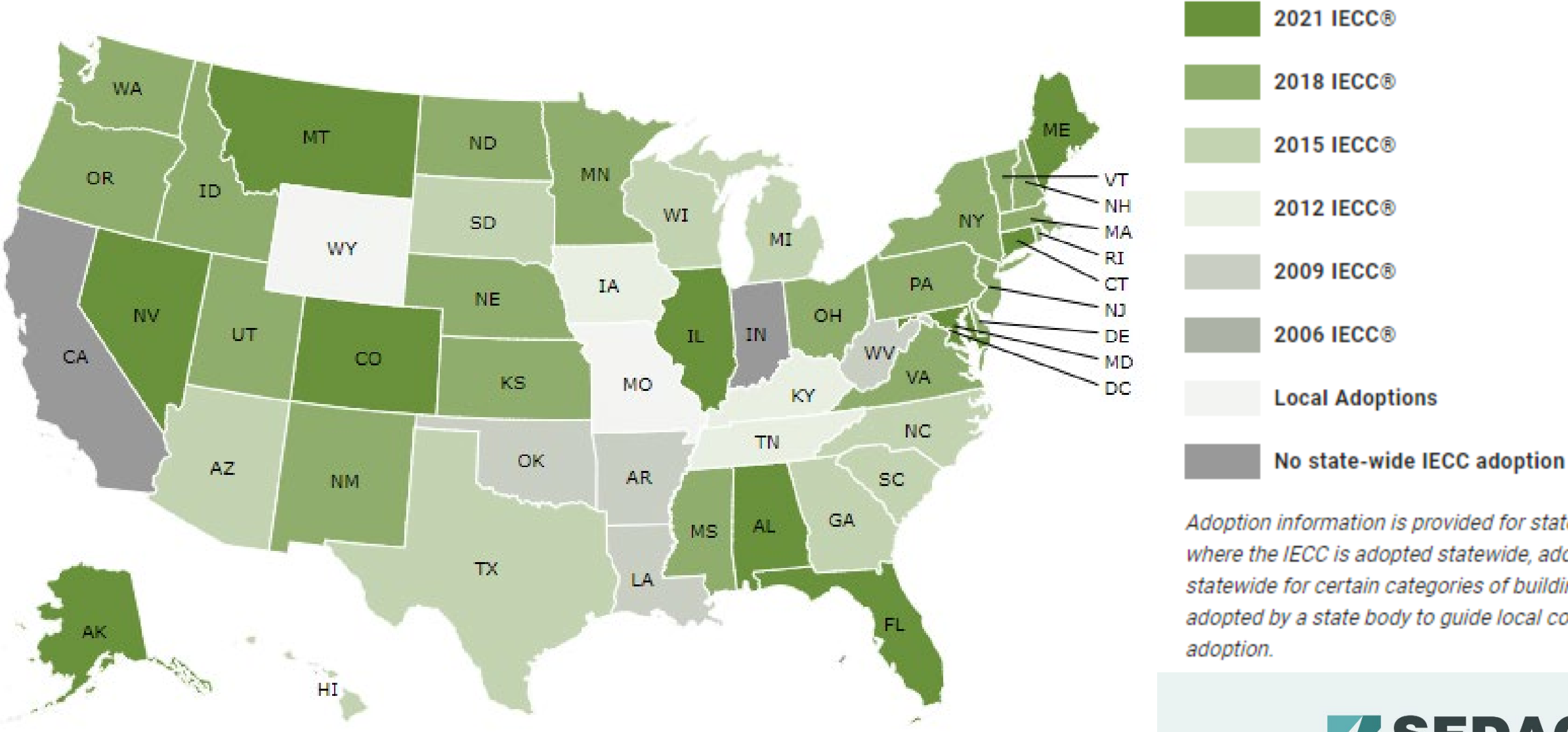
Where do **energy** codes come from?

- In United States – created in response to the energy and economic crises of the 1970s
- 1978 – Congress passed legislation requiring states to initiate energy efficiency standards for new buildings
- 1992 – Energy Policy Act (EPact) – states must review and consider adopting national model energy standard

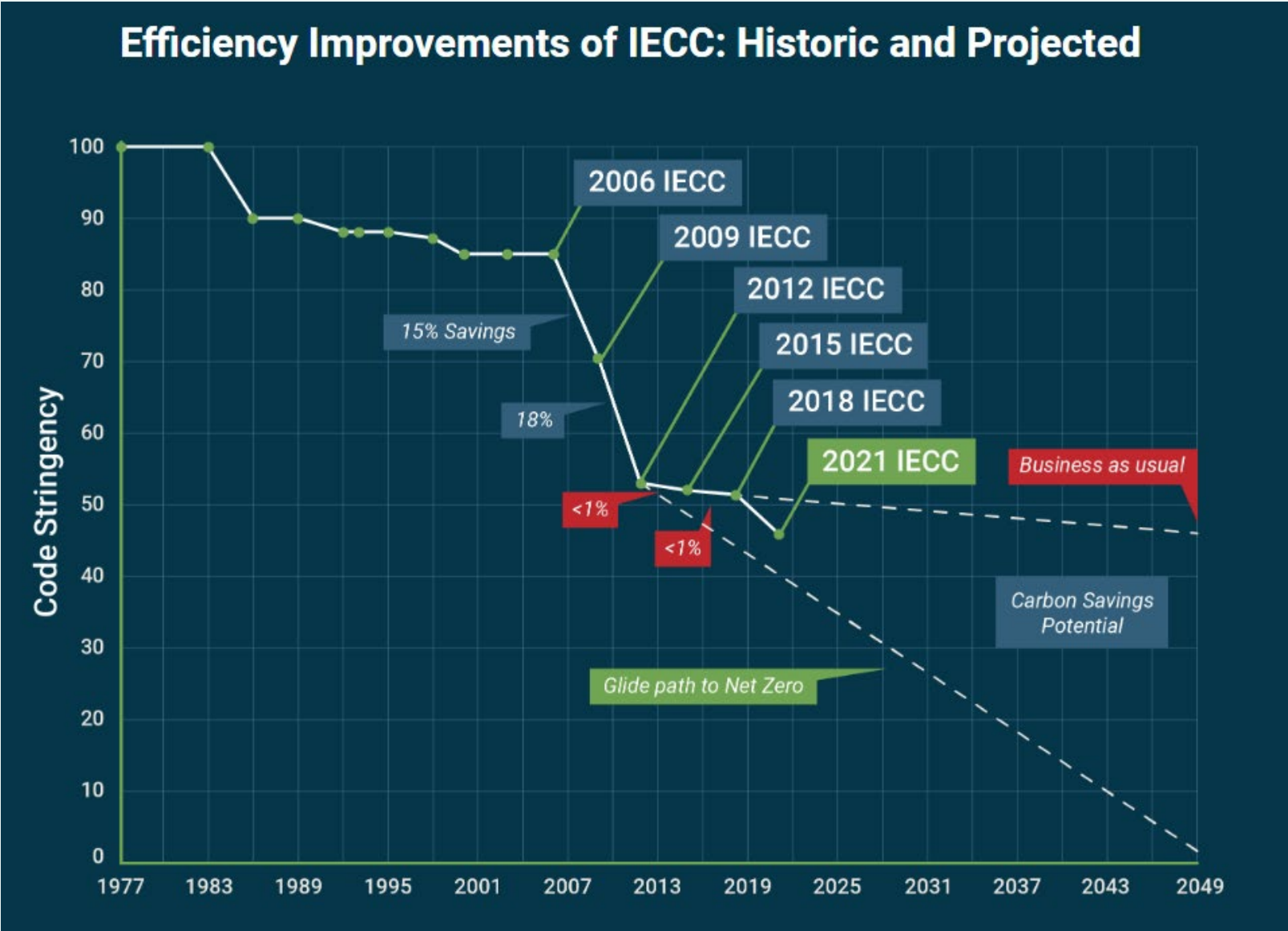


Source: <http://bcap-ocean.org/energycodes101>

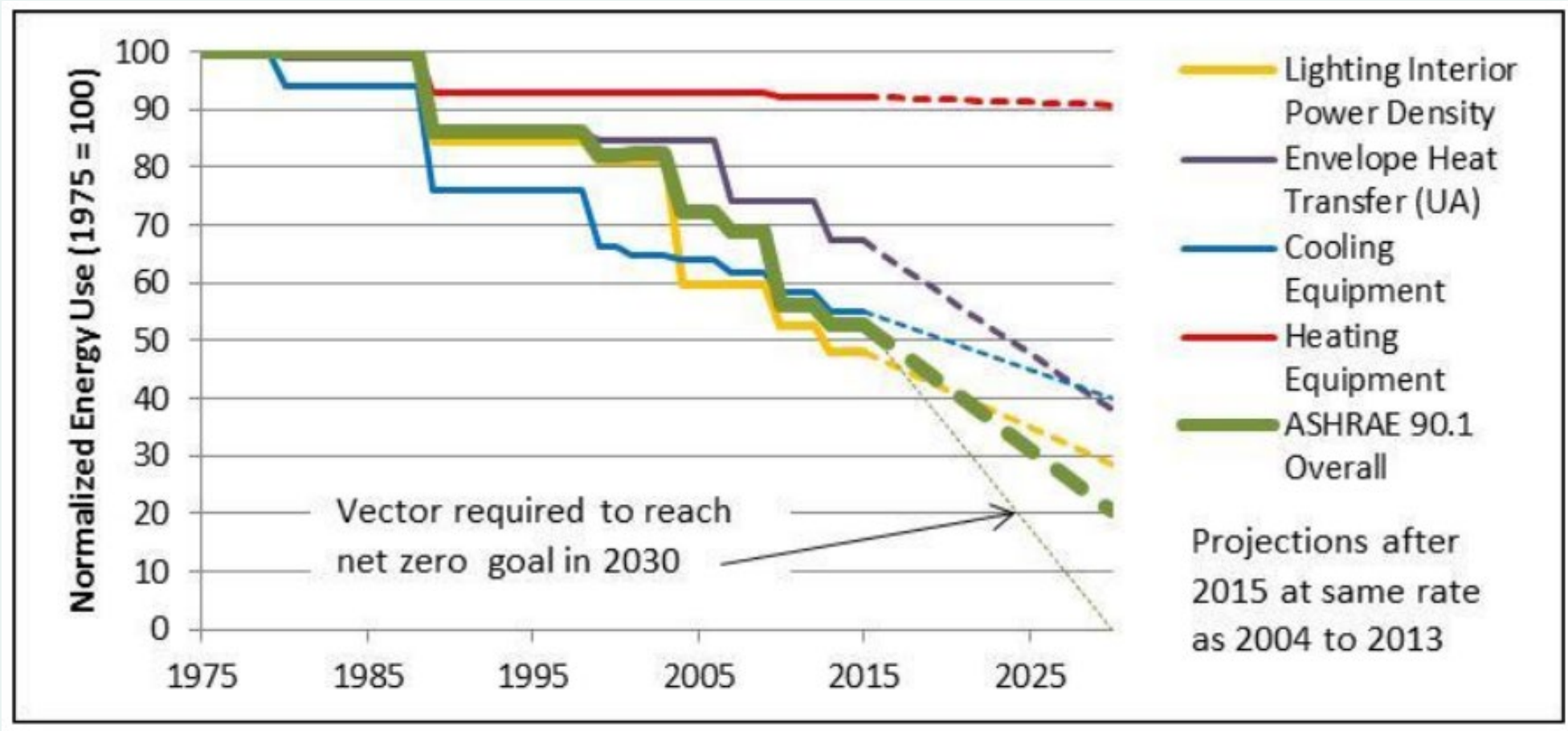
Commercial energy code adoption by state



IECC Improvements: historic and projected



Efficiency improvements by building system



Roof insulation requirements over time

Zone 5, insulation entirely above roof deck, IECC

2003	2006	2009	2012	2015	2018	2021
R-15ci	R-20ci		R-25ci	R-30ci		

High level overview of Codes

- **Building codes are state laws.** The U.S. does not have a national building code or energy code; instead, states or local governments can choose to adopt one of the national model energy codes, a modified version of the model code, or their own state-specific code.
- **Energy codes are just one of many building codes,** such as fire, electrical, structural, or plumbing.
- **Energy codes are different than appliance and equipment standards.** Energy codes cover the building itself—for example, the walls/floors/ceiling insulation, windows, air leakage, and duct leakage. Appliance and equipment standards cover the things that go into the buildings. However, there is some overlap, particularly in lighting.

