



Building
Energy
Education

architects

IL Base Energy Code, IL Stretch Energy Code & Chicago Energy Transformation Code

5.18.2023



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Providing effective energy strategies for buildings and communities



Eric Klinner
Managing Director



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Executive Director





SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Presenters:

Robert Schlorff



Ryan Siegel



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



This workshop is approved for 1.5 LU/HSW CES credits from the American Institute of Architects (AIA). Credits earned on completion will be reported for AIA members.



Learning Objectives

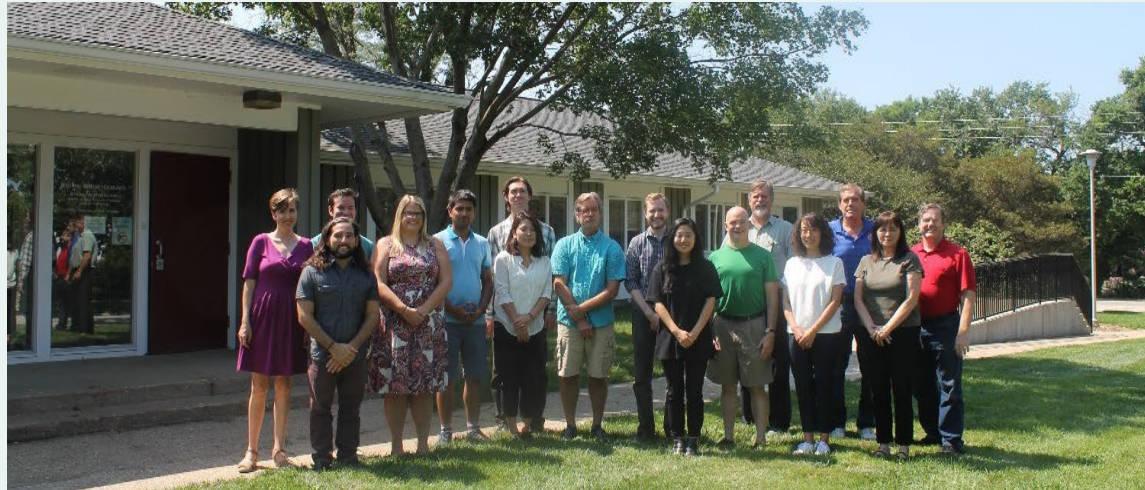
1. Understand the IL Stretch Code requirements in relation to those of the base energy code.
2. Identify specific Stretch Code improvements beyond the base code.
3. Identify the benefits of stretch code implementation.
4. Understand mandatory requirements in all Illinois energy code compliance options (Base Code, Stretch Code, and Chicago Energy Transformation Code).

Who We Are

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

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

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





**Building
Energy
Education**

architects

Energy efficiency basics + advanced topics
Take your designs to the next level!

Learn more and register at
smartenergy.illinois.edu/events

5/18/2022 @ 1pm-2:30pm
IL-ECC, IL Stretch Code & CETC Overview

Training delivered by the University of Illinois
Smart Energy Design Assistance Center (SEDAC) in
partnership with the American Institute of Architects
Illinois and the Illinois Green Alliance.

Webinars | Workshops | Online Modules
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ILLINOIS GREEN

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Upcoming Events

Top 40 Requirements You Should Know: 2021 IECC

- Jun 13, 2023 (DuPage County) - **in person!**

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

Energy Code Training Program

- Technical support
energycode@illinois.edu
800.214.7954
- Online resources at
smartenergy.illinois.edu/energy-code
- Workshops
- Webinars
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TRAINING & SUPPORT SERVICES



Workshops



Webinars



Online courses



Technical support

"Thank you. This is a gold mine of energy code info."

Robert, Mechanical Engineer

"This was probably one of the most successful seminars we've had. I got a lot of good feedback from it."

Harold, Plumbing Inspector

ENERGY CODE RESOURCES



Illinois Energy Conservation Code



Chicago Energy Transformation Code



Illinois Stretch Code



Frequently asked questions



Checklists



Energy code smart tips

"Thank you! That's the most clear explanation I've gotten on this topic. It's greatly appreciated!"

