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AIA
Approved
Continuing
Education

Learning Objectives

1. Understand the organization and intent of the 2022 *Chicago Energy Transformation Code*.
2. Understand key changes from the 2019 *Chicago Energy Transformation Code* due to changes in the 2021 *International Energy Conservation Code* (model code) and local amendments.
3. Determine and document a project's compliance with the 2022 *Chicago Energy Transformation Code* for permitting.
4. Find additional energy code resources.
5. Apply Chicago-specific provisions of the 2022 *Chicago Energy Transformation Code* to a project.

AIA Approved Continuing Education

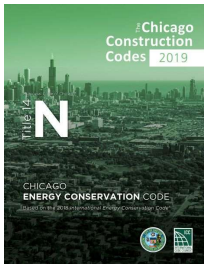
Katie Kaluzny
Illinois Green Alliance

Saagar Patel
ESD

Emily Purcell
SCB

Grant Ullrich
City of Chicago Department of Buildings

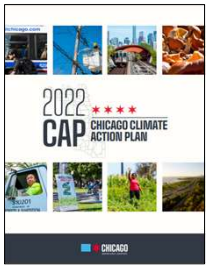
Chicago's Commitment on Energy and Climate



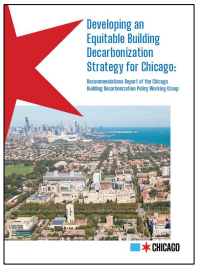
2019 Energy Code
eff. June 1, 2019

Climate Crisis Resolution
February 2020

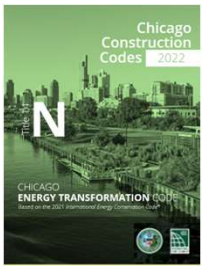
Green Recovery Agenda
April 2021



2022 Climate Action Plan
April 2022

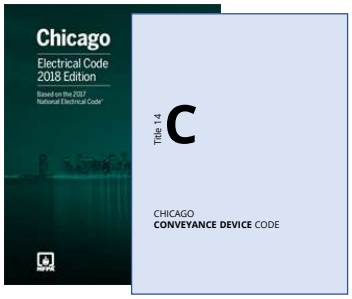


Decarbonizing Chicago's Buildings Report
October 2022



2022 Energy Code
eff. Nov. 1, 2022

Implementing Chicago's Climate Commitment Through Construction Codes

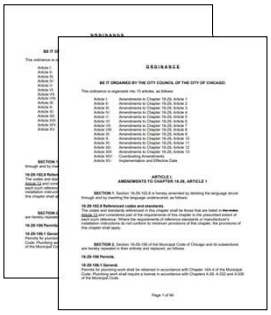


Electrical Code September 2017

Conveyance Device Code March 2018

Phase 1
2017-18

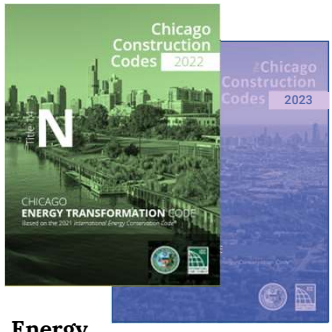
Phase 2
April 2019



Interim Mechanical Amendments September 2021

Interim Plumbing Amendments October 2021

Phase 3A
2021



Energy Code

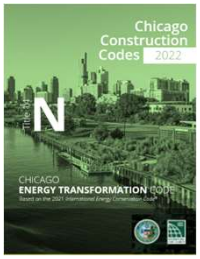
Mechanical Code

Phase 3B
2022-2023

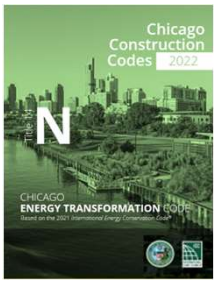
Overview

1. Code organization and intent
2. Key code changes from 2021 IECC and local amendments
3. How to determine and document compliance
4. Additional resources

Chicago Construction Code + Zoning Ordinance

A Chicago Construction Codes Administrative Provisions	**B** Chicago Building Code	**C** Chicago Conveyance Device Code	**E** Chicago Electrical Code	**F** Chicago Fire Prevention Code	**G** Chicago Fuel Gas Code
M Chicago Mechanical Code		**P** Chicago Plumbing Code	**R** Chicago Building Rehabilitation Code	**X** Minimum Requirements for Existing Buildings	**Chicago Zoning Ordinance**

Energy Code Organization



~~Commercial buildings~~

Everything else

C

R

Non-transient residential up to 4 stories

Energy Code Organization

Everything else **C**

- C1 Scope and Purpose
- C2 Definitions
- C3 General Requirements
- C4 Commercial Energy Efficiency
- C5 Existing Buildings
- C6 Chicago-specific Requirements
- C7 Referenced Standards

R Non-transient residential up to 4 stories

- R1 Scope and Purpose
- R2 Definitions
- R3 General Requirements
- R4 Residential Energy Efficiency
- R5 Existing Buildings
- R6 Chicago-specific Requirements
- R7 Referenced Standards

Energy Code Intent

The intent of this code is to regulate the design and construction of *commercial/residential buildings* for the effective use and conservation of energy over the useful life of each *building* and for the reduction of carbon emissions caused by use and occupancy of *buildings* built and renovated under this code. This code is intended to provide flexibility to allow the use of innovative and cost-effective approaches and techniques to achieve these objectives. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Energy Code Intent

- Regulates building design and construction for:
  - Effective **use and conservation of energy** over useful life
  - **Reduction of carbon emissions** caused by use and occupancy.
- **Flexibility** to allow the use of innovative and cost-effective approaches and techniques to achieve these objectives.
- Does not abridge **other applicable requirements** for safety, health, or environment.

What is Energy Transformation?

Energy Efficiency + **Clean Energy** = **Energy Transformation**

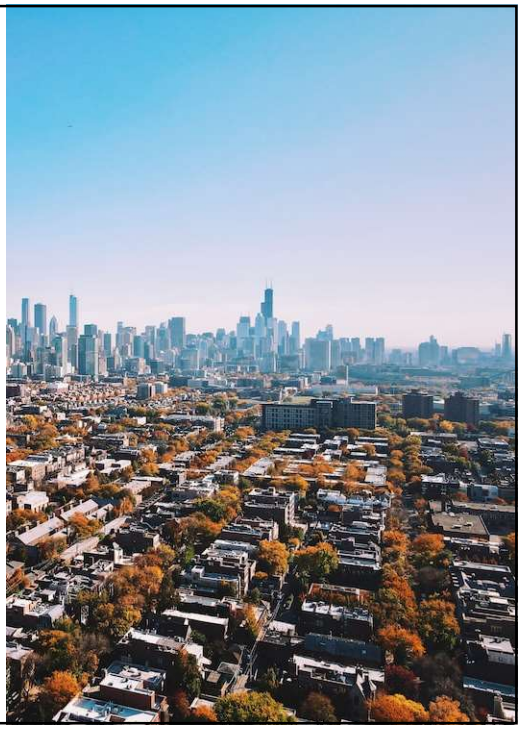
- **Save energy first** with more efficient building envelope and building systems.

- **Prepare for a clean energy transition** by requiring new buildings with gas appliances to have infrastructure for future electrification.

- **Make future solar easier** by requiring new buildings with large flat roofs to be structurally reinforced for future solar panels.