Chicago's adoption of energy codes

ARTICLE I.
2022 CHICAGO ENERGY TRANSFORMATION CODE

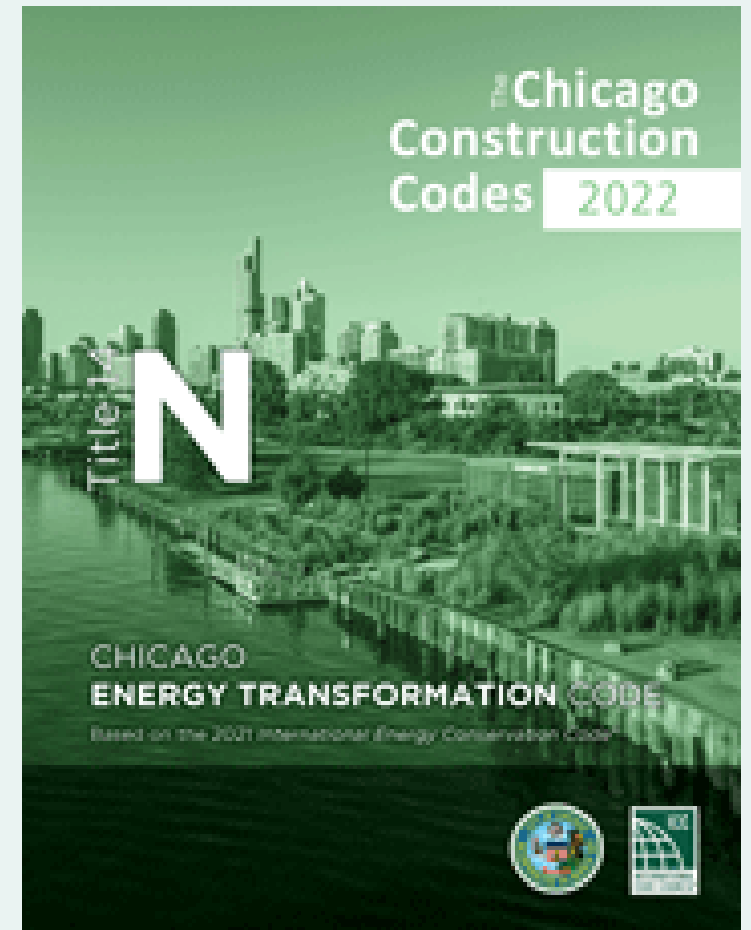
SECTION 1. The Municipal Code of Chicago is hereby amended by repealing Title 14N (the 2019 Chicago Energy Conservation Code) in its entirety and replacing it, as follows:

TITLE 14N 2022 ENERGY TRANSFORMATION 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.



<https://codes.iccsafe.org/codes/chicago>

Listed Historic Buildings are exempt

- Listed on National Register
- Listed on IL Register
- Designated by authorized personnel as historically significant



Slido 1

- What portions of the energy code do you find the most challenging to comply with? I.e. Meeting R-value/U-factor, air sealing details, providing all the elements listed in the energy code

2021 IECC Commercial Changes

C401.3 Thermal envelope certificate

Must include:

1. R-values of insulation installed in or on ceilings, roofs, walls, foundations and slabs, basement walls, crawl space walls and floors and ducts outside conditioned spaces
2. U-factors and solar heat gain coefficients (SHGC) of fenestrations.
3. Results from any building envelope air leakage testing performed on the building

Where there's more than one value for any component of the building envelope, shall be the area-weighted average value or list each value that applies to 10% or more of the component area

C401.3 Thermal envelope certificate (checklist)

Commercial

Commercial Thermal Envelope Certificate

Name of Designer/Builder: _____ Location (address): _____
 Energy Code Edition: _____
 2021 IECC: Yes No Permit Date: _____
 ASHRAE 90.1-2019 Yes No Permit #: _____
 Other (please indicate): _____ Building Area (sf): _____

1. Insulation Rating

Designation	R-Value (per assembly)	% (of component)	R-Value (area-weighted average)
Ceiling/Roof			
Walls (Above Grade)			
(Above Grade)			
(Below Grade)			
(Below Grade)			
Floors/Slabs			
Ducts			
(Unconditioned space)			
(Outdoor ducts)			

2. Fenestration Rating

Designation	NFRC U-Factor (per assembly)	NFRC SHGC (of component)	% (of component)	NFRC U-Factor (area-weighted average)	NFRC SHGC (area-weighted average)
Window					
Opaque door					
Skylight					

3. Air Leakage Test Results

Blower door _____ cfm/sf/ 75 Pa. Test date: _____ Tested by: _____

Residential

Energy Code Certificate

Name of Designer/Builder: _____ DATE: _____
 Energy Code edition: _____ Compliance Path: _____

1. Insulation Rating	R-Value	R-Value
Ceiling /Roof	Attic _____	Vaulted _____
Walls	Frame _____	Mass _____
	Basement _____	Crawl space _____
Floors	Over unconditioned space _____	Slab edge _____
Ducts	Attic _____	Other _____

2. Fenestration Rating	NFRC U-Factor	NFRC SHGC
Window	_____	_____
Opaque door	_____	_____
Skylight	_____	_____

3. Air Leakage Test Results

Blower door _____ ACH/50 Pa. Duct testing _____ Cfm/100 ft²

4. Equipment Performance	Type	Size	Efficiency
Heating system	_____	_____	_____
Cooling system	_____	_____	_____
Water heater	_____	_____	_____

Indicate if the following have been installed:
 Electric furnace Gas-fire unvented room heater Baseboard electric heater

5. Photovoltaic Panel Systems

Array capacity	_____	Panel tilt	_____
Inverter efficiency	_____	Orientation	_____

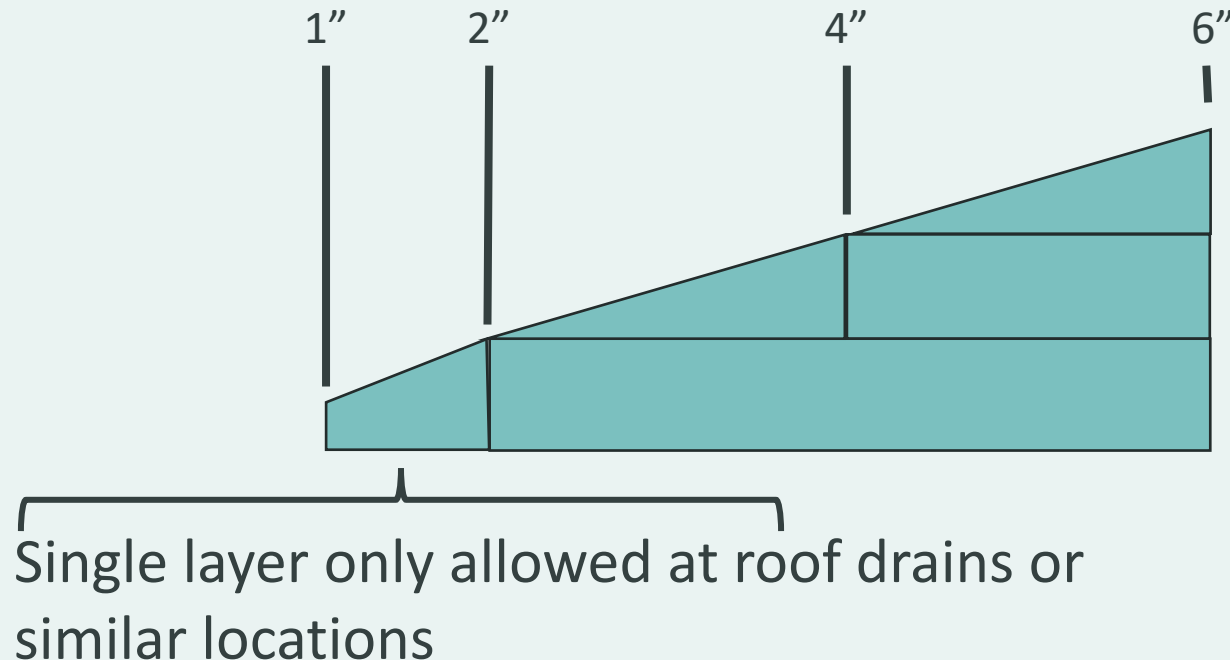
6. Energy Rating Index Score

Structure Permit _____

C402.2.1.2 Tapered insulation, min. thickness

Requires the minimum thickness of above-deck tapered roof insulation at its lowest point (gutter edge, roof drain, or scupper) **shall be not less than 1 inch**

Be aware, this minimum could lead to condensation or other moisture problems.



C402.2.1.2 Tapered insulation, Calculation

2021 IECC uses a U-factor calculation based on average thickness times R-value

Previously U-factor was used to determine the required thickness then allowed for reduction of 1” from that minimum thickness.

Table C402.4 Fenestration SHGC

Changed SHGC based on *Fixed* vs *Operable*, previously was based on orientation.

Climate Zone		5	
Vertical fenestration	U-Factor		
Fixed fenestration	0.36		
Operable fenestration	0.45		
Entrance Doors	0.63		
SHGC	Fixed	Operable	
PF < 0.2	0.38	0.33	
0.2 ≤ PF < 0.5	0.46	0.40	
PF ≥ 0.5	0.61	0.53	

C402.4 SHGC/U-Factor Performance Enhancement

Buildings with more east/west fenestration than north/south fenestration have increased performance criteria depending on the ratio

$$A_w * SHGC_w \leq (A_t * SHGC_c)/5$$

And

$$A_e * SHGC_e \leq (A_t * SHGC_c)/5$$

Area west/east/total

SHGC west/east/code table

C402.4 value



C402.5.1.2 Air barrier testing

Requires buildings or portions of building including Group R and I occupancies to meet C402.5.2 (≤ 0.30 cfm/ft² at 50Pa) testing each dwelling, sampling allowed for buildings w/ more than 7 dwellings

Or

Requires buildings or portions of buildings other than Group R and I occupancies to meet C402.5.3 (≤ 0.40 cfm/ft² at 75Pa)



<https://energyconservatory.com/applications/commercial-multifamily/>

C402.5.11 Operable openings interlock

Occupancies with openings to the outdoors **larger than 40 square feet** in area, such openings shall be interlocked with the heating and cooling system to adjust setpoints or deactivate systems within 10 minutes of opening the operable opening



Photo Courtesy of Garage Doors Unlimited

C403.2.3 Fault detection and diagnostics (FDD)

New buildings with HVAC systems serving over **100,000 square feet** shall include fault detection and diagnostics system. The FDD system shall:

1. Include permanently installed sensors and devices to monitor the HVAC system's performance
2. Sample performance at least every 15 min.
3. Automatically ID and report HVAC system faults & notify authorized personnel
4. Automatically provide prioritized recommendations for repair
5. Be capable of transmitting recommendations to remotely located authorized personnel

C403.8.3 Fan efficiency

Changed from *Fan Efficiency Grade* to *Fan Efficiency Index*

Needs to have **FEI of 1.00 or higher** at design point of operation, as determined in accordance with AMCA 208, VAV systems shall have **FEI of not less than 0.95**