Brett, Energy Modeler

Overview of IL Energy Codes

Available Energy Codes



2021 IECC with IL Amendments

- State-wide energy code floor
- Certain municipalities can adopt more stringent commercial, none can adopt more stringent residential

Chicago Energy Transformation Code

- 2021 IECC with Chicago amendments
 - Electrification, solar ready, and EV ready
- Applies within Chicago only

2023 Stretch Code

- Any municipality can adopt for residential and/or commercial once released



Work In Progress

Adoption Timelines

2022 Illinois Energy Conservation Code

- Late summer of 2023 (moving target date)



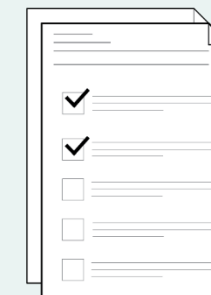
2022 Chicago Energy Transformation Code

- Adopted November 1st, 2021



Illinois Stretch Code

- Planned to be available July 31st, 2023
- Planned adoptability by December 31st, 2023
 - May push back to allow for publication of 2024 IECC



IL Stretch Code Overview

What is the Stretch Code?

IL Energy Transition Act (CEJA) requires State to develop stretch code that jurisdictions can adopt, or remain on base code

IL Stretch Code is a step code with predictable improvement over time, unlike base code which has sporadic improvements over time.

Stretch Code is based on Energy Use Index or Energy Use Intensity, rather than being based on building use types.

Why Adopt a Stretch Code?

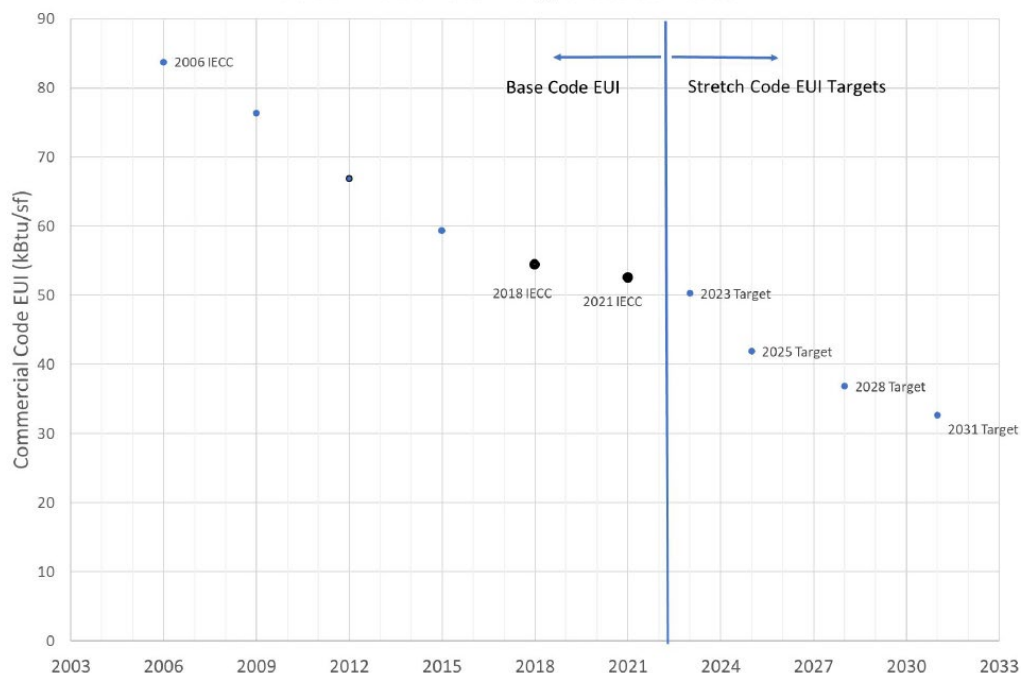
1. Greater stringency helps municipalities push toward climate goals
2. Better buildings are often more resilient
3. Lower operational expenses for new/renovated buildings
4. Train builders and designers on improved designs (competitive edge to IL firms)
5. Single advanced standard may simplify compliance and reduce design costs
6. Test future energy code requirements before they're mandatory