Existing Buildings (Chapter 5)

- Repairs cannot decrease compliance
- For alterations:
  - New elements must comply
  - Existing elements, not being touched, don't need to be upgraded
- For additions: 3 options
- Change in use that increases use of electricity or fossil fuel, creates new conditioned space, or creates or expands a dwelling unit



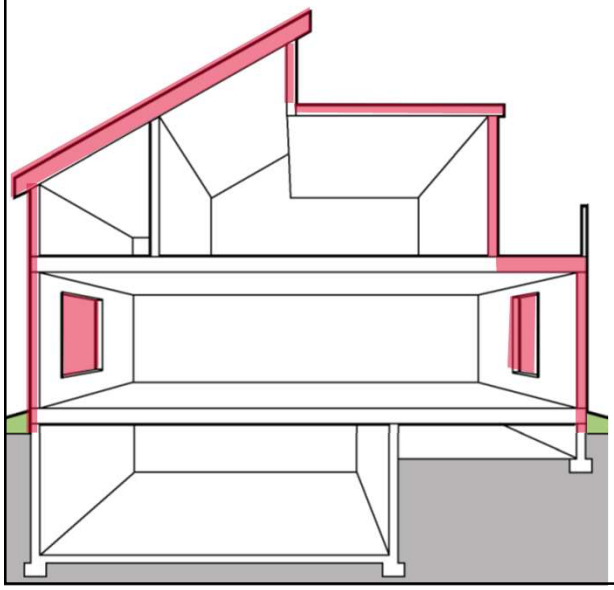
Key changes from 2019 to 2022

Key Changes in the 2021 IECC®

Residential Building Envelope

- Increased insulation requirements and reduced fenestration U-factors and solar heat gain coefficients (SHGCs)
- Revised air leakage requirements
- Revised duct testing requirements

Residential Building Envelope



- Fenestration U-factor: no change
- Skylights U-factor: no change
- Glazing SHGC: NR → 0.40
- Wood frame ceiling/roof: R49 → R60
- Wood frame wall
  - R20 → R30
  - R13 + 5ci → R20 + 5ci / R13 + 10ci / 20ci
- Mass wall: no change
- Floor: no change
- Bsmnt/crawl wall: R19 / 15ci / R13 + 5ci
- Slab edge: 2ft → 4ft

Key Changes in the 2021 IECC®

Residential Mechanical Systems

- Clarification on duct location and insulation requirements
- Removed exception for duct testing in conditioned spaces
- New mechanical ventilation system testing requirements



Key Changes in the 2021 IECC®

Residential Electrical Power and Lighting Systems

- All permanent lighting must be high-efficacy (up from 90%)
- Most interior lights require dimmer or occupant sensor, with exceptions for bathrooms, hallways, stairs
- Exterior lighting requirements for multifamily buildings must comply with commercial requirements



Key Changes in the 2021 IECC®

Residential ERI Compliance Alternative

- ERI values have been lowered. (Reduces allowed energy usage)
- 5 percent energy reduction



Key Changes in the 2021 IECC®

Residential "Additional Efficiency" Required

- New requirement for additional efficiency measures in residential buildings
- Pick two of five options:
  - Enhanced envelope performance
  - More efficient HVAC equipment performance
  - Reduced energy used in service water heating
  - More efficient duct distribution system
  - Improved air sealing for ventilation system



Local Amendments: Residential

Effective 11/1/22

- Incorporate state amendments:
  - Phius 2021 alternative compliance path
- Adopt additional Chicago provisions:
  - NGBS 2020 (gold or emerald) as alternative compliance path
  - Prohibit new gas lighting
- Differences from Illinois proposals:
  - Reroofing (same language from 2018)
  - Masonry wall insulation (language from 2017 memo)
  - Illinois-specific whole-house ventilation
  - Envelope requirements for cold-formed steel based on 2024 proposals from AISC

Local Amendments – Energy Transformation

Effective 1/1/23

- Adopt additional Chicago provisions:
  - New residences with individual gas-fired appliances must be built with electrical capacity and wiring for future electrification
  - Solar-ready zone for residential exceeding 3 stories and 7,500 ft^2 ground-level footprint
  - Enhanced thermal break requirements for most parapets and exterior balconies

Key Changes in the 2021 IECC®

Commercial Building Envelope (prescriptive)

- Increased insulation requirements and reduced fenestration U-factors and solar heat gain coefficients (SHGCs)
- Expanded requirements for envelope air leakage testing and verification
- New provisions for operable openings: interlocking and mandatory controls



Key Changes in the 2021 IECC®

Commercial Mechanical Systems (prescriptive)

- Updated equipment efficiency requirements
- Refinement of energy recovery ventilation (ERV) system requirements
- Updated fan efficiency metric


Key Changes in the 2021 IECC®

Commercial Electrical Power and Lighting Systems (prescriptive)

- Increased lighting efficacy and decreased lighting power density requirements
- New provisions for plant growth lighting
- New provisions for automatic receptacle control (*aligned with* ASHRAE)
- New provisions for energy metering and monitoring (*aligned with* ASHRAE)



Key Changes in the 2021 IECC®

Commercial "Additional Efficiency" Options

- Increased number of "additional efficiency" options allowed to meet code
- Reorganized section C406 for clarity



Local Amendments - Commercial

Effective 11/1/22

- Incorporate state amendments:
  - Fenestration orientation
  - Lighting for plant growth and maintenance
  - Incentivize grid-integrated controls
- Adopt additional Chicago provisions:
  - Recognize Phius 2021 and NGBS 2020 (gold or emerald) as alternative compliance paths
  - Prohibit new gas lighting
- Modified for Chicago
  - Low-slope reroofing (same language from 2018)
  - Masonry wall insulation (language from 2017 memo)
  - Envelope requirements for cold-formed steel

Local Amendments – Energy Transformation

Effective 1/1/23

- Adopt additional Chicago provisions:
  - New residences with individual gas-fired appliances must be built with electrical capacity and wiring for future electrification
  - Solar-ready zone for flat roofs on buildings up to 60 feet high, exception for buildings with footprint less than 7,500 ft^2
  - Enhanced thermal break requirements for most parapets and exterior balconies

Determining and Documenting Compliance

Today

- Form 408 (PDFs)
- ResCheck (2021 IECC) + Chicago Requirements
- ComCheck (2021 IECC) + Chicago Requirements

Coming Soon!

- Interactive Compliance Form (replaces Form 408)
- ResCheck (2022 CETC)
- ComCheck (2022 CETC)

Determining and Documenting Compliance

Chicago.gov/energycode

Compliance Methods (Residential)

The residential provisions of the *Chicago Energy Transformation Code* apply to Group R-2, R-3, R-4, and R-5 occupancies with no more than four stories above grade plane. Residential projects must demonstrate compliance with the code using one of the following methods:

REScheck compliance certificate (2021 IECC) −

Use the U.S. Department of Energy's REScheck software to demonstrate compliance with the 2021 *International Energy Conservation Code* (IECC). The professional who completes the Compliance Statement is responsible for ensuring that the project meets additional requirements of the *Chicago Energy Transformation Code* that are not reflected in REScheck.

Upload to ProjectDox

- Construction documents that include all information required by Section 14A-4-411.3.13 of the *Chicago Construction Codes Administrative Provisions*
- Completed 2022 Chicago Energy Transformation Code Compliance Statement
- Compliance certificate generated from REScheck for IECC 2021

During and After Construction

- Build the project in accordance with the approved construction documents and the *Chicago Construction Codes*.
- Perform testing as required by Sections R402.4.1.2 (building envelope) and R403.3.5 (ducts), as applicable.
- Install an Energy Code Compliance Data Certificate as required by Section R401.3.