Comparing FEI against FEG

Fan Size in. (mm)	Fan Speed rpm	Fan Power bhp [kW]	Actual Total Efficiency %	Baseline Power	FEG	FEI
18 (460)	3,238	11.8 [8.8]	40.1	7.96	85	0.67
20 (510)	2,561	9.6 [7.2]	49.5	7.96	85	0.83
22 (560)	1,983	8.0 [6.0]	59.0	7.96	85	0.99
24 (610)	1,579	6.8 [5.0]	69.1	7.96	85	1.16
27 (685)	1,289	6.2 [4.6]	75.8	7.96	85	1.28
30 (770)	1,033	5.7 [4.3]	82.5	7.96	85	1.39
36 (920)	778	6.0 [4.5]	78.7	7.96	85	1.32

Includes drive losses; more accurate to system efficiency rather than component efficiency

Data table courtesy

<https://staging.amca.org/assets/resources/public/pdf/EEDAL-2017-Paper.pdf>

C405.2.1.4 Corridor occupant sensor function

Need to reduce lighting power by **at least 50%** of full power **within 20 minutes** after all occupants have left the space

Excludes corridors with less than 2 fc of illumination on the floor at the darkest point with all lights on



C405.11 Automatic receptacle control

In enclosed offices, conference rooms, copy/print rooms, breakrooms, classrooms, and individual workstations, **at least 50%** of all 125V, 15- and 20-amp receptacles shall have automatic control function

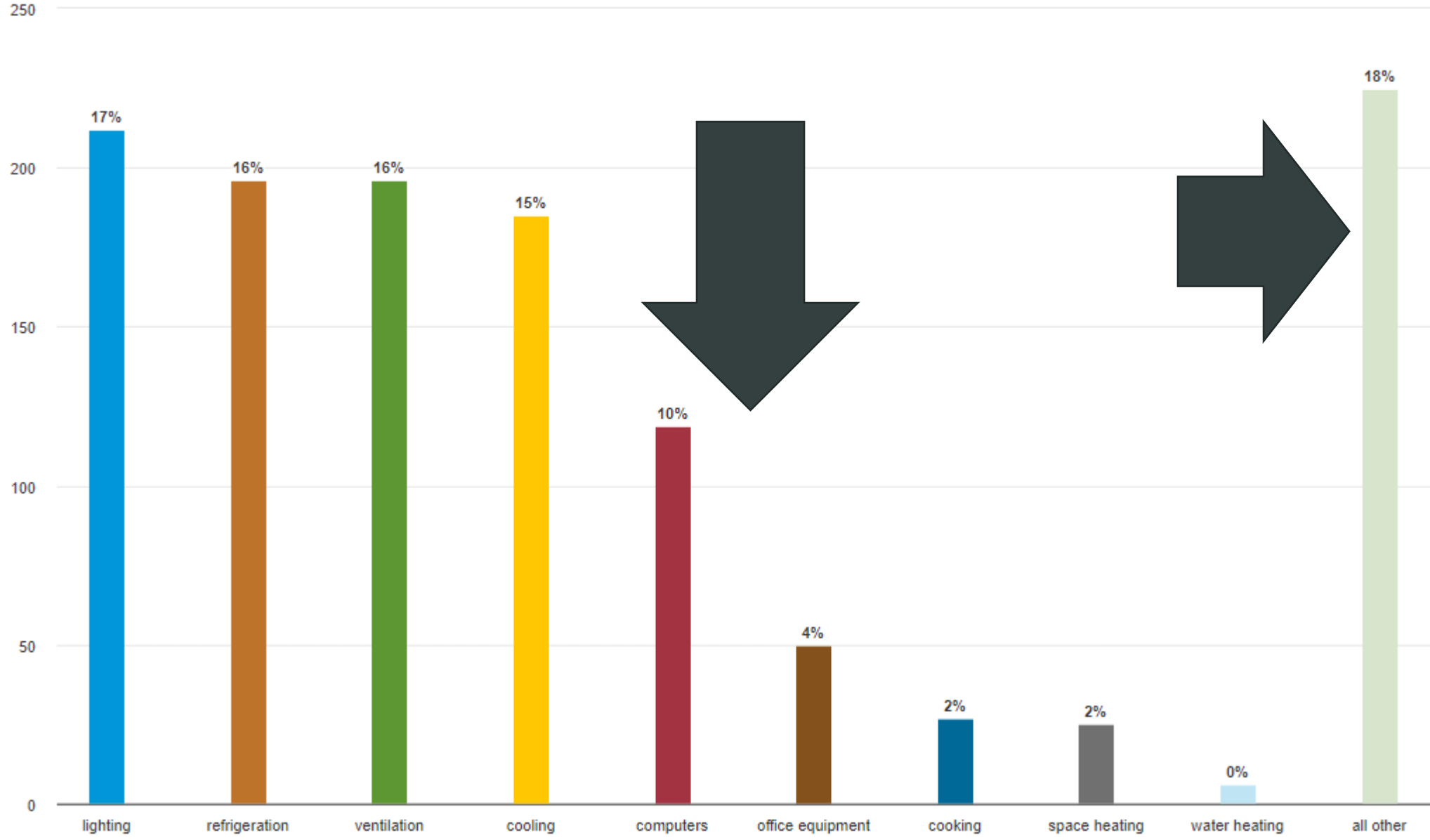



At least 25% of all branch circuit feeders installed for modular furniture not shown on the construction documents

Image courtesy of Leviton

Electricity use in U.S. commercial buildings by major end uses, 2012

total = 1,243 billion kilowatthours (kWh)



 Note: All other includes motors, pumps, air compressors, process equipment, backup electricity generation, and miscellaneous appliances and plug-loads.
Source: U.S. Energy Information Administration, 2012 Commercial Buildings Energy Consumption Survey, Consumption and Expenditures, Table E5, May 2016

C405.12 Energy Monitoring

New buildings with a gross conditioned floor area of **at least 25,000 square feet** need to be equipped to measure, monitor, record, and report energy consumption data at least hourly with 36-month capacity

End use categories:

1. Total HVAC system
2. Interior Lighting
3. Exterior Lighting
4. Plug loads
5. Process loads exceeding 5% of peak connected load
6. Building operations and other misc. loads



Image source:

<https://betterbuildingsolutioncenter.energy.gov/alliance/technology-solution/energy-management-information-systems>

C406 Additional Efficiency

Previously was choose 1 from list of 8, now need **10 credits** from applicable table

Each credit worth approximately **1/4% energy use reduction**

10 credits equal to about 2.5% savings

C406 Additional Efficiency

	Group B	Group R & I	Group E	Group M	Other
C406.2.1 5% heating efficiency improvement	1	1	1	1	1
C406.2.2 5% cooling efficiency improvement	2	1	2	2	2
C406.2.3 10% heating efficiency improvement	2	1	2	2	2
C406.2.4 10% cooling efficiency improvement	4	2	4	4	4
C406.3 (10%) Reduced lighting power	8	2	8	15	8
C406.4 Enhanced digital lighting controls	2	0	2	4	2
C406.5 On-site renewable energy	9	7	6	8	8
C406.6 Dedicated outdoor air system	5	6	0	3	5
C406.7.2 Recovered or renewable water heating	0	14	1	0	14
C406.7.3 Efficient fossil fuel water heater	0	8	2	0	8
C406.7.4 Heat pump water heater	0	5	1	0	5
C406.8 Enhanced envelope performance	7	4	1	6	5
C406.9 Reduced air infiltration	8	7	0	3	6
C406.10 Energy monitoring	3	1	3	4	3
C406.11 Fault detection and diagnostics system	1	1	1	1	1

Slido 2

- For your commercial clients that complain about energy code compliance, what aspects do they complain about? ie. Lack of enforcement, too much government intervention, too costly

2021 IECC Residential Changes

Additional Energy Efficiency

R402.1.5 lays out requirements for improving efficiency over base compliance paths: Targets 5% improvement over base code-compliance building

- **Prescriptive Compliance:**

- Select **TWO** additional efficiency package from R408 to implement (CETC Amendment)

- **Total Building Performance Compliance:**

- Include **TWO** R408 packages but do not model in proposed design (CETC Amendment)
- Include R408 packages in proposed design, and achieve 5% energy cost reduction over standard reference design

- **Energy Rating Index Compliance:**

- ERI value shall be 5% less than specified in Table R406.5
- ERI targets return to 2015 IECC levels (more stringent!)

- **Passive House or NGBS Certified:**



- No additional requirements

- **Efficient Envelope Performance**
 - 5% reduction in UA over Table R402.1.2.
 - SHGC shall be 5% less than Table R402.1.2 values
- **Efficient HVAC Equipment Performance**
 - 95% AFUE/10 HSPF heating with 16 SEER cooling
 - 3.5 COP ground-source heat pump
 - All systems must comply for multi-system residences
- **Reduced Service Hot Water Energy**
 - 0.82 EF gas, 2.0 EF electric, and 0.4 solar fraction water heaters

- **Efficient Duct Thermal Distribution**
 - 100% of ducts within thermal envelope
 - 100% ductless or hydronic within thermal envelope
 - 100% within conditioned space per R403.3.2
- **Improved Air Sealing and Ventilation**
 - Air leakage of 3.0 ACH₅₀ or less with ERV or HRV
 - 75% sensible recovery + 50% latent recovery when applicable
 - 1.1 cfm/watt or less fan efficiency
 - Cannot use recirculation for defrost

Maximum Energy Rating Index

Climate Zone	2018 ERI Target	2021 ERI Target	2021 ERI w/ R408 Package Target
4	62	54	51
5	61	55	52

Baseline Targets
return to 2015
IECC ERI Targets!

Recall with Additional Efficiency Packages:

1. Meet this score and then include two packages OR
2. Model efficiency packages and have 5% reduction in ERI

Envelope performance backstop requirement if renewables not included: $UA_{\text{proposed}} \leq 1.15 \times UA_{\text{reference}}$

With renewables, envelope performance backstop is 2018 IECC

Energy Certificate

Energy Code Certificate			
Name of Designer/Builder:		DATE:	
Energy Code edition:		Compliance Path:	
1. Insulation Rating		R-Value	R-Value
Ceiling /Roof	Attic	<input type="text"/>	Vaulted <input type="text"/>
Walls	Frame	<input type="text"/>	Mass <input type="text"/>
	Basement	<input type="text"/>	Crawl space <input type="text"/>
Floors	Over unconditioned space	<input type="text"/>	Slab edge <input type="text"/>
Ducts	Attic	<input type="text"/>	Other <input type="text"/>
2. Fenestration Rating		NFRC U-Factor	NFRC SHGC
Window		<input type="text"/>	<input type="text"/>
Opaque door		<input type="text"/>	<input type="text"/>
Skylight		<input type="text"/>	<input type="text"/>
3. Air Leakage Test Results			
Blower door	<input type="text"/>	ACH/50 Pa.	Duct testing <input type="text"/>
			Cfm/100 ft ²
4. Equipment Performance		Type	Size
Heating system		<input type="text"/>	<input type="text"/>
Cooling system		<input type="text"/>	<input type="text"/>
Water heater		<input type="text"/>	<input type="text"/>
Indicate if the following have been installed:			
<input type="checkbox"/>	Electric furnace	<input type="checkbox"/>	Gas-fire unvented room heater
<input type="checkbox"/>		<input type="checkbox"/>	Baseboard electric heater
5. Photovoltaic Panel Systems			
Array capacity	<input type="text"/>	Panel tilt	<input type="text"/>
Inverter efficiency	<input type="text"/>	Orientation	<input type="text"/>
6. Energy Rating Index Score		Structure Permit	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

smartenergy.illinois.edu/energy-code/ | 800.214.7954 | energycode@illinois.edu
 Smart Energy Design Assistance Center, 1 St Mary's Road, Champaign, IL 61820

UNIVERSITY OF ILLINOIS SEDAC

Added requirement to list on-site PV capacity, inverter efficiency, and panel tilt/orientation if installed.