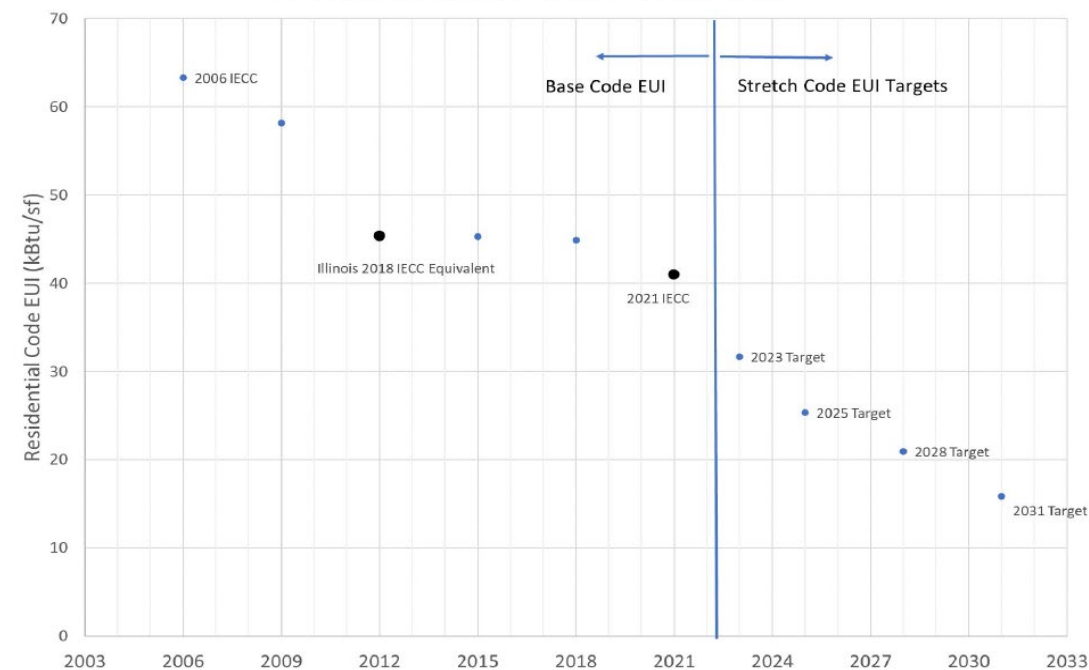
Stretch Code Predictable Improvements

Improvement Beyond 2006 IECC baseline		
Code Year	Commercial	Residential
2023	40%	50%
2025	50%	60%
2028	56%	67%
2031	61%	75%

Illinois Commercial Base Energy and Stretch Code



Illinois Residential Energy Code and Stretch Code



Commercial Stretch Code Details

2023 Commercial Stretch Code Summary

2024 IECC draft is current working basis of the 2023 Stretch Code **Stretch code adds following amendments to 2024 IECC Commercial:**

- Adds PHIUS and Appendix CC compliance paths
- For ASHRAE 90.1-2022 compliance, adds requirements to comply with certain parts of 2024 IECC (mainly, the IL amendments)
- OPTIONAL all electric appendix for adoption, if desired
- Incentivizes heat pump installations
- IL fenestration/building orientation amendment incorporated
- Performance Path updated to use EUI instead of utility cost
- Horticultural lighting must comply with current cannabis facility lighting requirements
- Existing building substantial improvements trigger additional efficiency requirements and electrification

Additional Compliance Paths

Appendix CC

- IECC Zero Code provisions
- Details renewable sizing to meet net-zero energy target
- Sets EUI targets based on building type and climate zone