REScheck compliance certificate (2022 CETC) +

CETC Prescriptive Path +

Resources

Chicago.gov/energycode

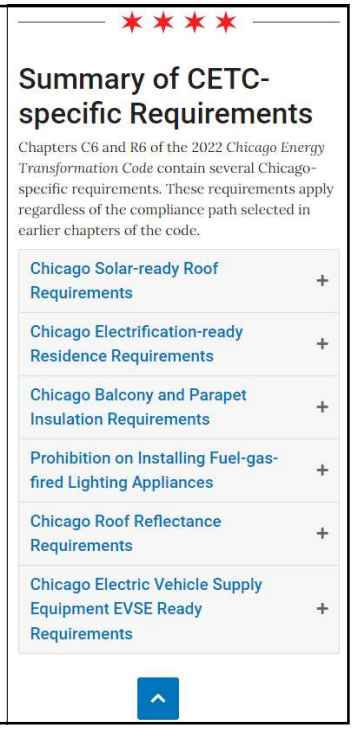
- Summary of compliance methods
- Summary of CETC-specific requirements

Smart Energy Design Assistance Center (SEDAC)

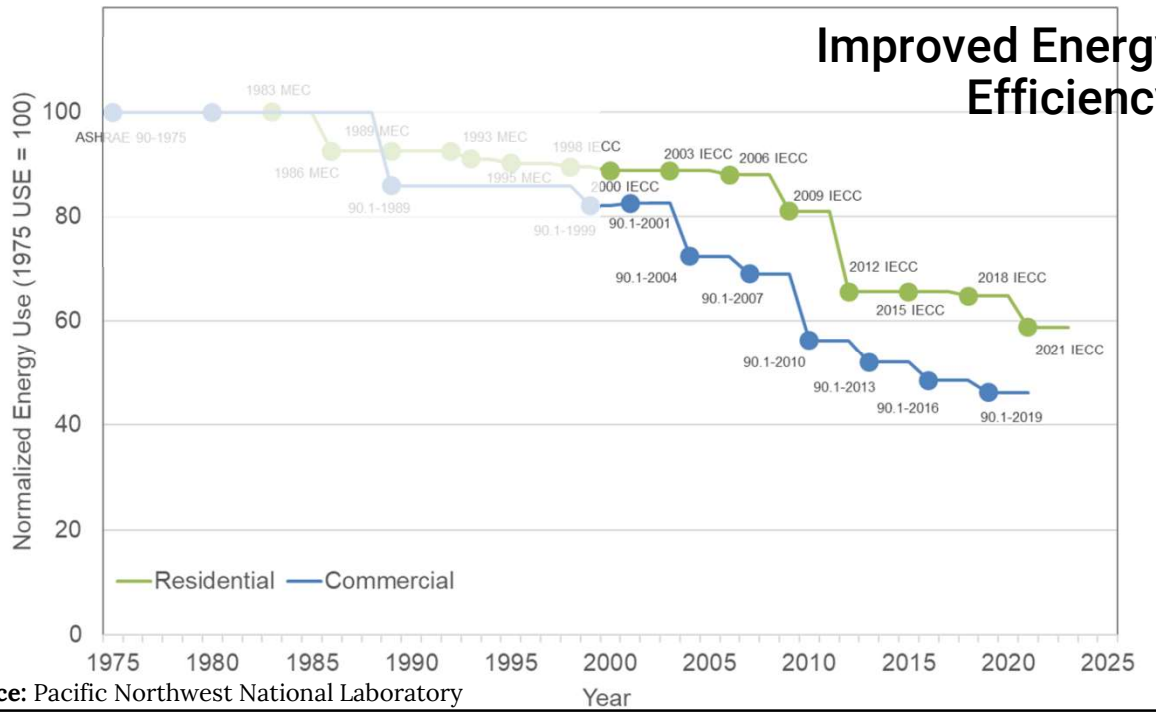
- smartenergy.Illinois.edu

US Department of Energy

- energycodes.gov
- basc.pnnl.gov (Building America Solutions Center)



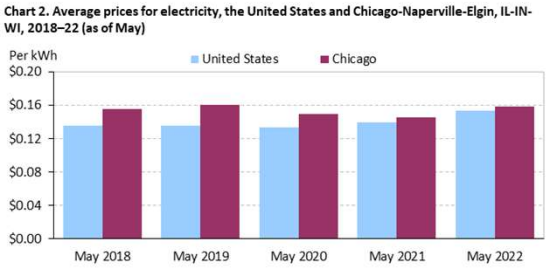
Improved Energy Efficiency



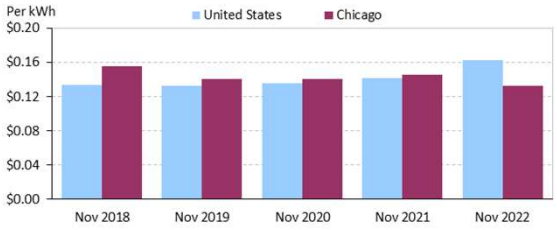
Source: Pacific Northwest National Laboratory

Electricity ($/kWh)

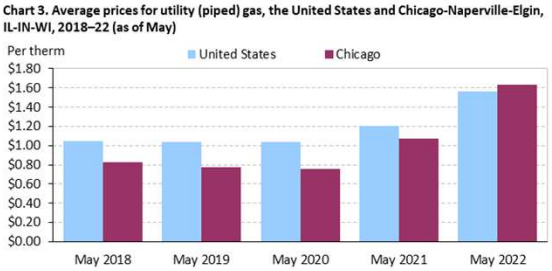
May

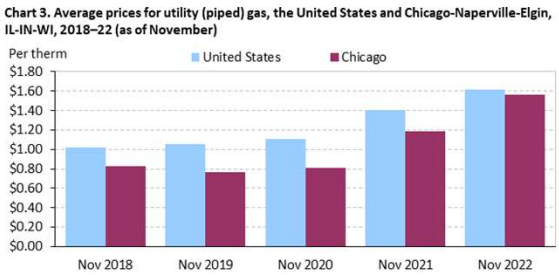


November



Piped Gas ($/therm)