Ensure certificate does not cover other safety or informational tags when installed!
 Other requirements unchanged. Display:

- Weighted average or largest portion R-values
- Display window U-factors and SHGCs
- Air & duct leakage test results
- Type and Efficiency of HVAC systems
- Code version for compliance

Vapor Retarder

- Vapor retarders must comply with Section R1404.3 of the Chicago Building Code
 - Class I or II vapor retarders shall be installed to the interior of framed walls.
 - Exceptions for basements, below-grade wall portions, construction where moisture or freezing will not cause damage, or where Class III vapor retarders are required per 1404.3.2
 - Class III vapor retarders are permitted per Table 1404.3.2

TABLE 1404.3.2

CLASS III VAPOR RETARDERS

ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR: ^a
5	Vented cladding over wood structural panels Vented cladding over fiberboard Vented cladding over gypsum Continuous insulation with R -value $\geq R5$ over 2×4 wall Continuous insulation with R -value $\geq R7.5$ over 2×6 wall

Table
R402.1.2

Maximum Assembly U-Factors

Climate Zone	Fenestration U-Factor	Skylight U-factor	Fenestration SHGC	Ceiling U-Factor	Wood Frame Wall U-Factor	Mass Wall U-Factor	Floor U-Factor	Basement Wall U-Factor	Crawl Space Wall U-Factor
4-2018	0.32	0.55	0.40	0.026	0.060	0.098	0.047	0.059	0.065
5-2018	0.30	0.55	NR	0.026	0.060	0.082	0.033	0.050	0.055
4-2021	0.30	0.55	0.40	0.024	0.045	0.098	0.047	0.059	0.065
5-2021	0.30	0.55	0.40	0.024	0.045	0.082	0.033	0.050	0.055



IL Amended ceiling insulation maximum U-factor values to 0.026

CETC did NOT follow suite, and has maintained the 2021 IECC U-factors

Table
R402.1.3

Minimum Assembly R-Values

Climate Zone	Fenestration U-Factor	Skylight U-factor	Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-value	Floor R-value	Basement Wall R-value	Slab R-value & Depth
4-2018	0.32	0.55	0.40	49	20 or 13+5	8/13	19	10/13	10, 2ft
5-2018	0.30	0.55	NR	49	20 or 13+5	13/17	30	15/19	10, 2ft
4-2021	0.30	0.55	0.40	60	30, 20+5, 13+10, or 0+20	8/13	19	10ci/13	10, 4ft
5-2021	0.30	0.55	0.40	60	30, 20+5*, 13+10, or 0+20	13/17	30	15ci/19/13+5ci	10, 4ft



IL amendment sets ceiling insulation at R-49 for both climate zones.

CETC did NOT implement this amendment, maintaining the 2021 IECC values for CZ-5

**PHIUS notes for CZ-5; R20+R5ci for framed walls can lead to condensation without cautious design, thus R30, 13+10ci or 0+20ci is recommended!*

Specific Roof Insulation Requirements

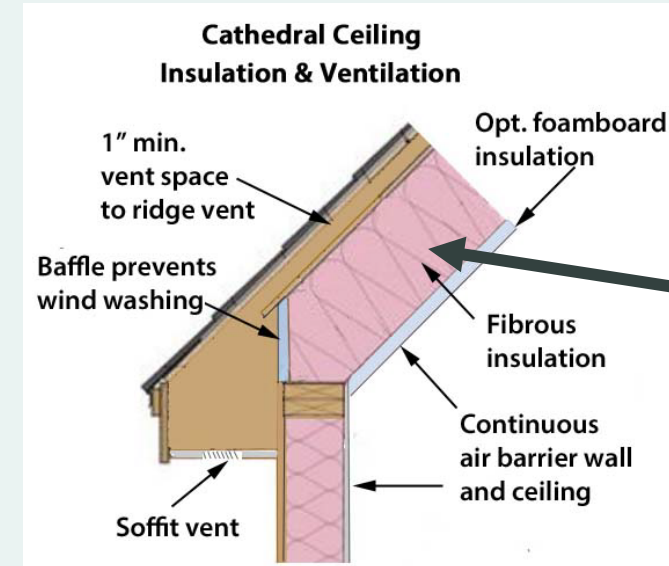
2022 CETC R402.2.2 provides allowances for insulation over 100% of the roof area.

Where Table R402.1.3 calls for R-60 ceiling insulation, R-49 is permitted if covers 100% of ceiling or attic area

Low-slope roof permitted to use R-42 to satisfy the R-60 requirement.

Insulation must be continuous
Must cover 100% of roof area

These reductions not permitted for UA tradeoff



Per 2022 CETC:
R-60 min.
Requires thicker framing or added continuous insulation



Per 2022 CETC:
R-42 allowable if 100% coverage above deck continuous

Access Hatches and Doors

R402.2.4: Access hatches to unconditioned spaces shall be insulated per Table R402.1.3 for the wall or ceiling in which they are installed.

R402.2.4.1: Insulation installation and retention

- Hatches and doors need to be weather stripped
- Access that prevents damage/compression provided to all equipment.
- Baffle, retainer, or dam required to hold loose-fill insulation

Note: This section is simplified from the 2021 IECC which has specific requirements for pull-down stair attic accesses.



Image source: Energy.gov

Steel-Frame Assemblies

- As with Commercial section, adds requirement to calculate steel-framed assembly U-factors using AISI S250
 - All exterior continuous insulation can be any framing distance
 - 16" and 24" O.C. framing uses next lower framing member spacing input when calculating U-factor
 - Larger spacings use AISI calculation without modification
 - For custom framing members, use of AISI S250 calculation for other than C-shaped members is allowed



<https://www.angi.com/articles/why-use-steel-frame-house.htm>

Steel-Frame Assemblies

- Revised Table R402.2.6 to remove references to type of assembly, and only uses the requirements for 16" and 24" O.C. framing with >30% continuous : cavity insulation ratio

**"TABLE R402.2.6
STEEL-FRAME WALL INSULATION R-VALUES**

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL-FRAME EQUIVALENT R-VALUE^a
Steel-frame Wall, 16 inches on center	
R-13&10ci	R-0&20ci or R-13&15ci or R-15&14ci
R-20&5ci	R-13&12.7ci or R-15&12.3ci or R-19&11.6ci or R-21&11.3ci or R-25&10.9ci
Steel-frame Wall, 24 inches on center	
R-13&10ci	R-0&20ci or R-13&13ci or R-15&12ci or R-19&11ci or R-21&11ci
R-20&5ci	R-13&11.5ci or R-15&10.9ci or R-19&10.1ci or R-21&9.7ci or R-25&9.1ci

ci = continuous insulation.

- a. The first value is cavity insulation *R*-value; the second value is continuous insulation *R*-value. Therefore, for example, "R-30&3ci" means R-30 cavity insulation plus R-3 continuous insulation."

Basement Walls

Large portion added explaining insulation for unconditioned basements

- Insulate floor over basement, including stairwell stringers
- Ensure **no uninsulated ducts** or hydronic systems, and no supply/return diffusers
- Walls surrounding stairway to be insulated
- Door insulated per R402.1.3 / R402.2 and weather stripped



Image source: <https://blog.delafleur.com/?p=5944>

Sunrooms and Heated Garages

Added heated garages to sunroom section as similar low-energy space types

- Must be **thermally isolated** from other conditioned spaces
- CZ 4 minimum ceiling insulation: R-19
- CZ 5 minimum ceiling insulation: R-24
- Minimum wall insulation: R-13
- Wall separating sunroom or heated garage from other spaces **fully insulated** per Table R402.1.2



Image courtesy: www.energy.gov

Parapets and Balconies

- Adds section to IECC model code on specific insulation requirements for these common thermal bridge locations. Refers to R605 in CETC
 - Continuous insulation wrap around balcony or parapet thermal bridge
 - R-3 minimum thermal break between assembly and plane of home thermal envelope.
 - *Exceptions for $\leq 1sf$ thermal bridge and R-5 occupancies*

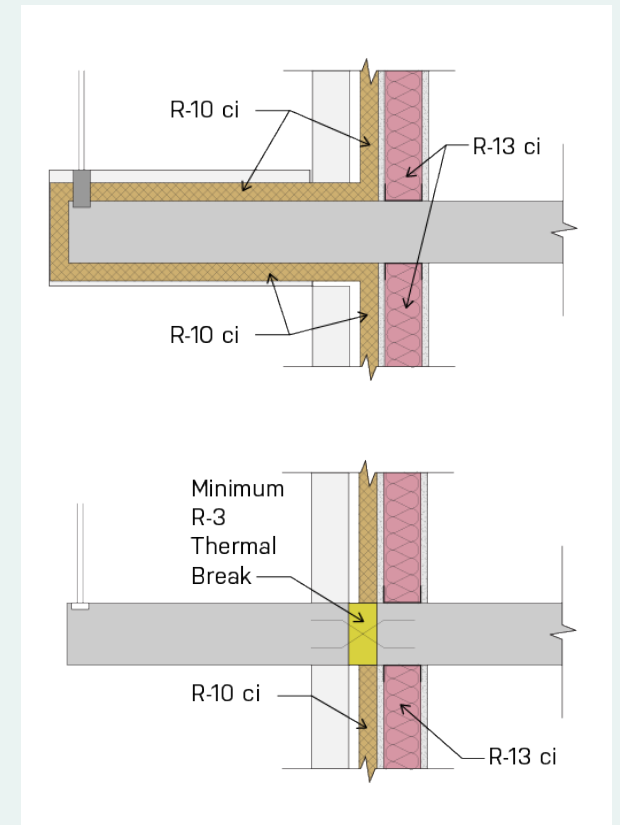


Table R402.4.1.1 Air Barrier, Air Sealing, and Insulation reference table updated

- Expanded air sealing list for foundations
 - Exposed earth covered with Class 1 vapor retarder
 - Penetrations through slab shall be air sealed
 - Class 1 vapor retarders **SHALL NOT** be used as the air barrier on below-grade walls
- Added detail for narrow cavities
 - Shall be air sealed if 1” or less and cannot be insulated.
- Added air sealing note around plumbing and utility penetrations



Image source: <https://basc.pnnl.gov/slab-penetrations>

Air Leakage Testing

Adds backstop to air leakage of 5.0 ACH for all compliance paths

Added testing exception for heated garages on 1- and 2-story homes and townhomes, must maintain thermal isolation.

Added specific procedure for **multi-family testing** (previously included as IL amendment)

- Enclosure area-based metric (0.30 cfm/sf) rather than ACH at 50 Pa
- Unguarded test – neighboring units not pressurized to same as test unit



Image source: <https://www.mncee.org/new-construction-services>

Ducts in Unconditioned Space

- No changes to duct insulation requirements
 - R-8 wrap on ducts if 3” or more in diameter
 - R-6 wrap if less than 3” in diameter
 - Ducts under slab insulated as above or have **equivalent Thermal Distribution Efficiency (TDE)**.
 - If using TDE method, must be labeled and listed with equivalent R-value.