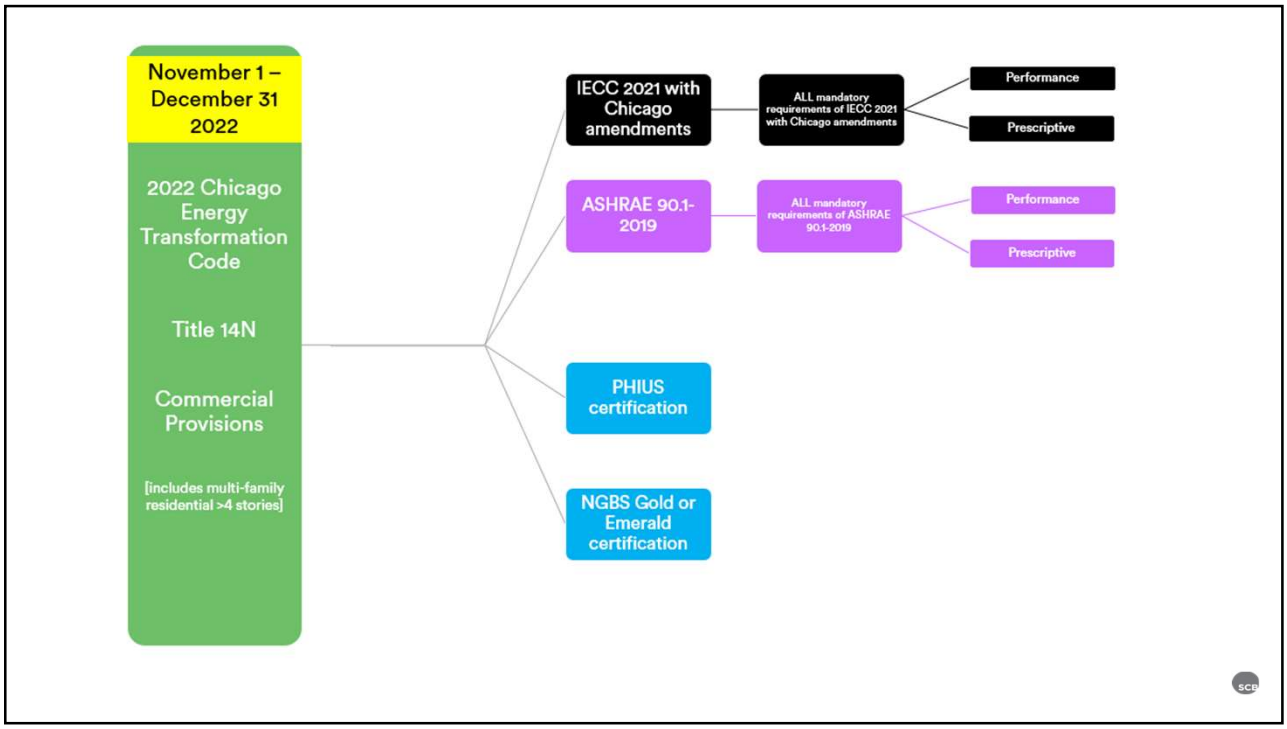


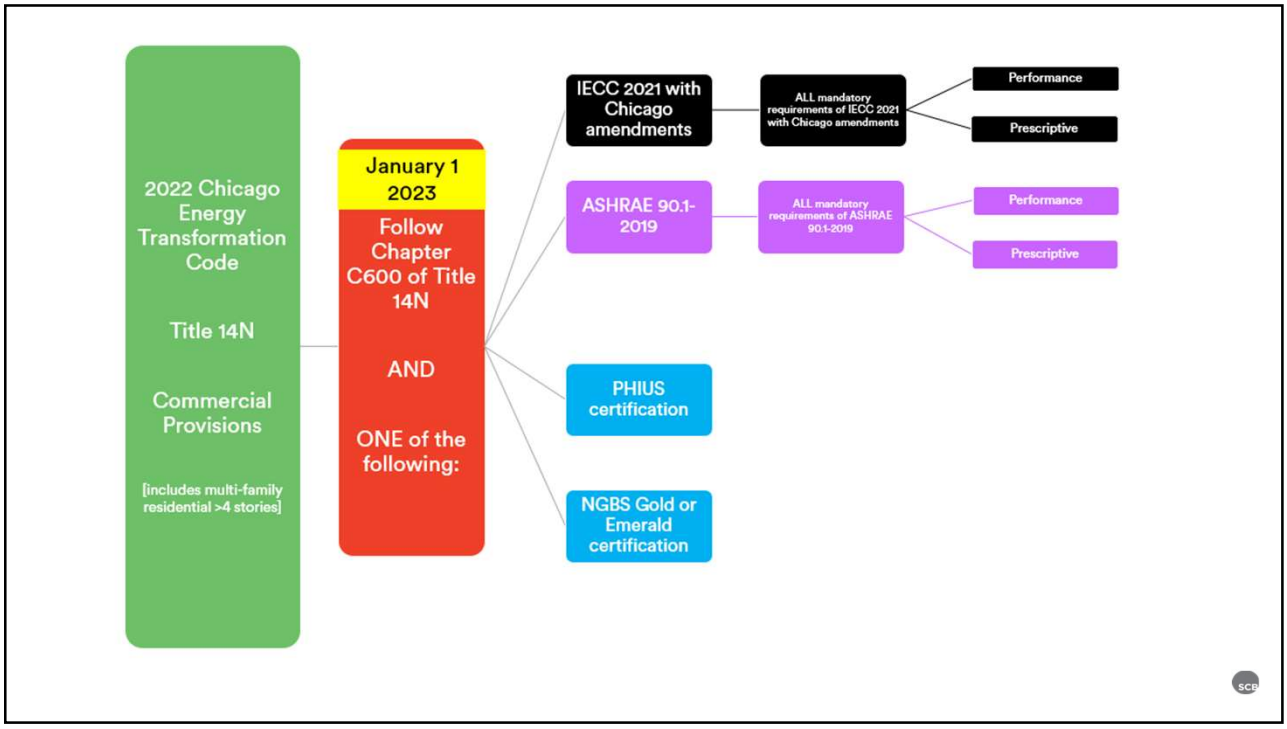
Source: U.S. Bureau of Labor Statistics

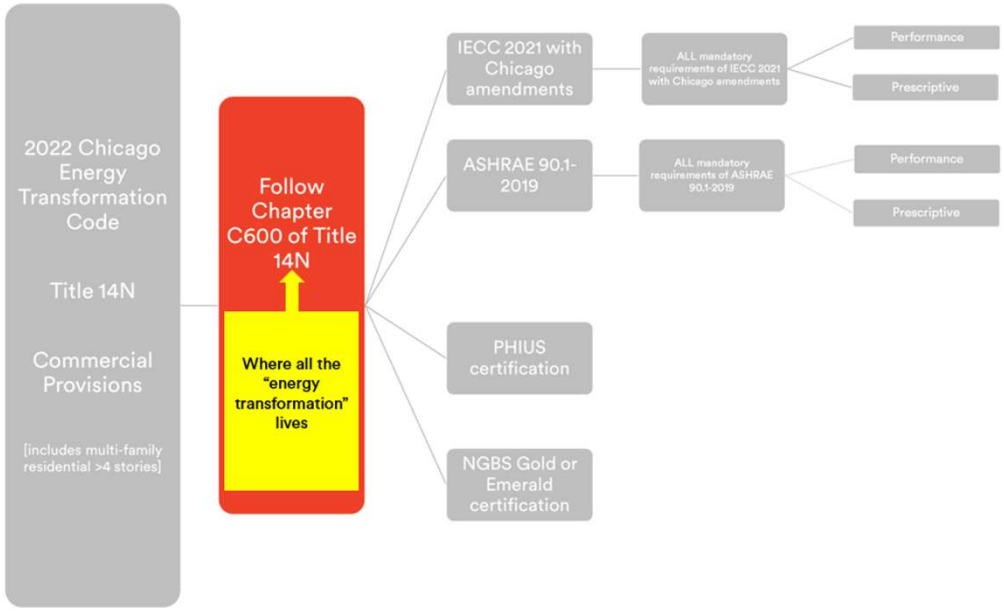
Chicago Area Energy Prices

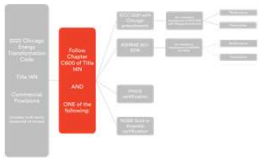
Chicago Energy Transformation Code

Highlights for Architects


November 1 – December 31 2022
2022 Chicago Energy Transformation Code
Title 14N
Commercial Provisions
[includes multi-family residential >4 stories]
IECC 2021 with Chicago amendments
ALL mandatory requirements of IECC 2021 with Chicago amendments
Performance
Prescriptive
ASHRAE 90.1-2019
ALL mandatory requirements of ASHRAE 90.1-2019
Performance
Prescriptive
PHIUS certification
NGBS Gold or Emerald certification