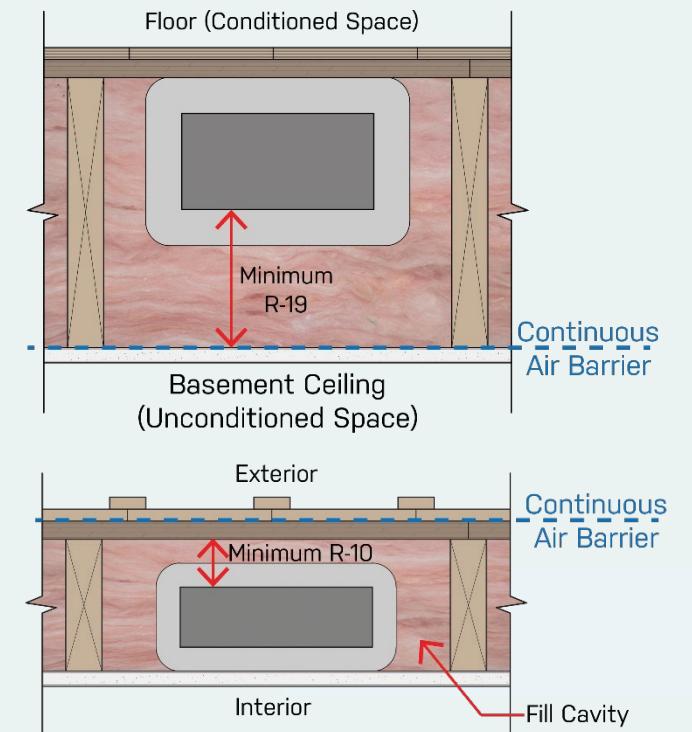
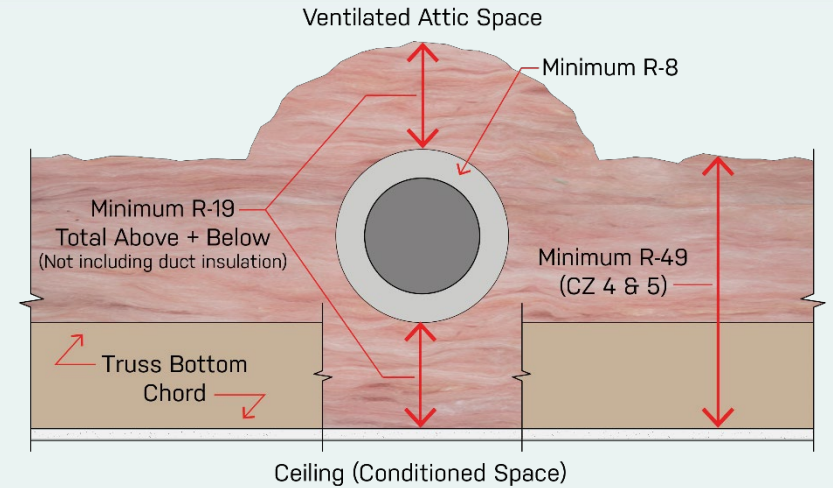


	A	B	C	D
1	Draft ASHRAE standard 152 duct efficiency calculations			
2	Jan-03		modified by PRC (location index and lookup values)	
3	Mar-11		fixed typo "Qemen" --> "Qeman" (NREL)	
4				
5	INPUT PARAMETERS			CALCULATED PAF
6		Value used in calculation	Notes	
7	Location Index	65	Chicago, IL	
8	Conditioned floor area, (ft ²)	1761		
9	Number of Stories	2		
10	Number of return Registers	3		Ground Temperature for basements, and slabs
11	House Volume, (ft ³)	14440	has a default of 8.2*Floor Area	
12	Supply Duct Surface Area, (ft ²)	357	has default equation	Fraction of supply duct outside conditioned space
13	Return Duct Surface Area, (ft ²)	198	has default equation	Fraction of return duct outside conditioned space
14	Fraction of supply duct in attic	1		Design Supply Duct Zone temperature, Heating, (F)

- TDE can be calculated using ASHRAE 152 methods. A spreadsheet is available at <https://www.energy.gov/eere/buildings/downloads/ashrae-standard-152-spreadsheet>

Ducts in Conditioned Space

- Clarifies definitions of conditioned space for ducts
 - Entirely within thermal envelope
 - Ductless or hydronic system within thermal envelope
 - Ducting qualifies as within **conditioned space** if:
 - Buried in attic insulation and sealed to 1.5cfm/100sf floor area
 - Ducts in floor cavities must have R-19 between duct and unconditioned space
 - Ducts in exterior walls must have R-10 between duct and exterior sheathing; rest of cavity filled with insulation



Duct Leakage Exceptions Added

- Rough-in Test: **4.0 cfm/100 sf with AHU installed, 3.0 cfm/100 sf without AHU.**
 - *Added Exception: 60 cfm for ducts serving $\leq 1,500$ sf*
- Postconstruction Test: **4.0 cfm/100 sf**
 - *Added Exception: 60 cfm for ducts serving $\leq 1,500$ sf*
- Ducts within Thermal Envelope: **8 cfm/100 sf**
 - *Added Exception: 60 cfm for ducts serving ≤ 750 sf*



<https://basc.pnnl.gov/resource-guides/total-duct-leakage-tests>

Ventilation Fan Efficacy

Fan Location	Min. Airflow Rate	Min. Efficacy [CFM/W]	Fan Location	Min. Airflow Rate	Min. Efficacy [CFM/W]
2021 IECC			2018 IECC		
HRV/ ERV	Any	1.2	HRV/ ERV	Any	1.2
In-Line	Any	3.8	In-Line	Any	2.8
Other	<90	2.8	Bath/ Utility	<90	1.4
Other	≥90	3.5	Bath/ Utility	≥90	2.8
Integrated with tested/listed HVAC	Any	1.2	Range Hood	Any	2.8

Grouped all common fans as “Other” and increased efficacy (bath, range, utility)

In-Line Fan efficacy increased

Added supply-only ventilation fans incorporated with tested and listed HVAC equipment efficacy.

Ventilation Fan Efficacy

Fan efficacy must be on fan label or in the product documentation
Can find fan information at HVI website:

<https://www.hvi.org/hvi-certified-products-directory/section-i-complete-product-listing/>

Product Category	Brand Name	Model	SP	Rated CFM	Rated Watts	Efficacy (CFM/W)	2021 IECC
Bathroom Exhaust Fans	Homewerks Worldwide	7140-50-G3	0.1	50	17	2.9	YES
Bathroom Exhaust Fans	Homewerks Worldwide	7140-50-G3	0.1	80	28	2.9	YES
Bathroom Exhaust Fans	Hampton Bay	1000750751	0.1	70	50	1.4	NO
Bathroom Exhaust Fans	Hampton Bay	1000750752	0.1	110	31.8	3.5	YES
Bathroom Exhaust Fans	Delta	100F	0.1	100	12.6	7.9	YES
Bathroom Exhaust Fans	Uberhaus	30395000	0.1	70	24.7	2.8	YES
Bathroom Exhaust Fans	Uberhaus	30395001	0.1	90	56	1.6	NO
Bathroom Exhaust Fans	Utilitech	553457	0.1	70	13.2	5.3	YES



Local Exhaust and Exhaust Discharge

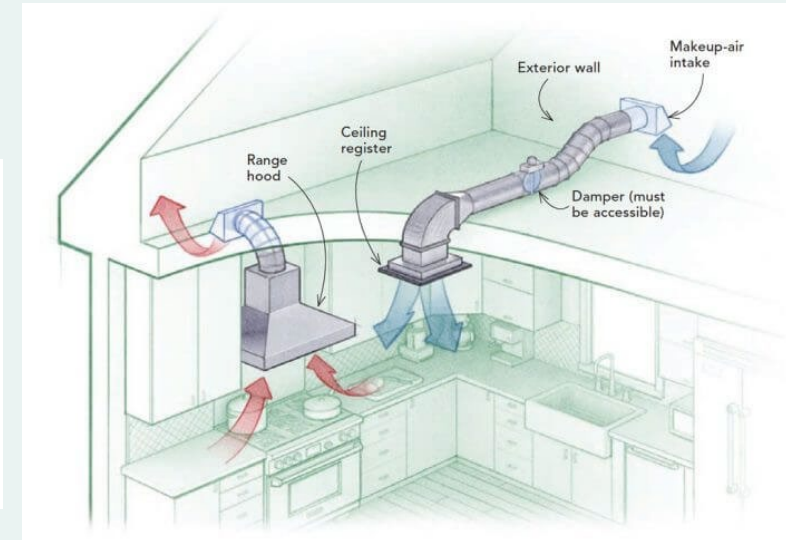
- Additional requirement in CETC R403.6.4
 - Contained in mechanical code, ported to energy code for clarity when designing.

Table 403.6.4
Minimum Required Local Exhaust Rates

Area to Be Exhausted	Exhaust Rate Capacity
Kitchens	100 cfm intermittent or 50 cfm continuous
Bathrooms and toilet rooms	50 cfm intermittent or 20 cfm continuous

For SI: 1 cubic foot per minute = 0.47 L/s.

- Additional requirement in CETC R403.6.5
 - Exhaust must discharge outside the envelope of the building, not in attic or crawl. Can't be near ventilation intake.
 - *Exceptions for whole-house fans in private dwellings and kitchen range hoods*

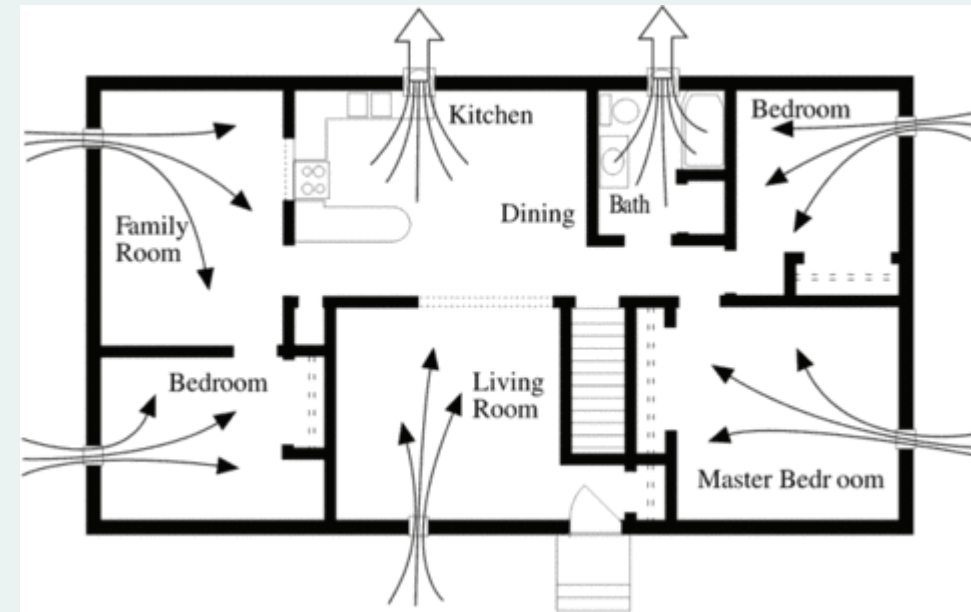


<https://kitchen.services/range-hood-duct-complete-guide/>

Ventilation Design

Additional details in 2022 CETC

- Required ventilation rate can be reduced 30% if supply air is ducted to all bedrooms and at least one of: living room, dining room, kitchen. Must be balanced supply/exhaust
- Ports over mechanical code ventilation requirement for clarity
 - $CFM = 0.03 \times CFA + 7.5 (N_{br} + 1)$
 - Can operate ventilation intermittently for not less than 25% of every 4hrs.



<https://www.buildinggreen.com/primer/fresh-air-supply-exhaust-only-ventilation>

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor ^a	4.0	3.0	2.0	1.5	1.3	1.0

a. For run-time percentage values between those given, the factors are permitted to be determined by interpolation.

b. Extrapolation beyond the table is prohibited.

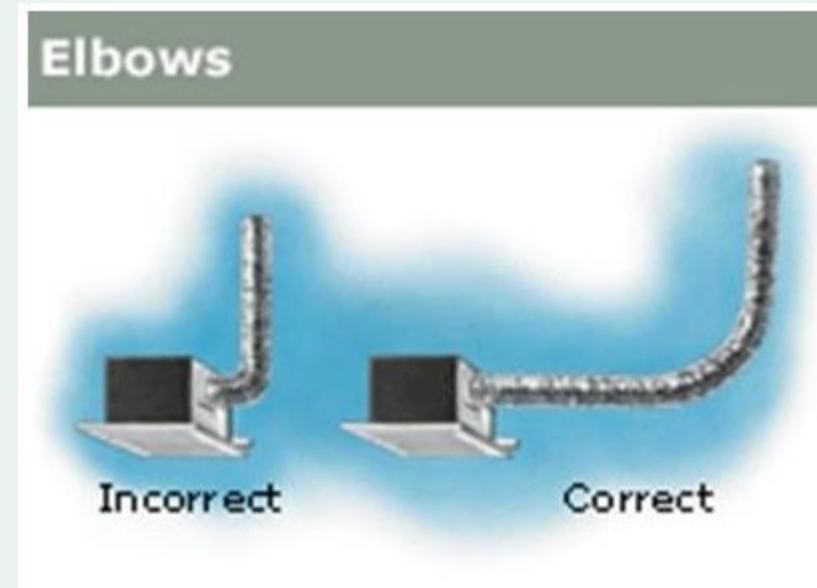
Ventilation Testing

Installed fans must now be **TESTED** to verify performance
Avoids issue of installing rated fan, but duct length and bends reduce flow rate.

- Exception for kitchen range hoods w/ 6" duct & at most 1 bend



<https://energyconservatory.com/applications/air-flow-devices/>



<https://basc.pnnl.gov/resource-guides/bathroom-exhaust-fans#edit-group-description>

Interior Lighting

- 2018 IECC: 90%+ of permanent lighting shall be high-efficacy
- 2021 IECC: **100%** of permanent lighting shall be high efficacy
- Does not impact non-permanent lighting sources like floor and desk lamps

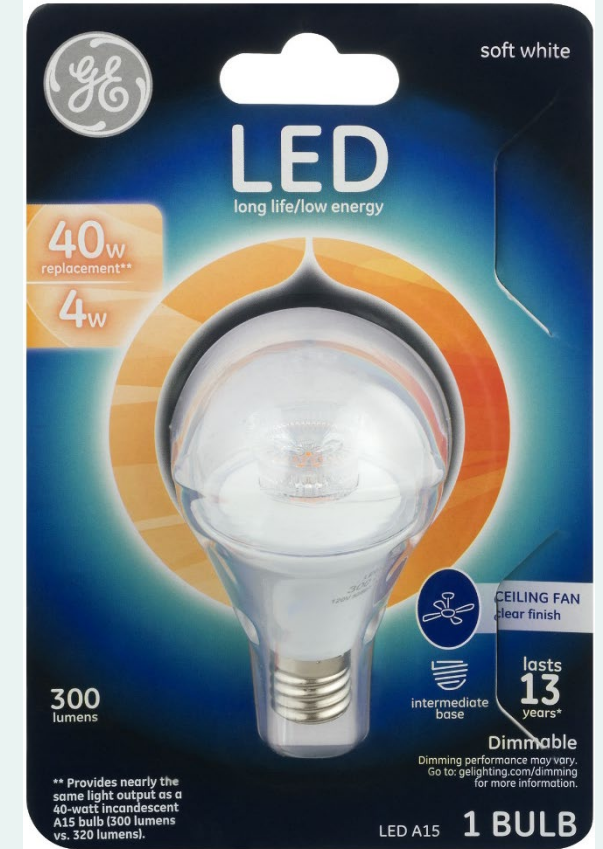


Image source: GE Lighting

Interior Lighting Controls

New requirement to 2021 IECC – Residential Lighting Controls

- **PERMANENTLY INSTALLED FIXTURES** shall have dimmer, occupant sensor control, or other control installed or built into fixture.
 - Exceptions include
 - Bathrooms
 - Hallways
 - Exterior lighting fixtures*
 - Lighting for safety or security

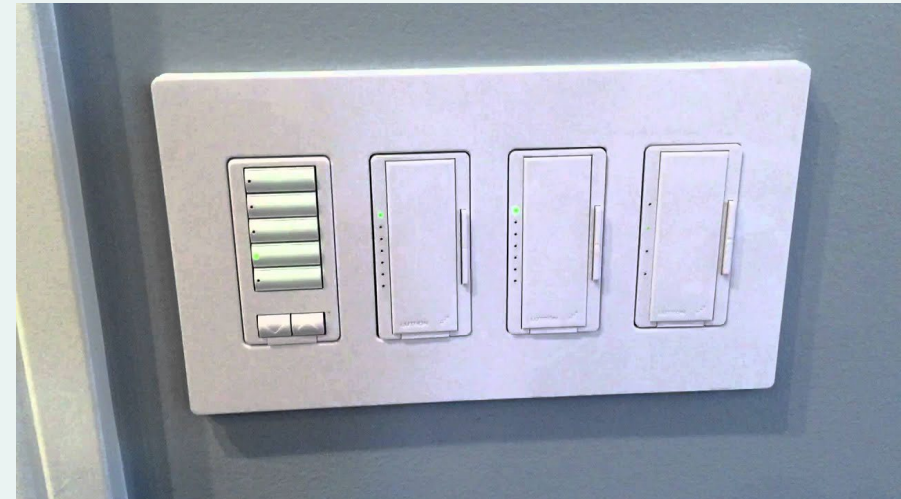


Image source:

<https://manuals.plus/lutron/wireless-lighting-control-manual#axzz7Xos3cbjA>

Exterior Lighting Controls

New to 2021 IECC – Exterior Lighting Controls

- **PERMANENTLY INSTALLED** outdoor lighting >30 W in total power required to turn off with adequate daylight
- Can be photocell or time clock
- Override permitted up to 24hrs
 - Must then return to automatic operation



Image source: cnet.com

Building Additions

Added clarification for change in space conditioning

- Examples: Converting garage to conditioned room, conditioning attic, etc...
 - Performance Path: If proposed design is 110% of reference design, addition is compliant
 - Performance Path: If Addition + Original Building energy cost is less than Original Building alone
 - UA Trade-off: Where UA of building + addition is less than UA of original building

Removed restriction to exception for extending existing ducts to addition

- No longer must be <40ft in unconditioned space to qualify for exception

Duct requirements have been relaxed

- **2018 IECC:** New HVAC ducts shall comply with R403,
 - If length of alteration <40ft in unconditioned space, don't need to test for leakage.
- **2021 IECC:** Altered HVAC ducts shall comply with R403,
 - If alteration is **extension of existing ducts to an addition**, exempt from R403

Change of Occupancy or Use

2018 IECC R505.1: **Any space** changing occupancy class that **increases demand** for energy shall comply with full energy code

2018 IECC R505.2: Any space converted to a dwelling unit...from another use or occupancy shall comply with this code

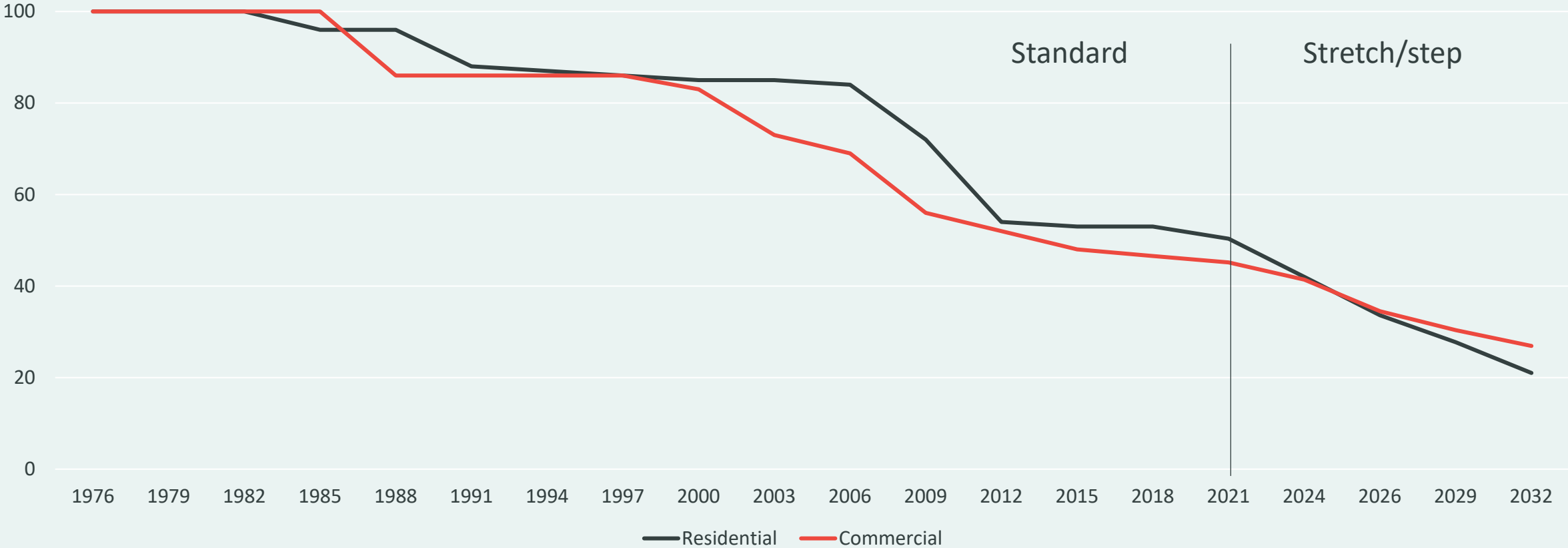
IECC R505.1.1: Any unconditioned or low-energy space altered to become conditioned space shall comply with R502-Additions



Image Source: <https://www.feldcochicago.com/garage-living-space/>

IL Stretch Code

Available starting July 2024



Slido 3

- For your residential clients that complain about energy code compliance, what aspects do they complain about? ie. Lack of enforcement, too much government intervention, too costly

Simplifying Code Compliance – Envelope Measures

Passive Strategies reduce HVAC size/loads

Buildings are systems of systems

Enhancing one area may simplify another

Better envelopes generally reduce HVAC needs

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

Even the best glazing performs like a poor wall



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 minimally-heated storage buildings and warehouses or high-performance buildings



Example semi-heated warehouse



Example semi-heated garage

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

If over 40%, must use performance compliance path

The image shows a detailed ENERGY STAR label for JELD-WEN windows and doors. The label is divided into several sections:

- ENERGY STAR Certified in Highlighted Regions:** Includes the ENERGY STAR logo and a map of the United States with highlighted regions. A legend indicates that the highlighted areas are certified.
- NFRC Certified:** Features the National Fenestration Rating Council (NFRC) logo and the word "CERTIFIED".
- JELD-WEN WINDOWS & DOORS:** Specifies the product as "Brickmould Vinyl Horizontal Slider" with "Double-glazing with Grid, Low-E and Argon fill" and provides the contact number "JEL-A-538-02573-00000".
- ENERGY PERFORMANCE RATINGS:** A table with the following data:

U-FACTOR		SOLAR HEAT GAIN COEFFICIENT	
FACTOR U	(Metric/SI)	COEFFICIENT	(Metric/SI)
0.30	(U.S./J-P)	1.70	(Metric/SI)
0.46			
- ADDITIONAL PERFORMANCE RATINGS:** A table with the following data:

VISIBLE TRANSMITTANCE		AIR LEAKAGE	
TRANSMITTANCE	(U.S./J-P)	INFILTRATION	(Metric/SI)
0.55		≤ 0.3	(U.S./J-P) ≤ 1.5 (Metric/SI)
- American Architectural Manufacturers Association:** Includes the AAMA logo and the text "Manufacturer of Certified Products".

At the bottom, it states "Manufacturer attests to performance to the applicable standard." There is also a small section on the right side of the label with text in Spanish: "PUÉS DE LA INSPECCIÓN...".