2022 Chicago Energy Transformation Code
Title 14N
Commercial Provisions
[includes multi-family residential >4 stories]
January 1 2023
Follow Chapter C600 of Title 14N
AND
ONE of the following:
IECC 2021 with Chicago amendments
ALL mandatory requirements of IECC 2021 with Chicago amendments
Performance
Prescriptive
ASHRAE 90.1-2019
ALL mandatory requirements of ASHRAE 90.1-2019
Performance
Prescriptive
PHIUS certification
NGBS Gold or Emerald certification





C600

C603: Solar Ready Roofs

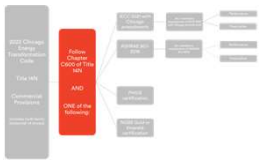
C604: Electrification-Ready Residences

C605: Exterior Balconies and Parapets

C606: No New Gas Lighting

C607: Cool Roof

C608: EV Ready

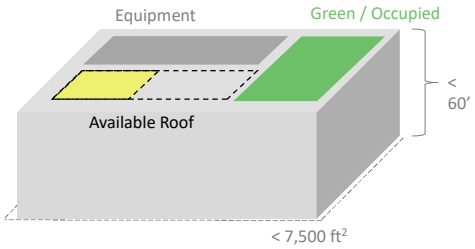


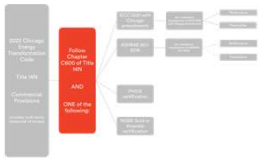
C600

C603: Solar Ready Roofs

Applies to buildings <60’ tall, with a ground footprint of > 7,500 ft².

≥40% of *available roof area* must be designated as the *solar-ready zone*.

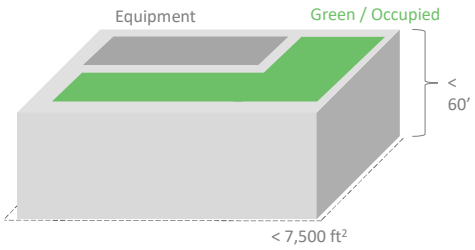


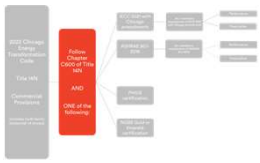


C600

C603: Solar Ready Roofs

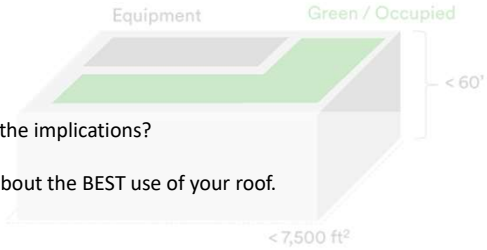
What if there’s no *available roof area*?





C600

C603: Solar Ready Roofs

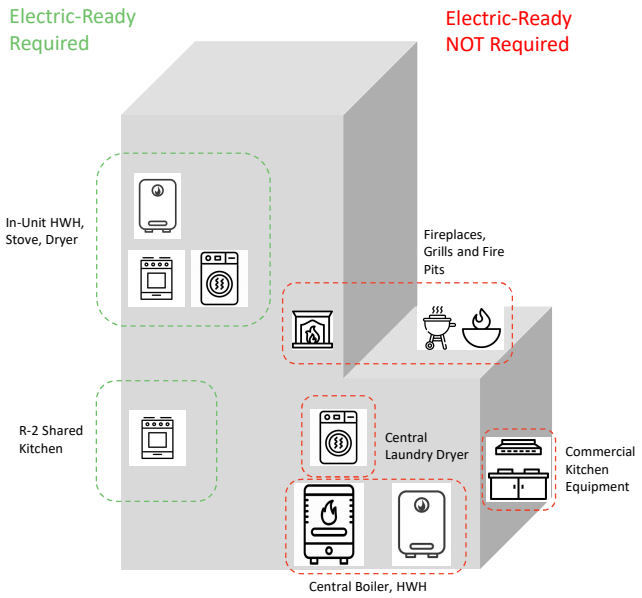


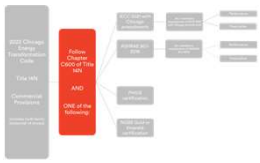
What are the implications?

- Think about the BEST use of your roof.

C600

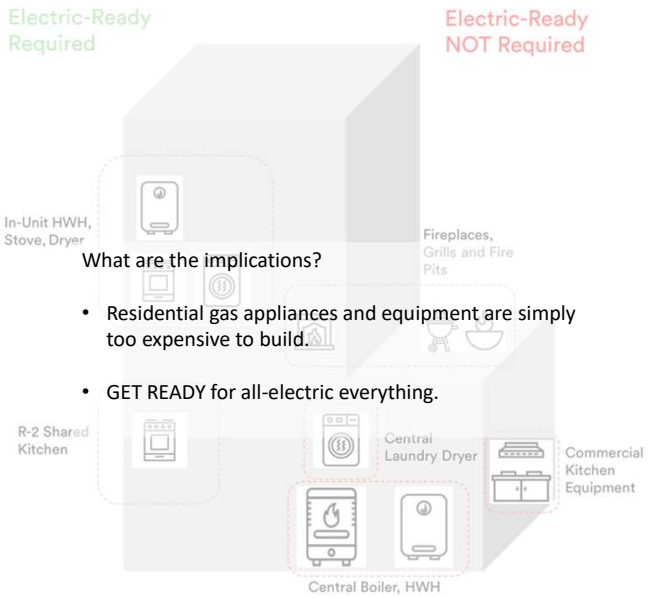
C604: Electrification Ready Residences





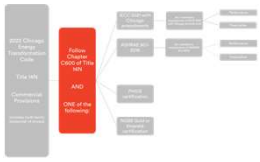
C600

C604: Electrification Ready Residences



What are the implications?

- Residential gas appliances and equipment are simply too expensive to build.
- GET READY for all-electric everything.

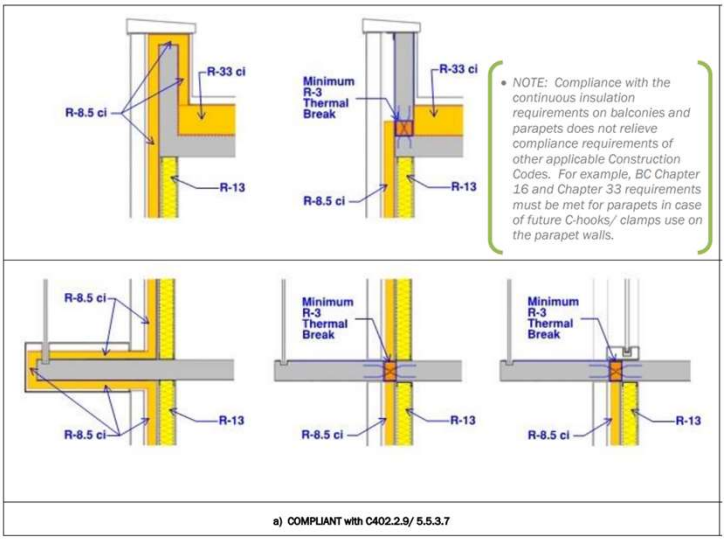


C600

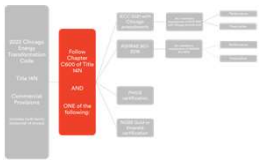
C605: Exterior Balconies and Parapets

Must be continuously insulated or thermally broken.