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. This 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 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



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% (area-weighted)** avoids need to install daylight responsive controls

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



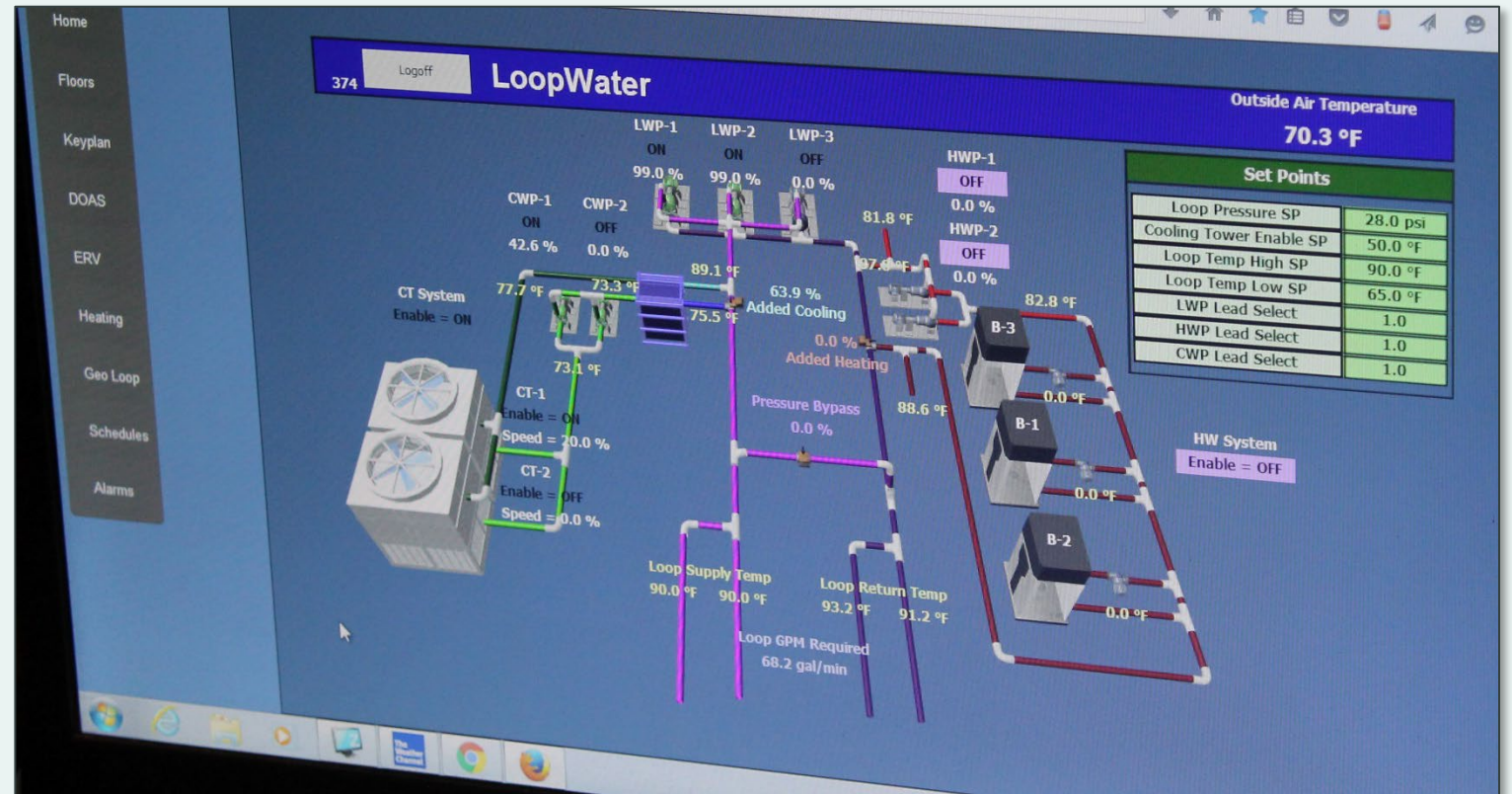
Consolidate Time Switch Controls (C405.2.7.2 & C405.2.7.3)

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



Simplify Commissioning (C408)

Simplifying controls simplifies commissioning



Simplifying Code Compliance – Residential

Passive House (R401.9)

Passive House Certifications simplifies Energy Code Compliance



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

Attic Access (R402.2.4)

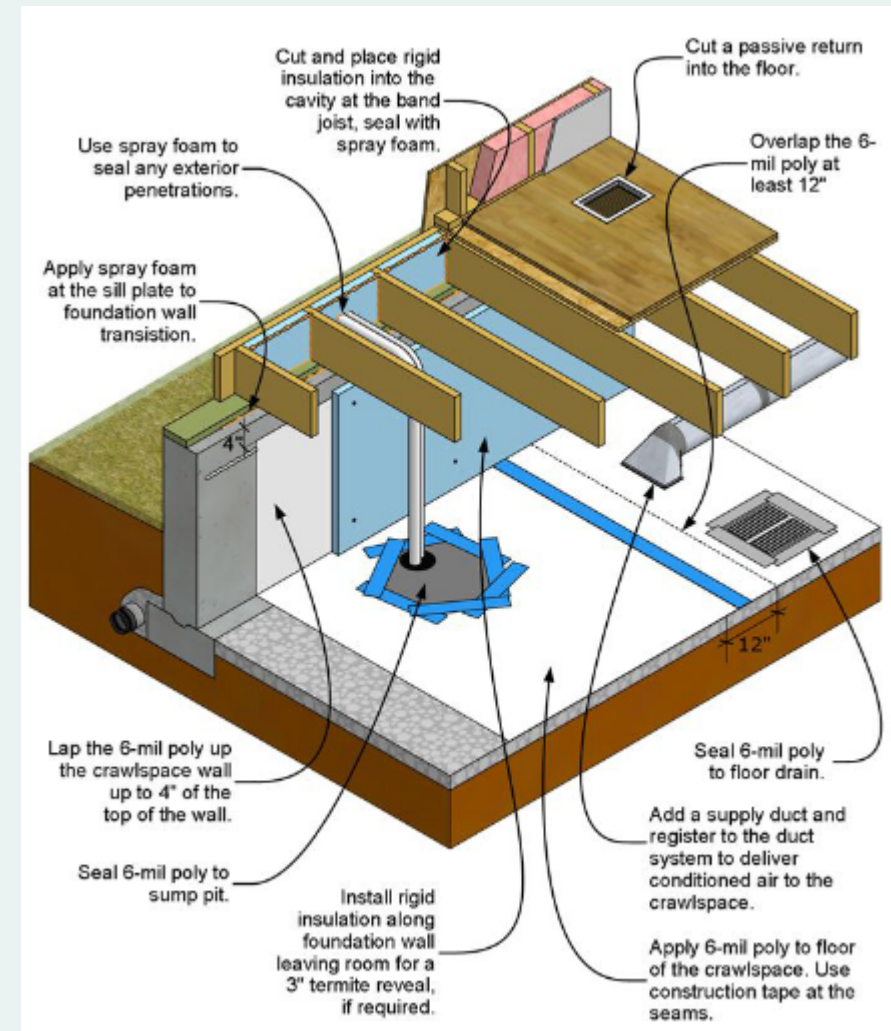
Installing unconditioned attic access outside the thermal envelope avoids needing to insulate and air sealed the access hatch.



Crawl Space (R402.2.10)

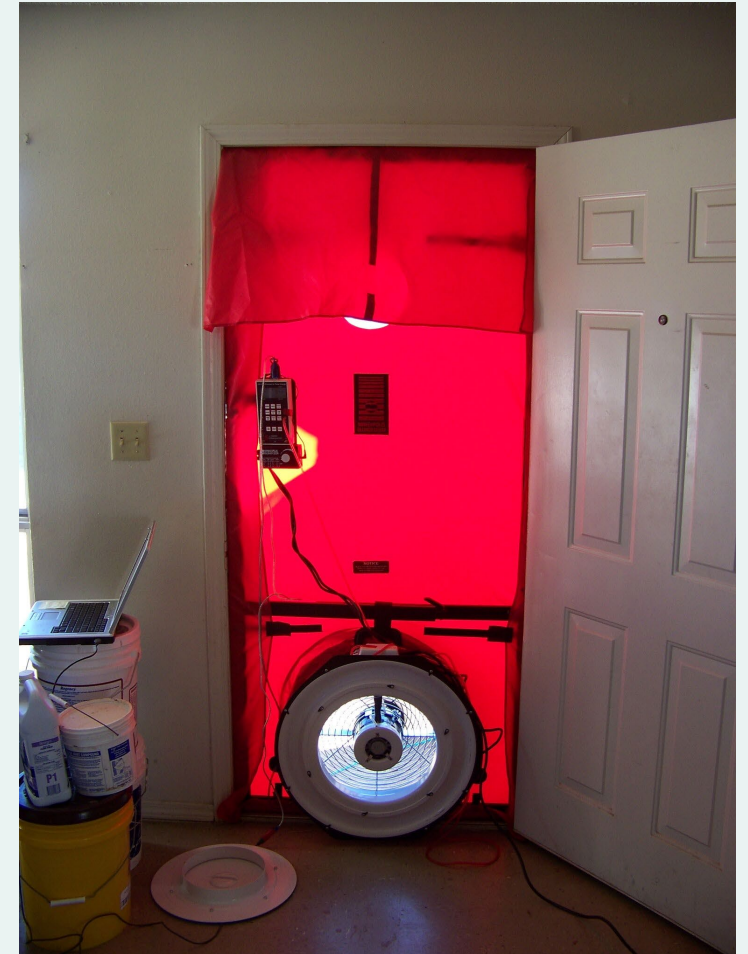
Treat crawl space as short basement to improve ease of insulation

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



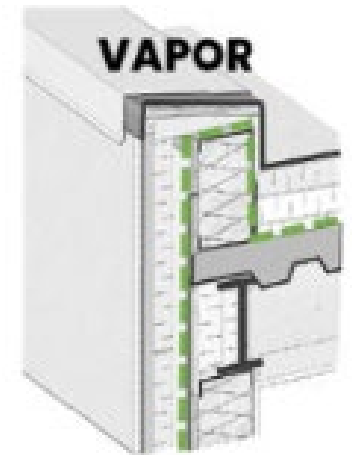
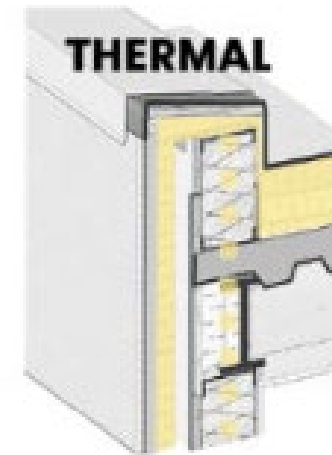
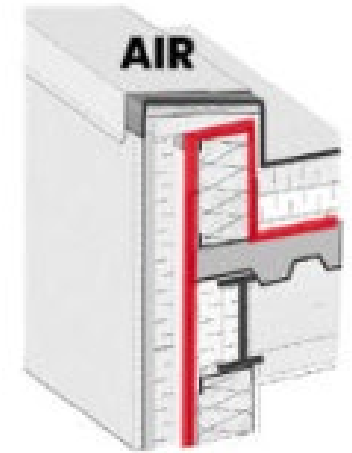
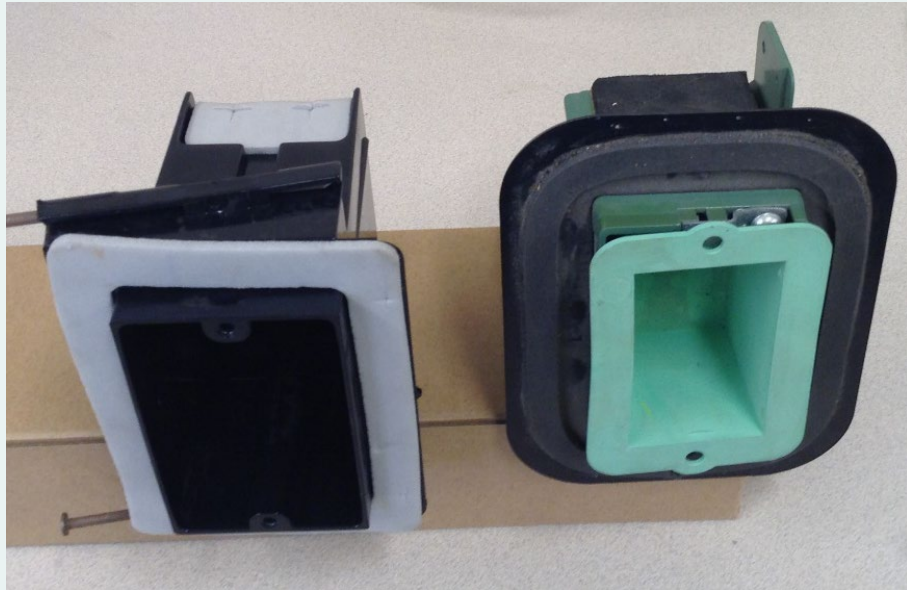
Improve Air Sealing Accuracy (R402.4.1.2)