This is new to us! Is this an energy code requirement anywhere else? Where do we find example details?



https://www1.nyc.gov/assets/buildings/pdf/h2g2_be_2020_nycecc.pdf

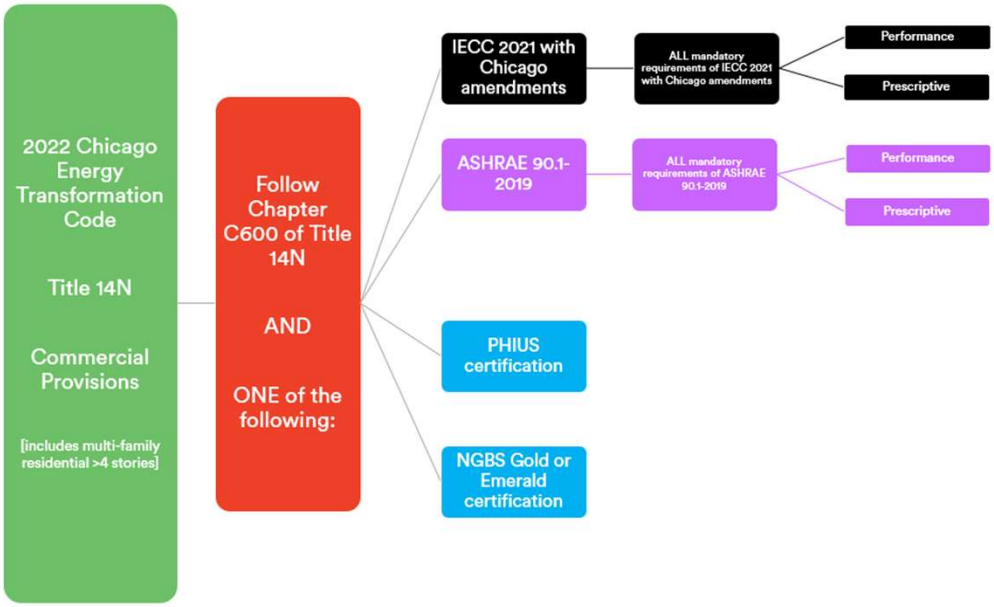


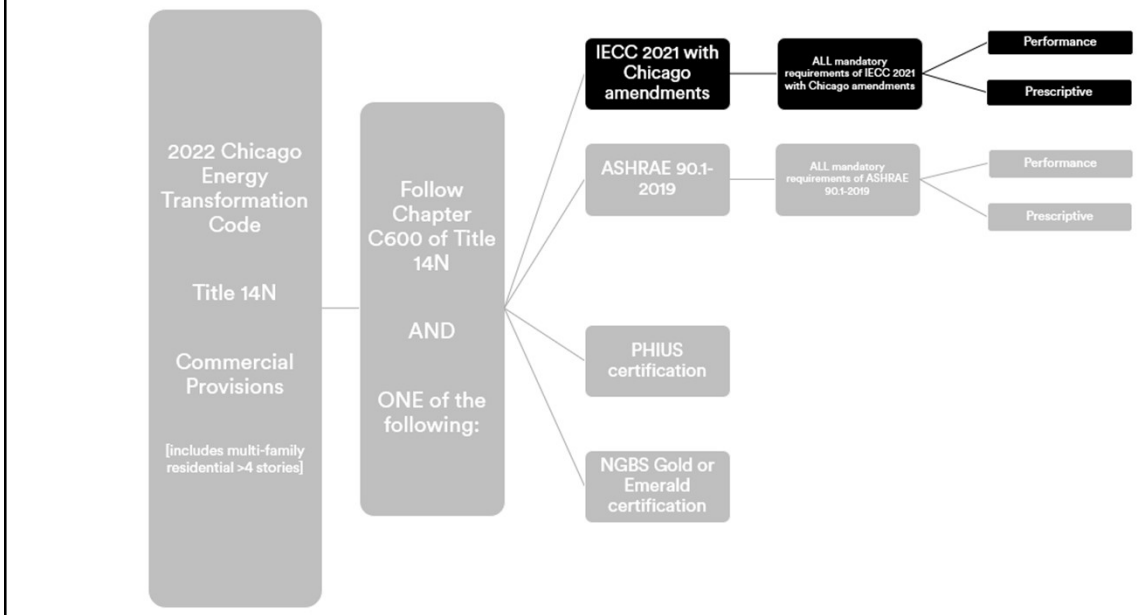
C600

C606: No New Gas Lighting

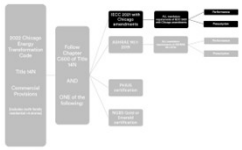
C607: Cool Roof >>> Chicago Building Code

C608: EV Ready >>> Zoning Code



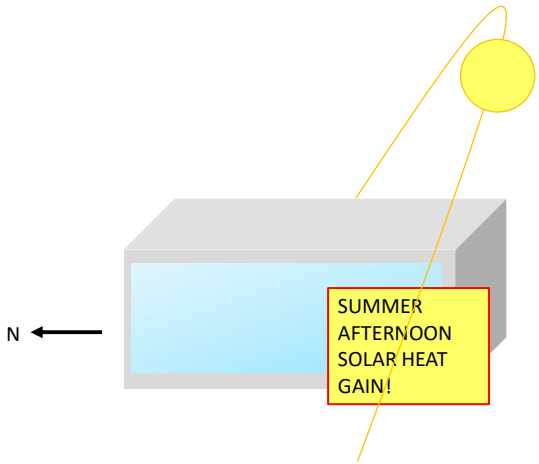


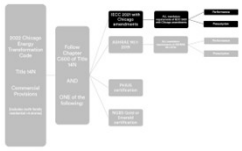
IECC 2021



Chicago Amendment:
Fenestration Orientation
C402.4.1.3
IECC Prescriptive path or
Performance path baseline

What we're trying to avoid:





IECC 2021

Chicago Amendment:
Fenestration Orientation

Note this is consistent with ASHRAE 90.1-2019

"**C402.4.1.3 Orientation.**
The *fenestration area* for *vertical fenestration* shall comply with either equations 4-3a and 4-3b or 4-3c and 4-3d.

Exceptions:

1. Buildings with shade on 75% of the east- and west-oriented *vertical fenestration area* from permanent projections, *existing buildings*, existing permanent infrastructure, or topography at 9 a.m. and 3 p.m., respectively, on the summer solstice (June 21).
2. *Alterations* and *additions* with no increase in *vertical fenestration area*.
3. Buildings where the west-oriented and east-oriented *vertical fenestration area* does not exceed 20% of the gross wall area for each of those facades and the actual SHGC for vertical fenestration on those facades is no greater than 90% of the maximum specified in Table C402.4.

$A_w \le (A_t)/4$ **(Equation 4-3a)**

$A_e \le (A_t)/4$ **(Equation 4-3b)**

$A_w \times SHGC_w \le (A_t \times SHGC_c)/5$ **(Equation 4-3c)**

$A_e \times SHGC_e \le (A_t \times SHGC_c)/5$ **(Equation 4-3d)**

where:

A_e = The *fenestration area* of east-oriented *vertical fenestration* (oriented within 45 degrees of true east to the south and within 22.5 degrees of true east to the north) in square feet.