- 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)

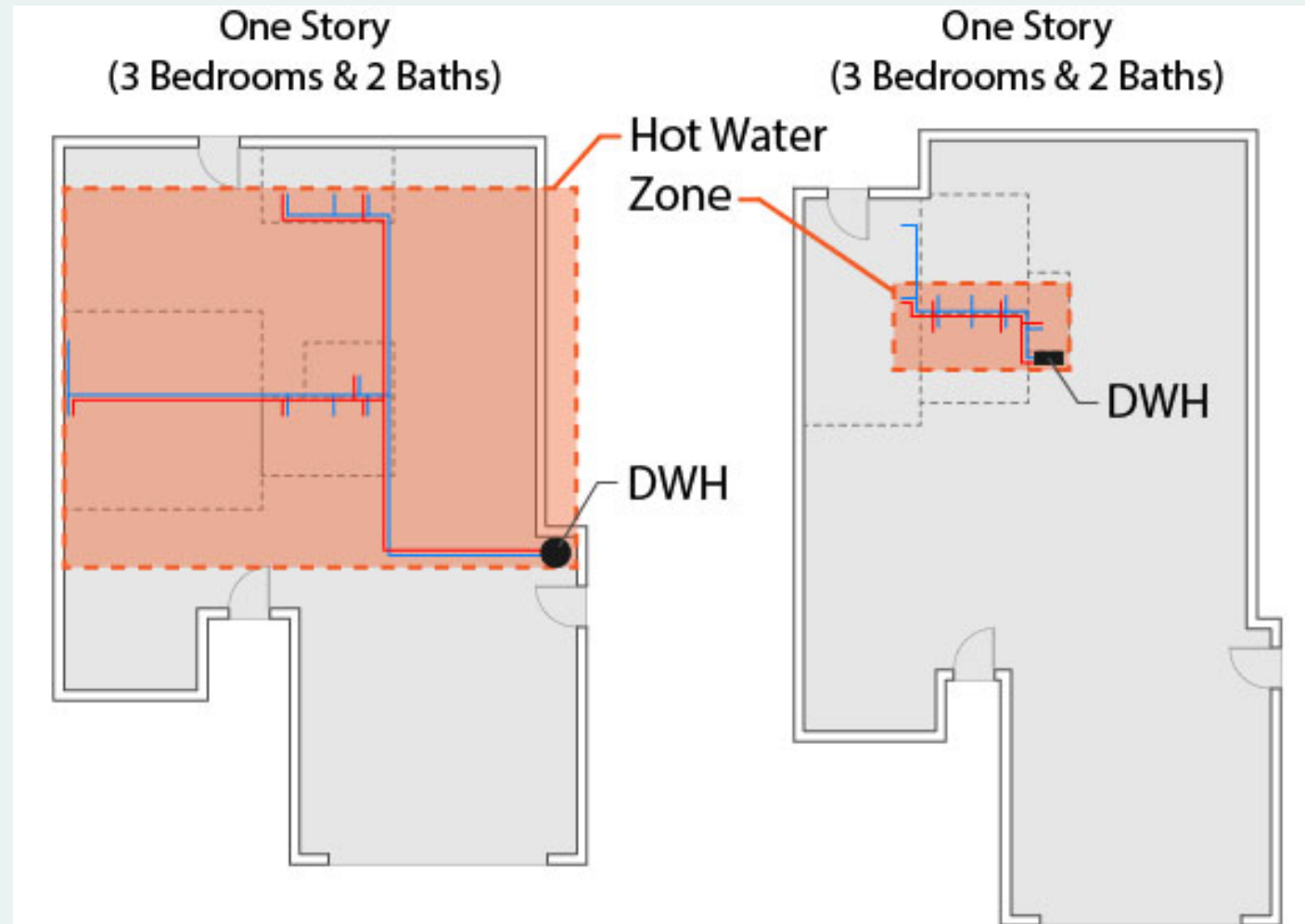
Ductwork inside thermal envelope lessens air sealing stringency (8CFM/100SF vs 4CFM/100SF).

Also avoids the cost of duct insulation.



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

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



Balanced Ventilation (R403.6.3)

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

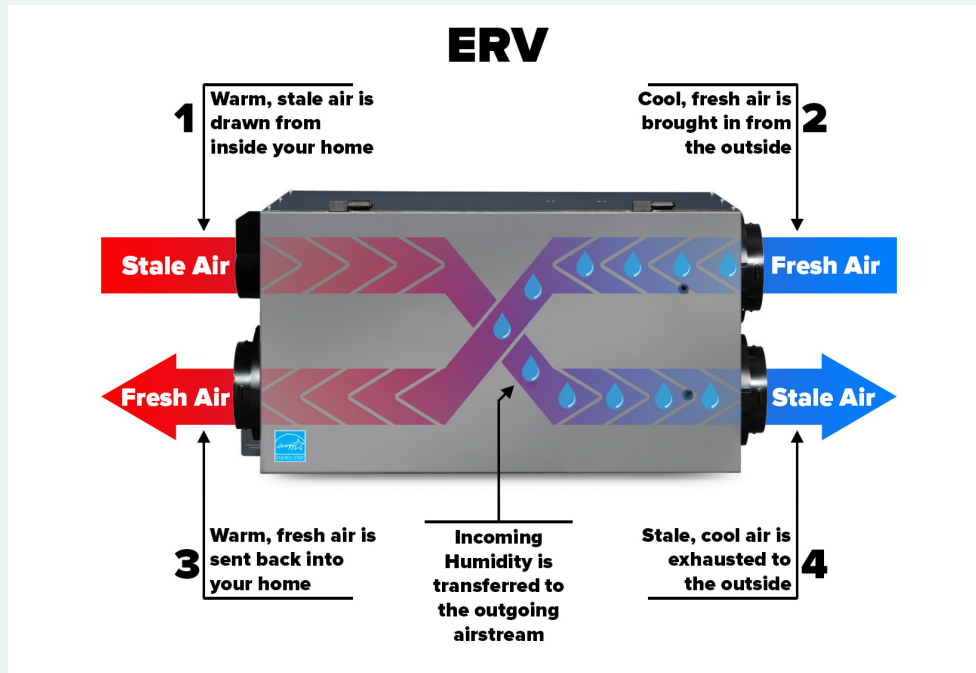


Image courtesy of Ferguson Supply

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.



**Energy Conservation
Code Compliance for Work
in Existing Buildings
IECC Chapter 5**

Repairs (C504/R504)

The following guidelines should be considered when applying the Chicago Energy Conservation Code to work in existing buildings:

REPAIRS are "the reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage."

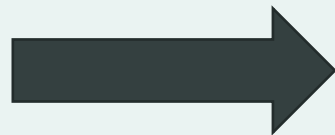
The Energy Conservation Code does not have requirements for repairs other than to not increase building energy consumption. Repairs include:

- a) Glass-only replacements in existing sash and frame;
- b) Roof repairs;
- c) Where only the bulb, ballast or both within existing luminaires provided lighting power is not increased;
- d) Ordinary repairs that are exempt from building permits

Additions (C502/R502)

ADDITIONS to existing buildings may comply in a number of ways, but in general, **only the newly-built portion must comply with the new construction requirements of the Energy Conservation Code.**

In many cases, the licensed design professional will submit a report generated by compliance software, such as REScheck or COMcheck to demonstrate compliance for additions and new construction or may just use the prescriptive requirements.



COMcheck-Web™

New Project PROJECT ENV

Code/Location

Code: 2018 IECC

State: Illinois

City: Chicago

If your location is not included here, choose a nearby location with similar weather conditions.

Project Type

New Construction Addition Alterations

Project Details (optional)

Additions (C502/R502)

In some circumstances, improvements to the energy efficiency of the pre-existing building may allow relaxed requirements to apply to the addition.

One may model the whole building to demonstrate compliance and not just the addition.



Alterations (C503/R503)

ALTERATIONS are "any construction, retrofit, or renovation to an existing structure other than repair or addition that requires a permit [or] a change in a building, electrical, gas, mechanical, or plumbing system that involves an extension, addition, or change to the arrangement, type, or purpose of the original installation."



Alterations (C503/R503)

ALTERATIONS shall be such that the existing building or structure is not less conforming to the provisions than prior to the alteration.



Alterations (C503/R503)

ALTERATIONS shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.



Alterations (C503/R503)

The following alterations need ***not*** comply with the requirements for new construction, *provided that the energy use of the building is not increased:*

1. Storm windows installed over existing fenestration
2. Surface-applied window film installed on existing single-pane fenestration assemblies reducing solar heat gain, provided that the code does not require the glazing or fenestration to be replaced
3. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation
4. Construction where the existing roof, wall or floor cavity is not exposed
5. Roof recover (see definition)

Alterations (C503/R503)



Definition of terms:

ROOF RECOVER: The process of installing an additional roof covering over an existing roof covering without removing the existing roof covering.

ROOF REPAIR: Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

ROOF REPLACEMENT: The process of removing the existing roof covering, repairing any damaged substrate including insulation or sheathing and installing a new roof assembly.

Roof Membrane Peel & Replacement

*This provision is narrow and not likely to apply as flat roofs are rarely replaced before there is a leak which would require work to be carried out on the roof insulation, eliminating the ability to use the provision.

Roof membrane peel and replacement – Where an existing weather resisting roof membrane is removed, exposing insulation or sheathing, only a new weather resisting roof membrane is installed.

This is also known in the City of Chicago as roof covering replacement.

REPEALED

Existing Condition Constraints on Added Code Required R-value:

C503.2.1 and R503.1.1 recognizes potential existing constraints to adding additional insulation required by the Code.

These sections allow for an accommodation in the required amount of insulation during replacement if the height of the installation would require other elements not part of the scope of work to be changed.

Need to install what will fit up to the level required by Code

C505/R505 Change of Occupancy or Use

Spaces undergoing a change in occupancy that would ***increase demand*** for energy need to be brought into full compliance



Images courtesy of
<https://architazer.com/projects/lampwork-lofts/>

R503.1 Alterations Exception

The following are not required to comply with the Energy Code provided the energy use of the building is not increased:

1. Storm windows over existing fenestration
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation
3. Construction where the existing roof, wall or floor cavity is not exposed
4. Roof recover (See definition)
5. Roofs w/o insulation in the cavity and where the sheathing or insulation is exposed during the reroofing shall be insulated either above or below the sheathing
6. Surface applied window film installed on existing single pane fenestration to reduce solar heat gain provided that the code does not require the glazing or fenestration to be replaced

Slido 4

- If you could change one thing that building officials do that causes you grief, what would that be?

Examples

Replacing HVAC unit

New unit needs to meet current requirements applicable to the unit i.e., heat/cooling load calculation, equipment sizing, economizer w/ fault detection, controls, demand control ventilation, etc.



<https://www.achrnews.com/articles/142042-rooftop-manufacturers-are-ready-for-2023-efficiency-standards>

Lighting Replacement

Replacing more than 10% of light fixtures in a space requires compliance with the current requirements ie. lighting power density, controls, etc.



Fenestration Replacement

New fenestration needs to meet the U-factor, SHGC, and air leakage requirements

Increasing area beyond C402.4.1 isn't allowed, area can be maintained if already exceeding, though.



<https://www.energy.gov/energysaver/update-or-replace-windows>

Slido 5

- What feedback mechanism do you provide to contractors to learn details that are easier to construct well?



Questions?

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