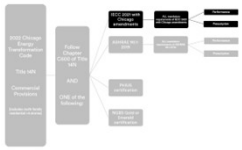
A_w = The *fenestration area* of west-oriented *vertical fenestration* (oriented within 45 degrees of true west to the south and within 22.5 degrees of true west to the north) in square feet.

A_t = The total *fenestration area* of *vertical fenestration* in square feet, measured using the rough opening and including the glazing, sash and frame.

$SHGC_c$ = Maximum allowed SHGC from Table C402.4.

$SHGC_e$ = Actual SHGC for east-oriented *vertical fenestration*.

$SHGC_w$ = Actual SHGC for west-oriented *vertical fenestration*."

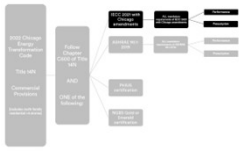


IECC 2021

Chicago Amendment:
Fenestration Orientation

Note this is consistent with ASHRAE 90.1-2019

"**C402.4.1.3 Orientation.**
The *fenestration area* for *vertical fenestration* shall comply with either equations 4-3a and 4-3b or 4-3c and 4-3d.



IECC 2021

Chicago Amendment:
Fenestration Orientation

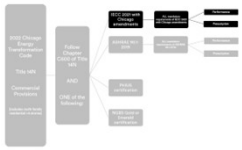
Note this is consistent with ASHRAE 90.1-2019

$A_w \le (A_t)/4$ **(Equation 4-3a)**

$A_e \le (A_t)/4$ **(Equation 4-3b)**

$A_w \times SHGC_w \le (A_t \times SHGC_c)/5$ **(Equation 4-3c)**

$A_e \times SHGC_e \le (A_t \times SHGC_c)/5$ **(Equation 4-3d)**

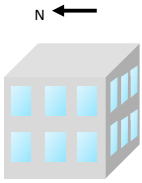


IECC 2021

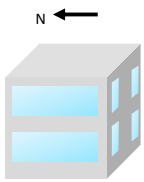
Chicago Amendment:
Fenestration Orientation

Breaking down the equations: 4-3a and 4-3b

1. Enter area values here:		2. Check pass/fail below:	
Ae	1000	**Equation 4-3a**	
east fenestration area		Aw ≤ (At / 4)	PASS
Aw	1000	**Equation 4-3b**	PASS
west fenestration area		Ae ≤ (At / 4)	
At	4000	**3. If PASS, project meets standard.**	
total fenestration area			



1. Enter area values here:		2. Check pass/fail below:	
Ae	1200	**Equation 4-3a**	
east fenestration area		Aw ≤ (At / 4)	FAIL
Aw	1200	**Equation 4-3b**	FAIL
west fenestration area		Ae ≤ (At / 4)	
At	4000	**3. If PASS, project meets standard.**	
total fenestration area			

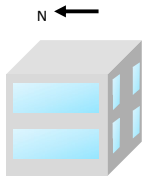


IECC 2021

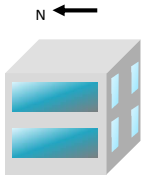
Chicago Amendment:
Fenestration Orientation

Breaking down the equations: 4-3c and 4-3d

1. Enter area values here:		2. Check pass/fail below:	
Ae	1200	**Equation 4-3a**	
east fenestration area		Aw ≤ (At / 4)	FAIL
Aw	1200	**Equation 4-3b**	FAIL
west fenestration area		Ae ≤ (At / 4)	
At	4000	**3. If PASS, project meets standard.**	
total fenestration area			



4. If FAIL, enter SHGC values here:		5. Must pass below:	
SHGCc	0.38	**Equation 4-3c**	PASS
code maximum SHGC		Aw * SHGCw ≤ (At * SHGCc)/5	
SHGCw	0.25		
actual SHGC of east-facing fenestration		**Equation 4-3d**	PASS
SHGCe	0.25	Ae * SHGCe ≤ (At * SHGCc)/5	
actual SHGC of west-facing fenestration			



IECC 2021

Chicago Amendment:
Fenestration Orientation

Breaking down the equations

What are the implications?

- Complying via weighted SHGC (equations 4-3c and 4-3d) gets impractical quickly.
- Best to balance glass/opaque area on square(ish) buildings.
- N-S elongated buildings will typically be pushed to the performance path.

IECC 2021

Chicago Amendment:
Fenestration Orientation

+

IECC Update to Table C402.4

Note this is consistent with ASHRAE 90.1-2019

TABLE C402.4
BUILDING ENVELOPE FENESTRATION MAXIMUM *U*-FACTOR AND SHGC REQUIREMENTS

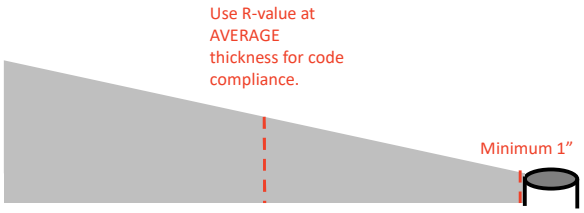
	3	4 EXCEPT MARINE	5 AND MARINE 4	6
Vertical fenestration				
***U*-factor**				
0.45	~~0.46~~0.42	~~0.38~~0.36	~~0.38~~0.36	~~0.36~~0.34
0.60	~~0.60~~0.54	0.45	0.45	~~0.43~~0.42
0.77	~~0.77~~0.68	~~0.77~~0.63	~~0.77~~0.63	~~0.77~~0.63
SHGC				
~~N~~Operable	~~SEW~~Fixed	~~N~~Operable	~~SEW~~Fixed	~~N~~Operable	~~SEW~~Fixed	~~N~~Operable	~~SEW~~Fixed	~~N~~Operable
~~0.33~~0.23	0.25	~~0.33~~0.23	0.36	~~0.48~~0.33	0.38	~~0.51~~0.33	~~0.40~~0.38	~~0.53~~0.34
~~0.37~~0.28	0.30	~~0.37~~0.28	0.43	~~0.53~~0.40	0.46	~~0.56~~0.40	~~0.48~~0.46	~~0.58~~0.41
~~0.40~~0.37	0.40	~~0.40~~0.37	0.58	~~0.58~~0.53	0.61	~~0.61~~0.53	~~0.64~~0.61	~~0.64~~0.54
Skylights				
65	0.55	0.50	0.50	0.50
0.30	~~0.35~~0.30	0.40	0.40	0.40

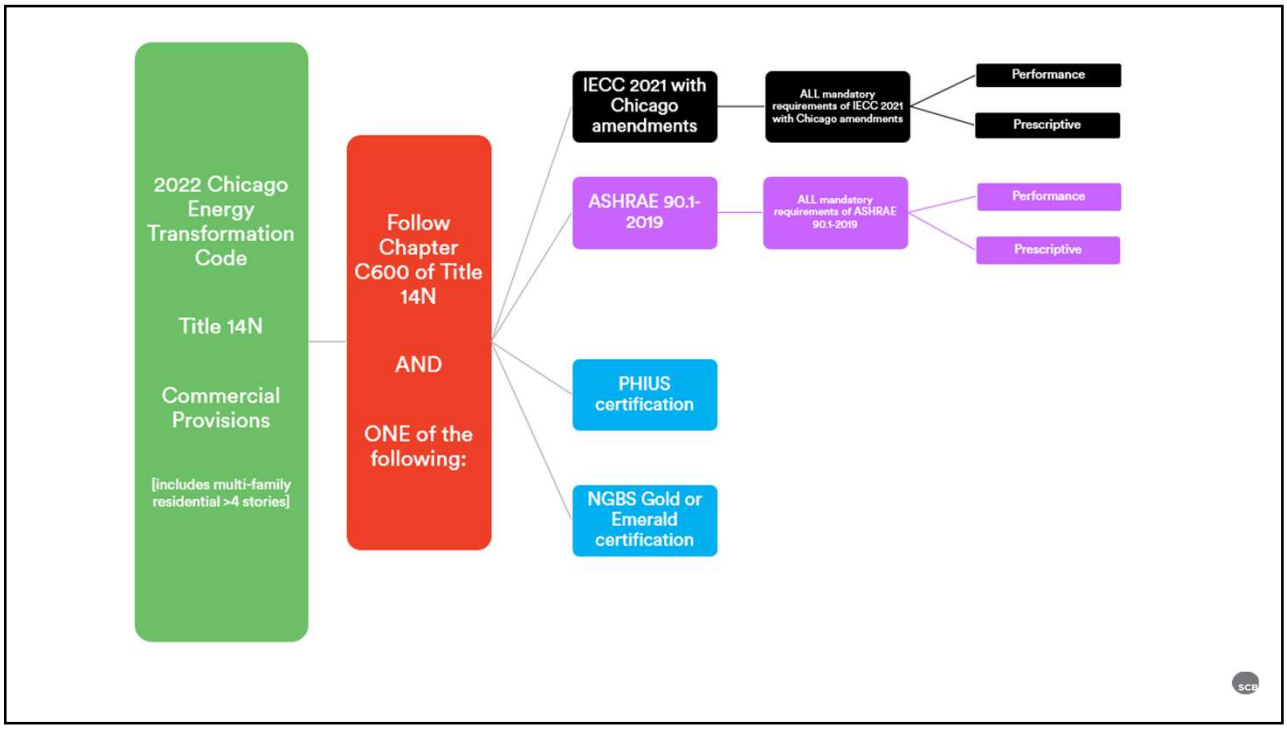
IECC 2021

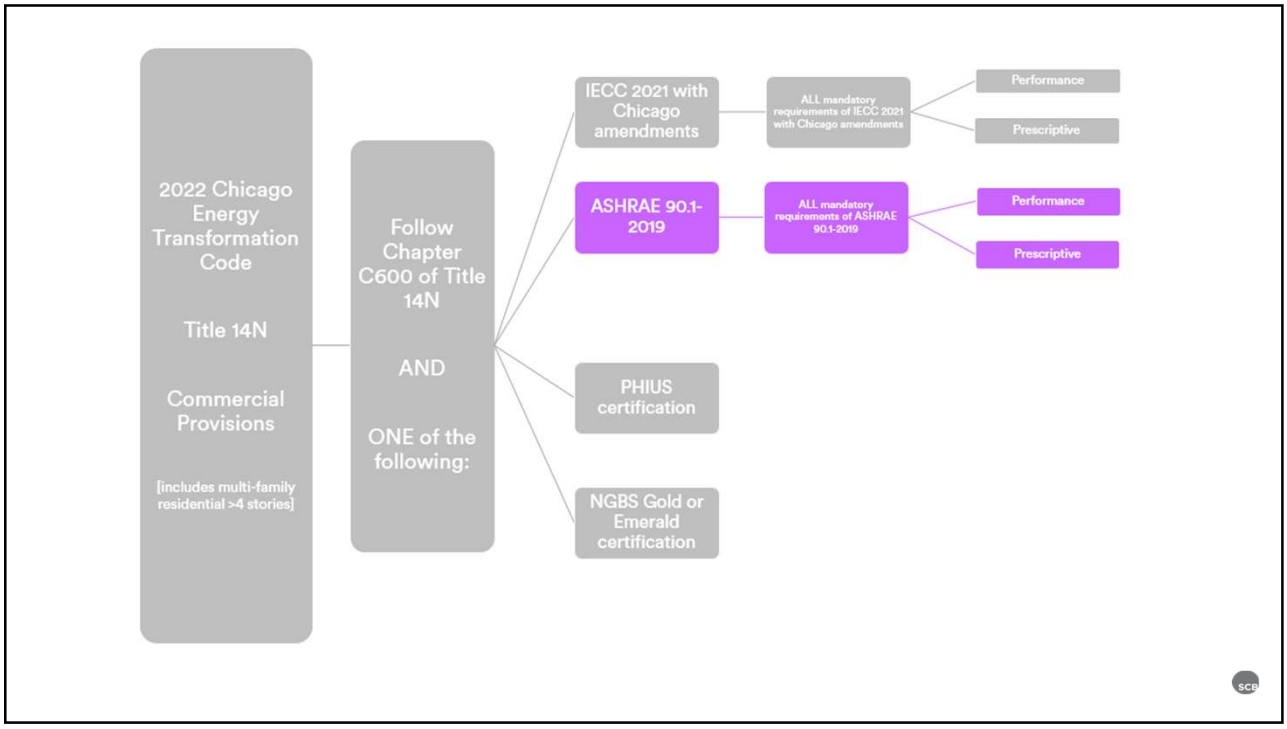
IECC Update:
Roof Insulation

C402.1.4.1 and C402.2.1.1
IECC Prescriptive Path

Note, this is different from ASHRAE 90.1-2019




2022 Chicago Energy Transformation Code
Title 14N
Commercial Provisions
[includes multi-family residential >4 stories]
Follow Chapter C600 of Title 14N
AND
ONE of the following:
IECC 2021 with Chicago amendments
ALL mandatory requirements of IECC 2021 with Chicago amendments
Performance
Prescriptive
ASHRAE 90.1-2019
ALL mandatory requirements of ASHRAE 90.1-2019
Performance
Prescriptive
PHIUS certification
NGBS Gold or Emerald certification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Performance
Prescriptive
PHIUS certification
NGBS Gold or Emerald certification

ASHRAE 90.1-2019 & IECC 2021

Whole Building Air Leakage Testing

New mandatory requirement in both energy codes

IECC: C402.5

ASHRAE: 5.8.3

Image sources: https://flowtech.com.au/building-enclosure-duct-pressure-testing/

ASHRAE 90.1-2019 & IECC 2021

Whole Building Air Leakage Testing

New mandatory requirement in both energy codes

What are the implications?

- Adds on-site verification where previously design only
- Detail your air barrier!
- Coordinate on-site testing with your contractor

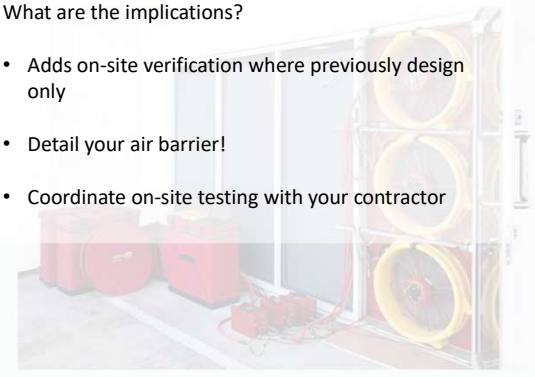

Image sources: https://flowtech.com.au/building-enclosure-duct-pressure-testing/


Thank you.
CHICAGO
ARCHITECTURE
CENTER
AIA Chicago
ILLINOIS
GREEN
ALLIANCE
CHICAGO
Department of Buildings