Passive House Institute - US

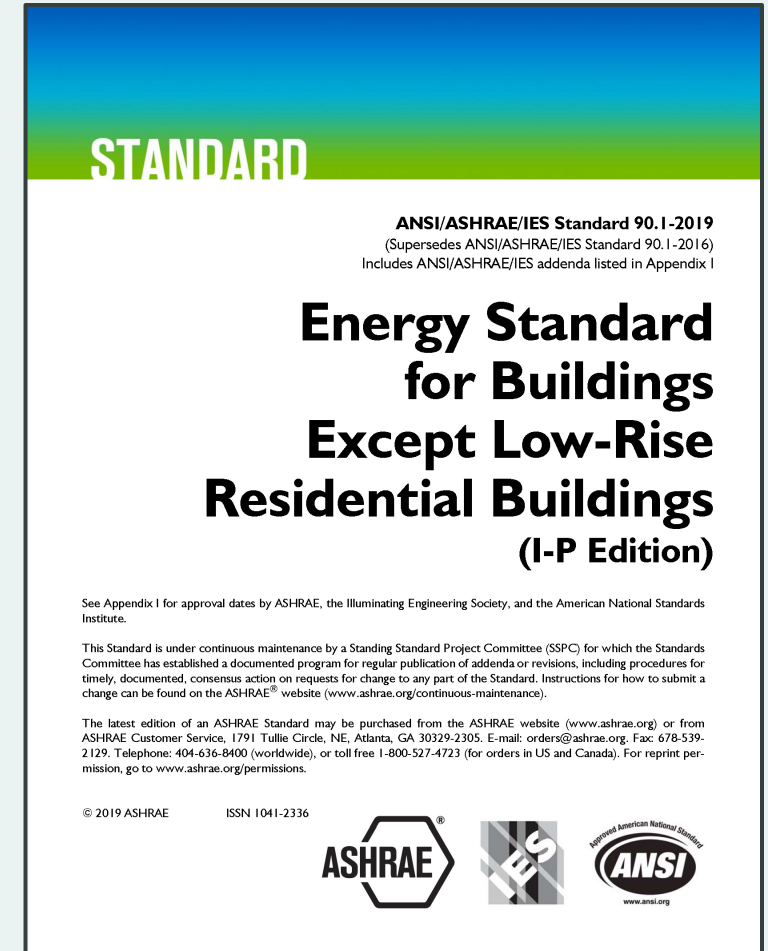
- Climate-zone specific requirements
- Beyond IECC performance levels for insulation, building tightness, and ventilation



ASHRAE 90.1 Compliance Additions

Additional provisions voted into the Stretch Code that are specifically listed as required under the ASHRAE 90.1 compliance path

- Horticultural lighting
- Electrification measures (EV- & Solar-Ready and Energy Storage)
- Existing Buildings Updates:
 - Additional efficiency credits
 - Substantial improvement advanced requirements
 - Mechanical system acceptance testing
 - Duct testing
 - Controls
 - System sizing



Energy Storage Ready



Image source: Energy.gov

- Storage capacity rated at:
 - Energy capacity $\geq 1.0X$ installed PV power (kWhdc)
 - Power capacity $\geq 0.25X$ installed PV power (kWdc)
- Storage-ready areas:
 - Energy storage \geq CFA of 3 largest stories \times 0.0008 kWh/sf
 - Power capacity \geq CFA of 3 largest stories \times 0.0002 kW/sf

Note: Each ESS-ready area shall be located in accordance with Section 1207 of the 2024 IFC. Spacing requirements of IFC also must be maintained

Electric Vehicle Service Accessibility

The Stretch Code modifies section C405.14.6 of the 2024 IECC to include accessibility for EV infrastructure requirements noted in the 2024 IBC section 1107

Note: The current Illinois Accessibility Code does not reference EVSE, so the most current IBC is referenced instead by this amendment.



Image courtesy of DOE

Horticultural Lighting

C405.4 of the 2024 IECC is modified to include the IL photosynthetic photon efficacy requirements that are added to the current code cycle plant lighting by IL amendments

- 1.7 $\mu\text{mol}/\text{J}$ for greenhouses
- 2.2 $\mu\text{mol}/\text{J}$ for indoor horticultural lighting

Exception to this requirement for cannabis facilities subject to 410 ILCS 705/10-45 (Cannabis Regulation and Tax Act).

- *Sets max LPD of 36 W/sf or 2.2 $\mu\text{mol}/\text{J}$ efficacy targets*



Image courtesy of DOE

Electrification-Ready Requirements

Requires plan drawings and construction to include provisions for installation of electric appliances in place of gas appliances in the future

- Gas furnaces shall have an accompanying electric circuit installed and labeled for future heat pump installation
 - Sizing requirements based on meeting existing equipment heating capacity
- Gas water heaters shall have electric services installed and labeled for future electric water heating
 - 30 A, 208/240 V branch circuit
 - Space reserved for future heat pump water heater = 7ft x 3ft x 3ft, or provided adequate air circulation to support HPWH



Image courtesy of energy.gov

Electrification-Ready Requirements

Requires plan drawings and construction to include provisions for installation of electric appliances in place of gas appliances in the future

- Gas for non-commercial cooking shall have installed and labeled circuit
 - 50 A, 208/240V circuit
- Gas Clothes Dryers
 - 30 A, 208/240 V circuit installed for residential dryers
 - Non-residential dryers shall have reserved raceway and panel space for same capacity as existing gas units.

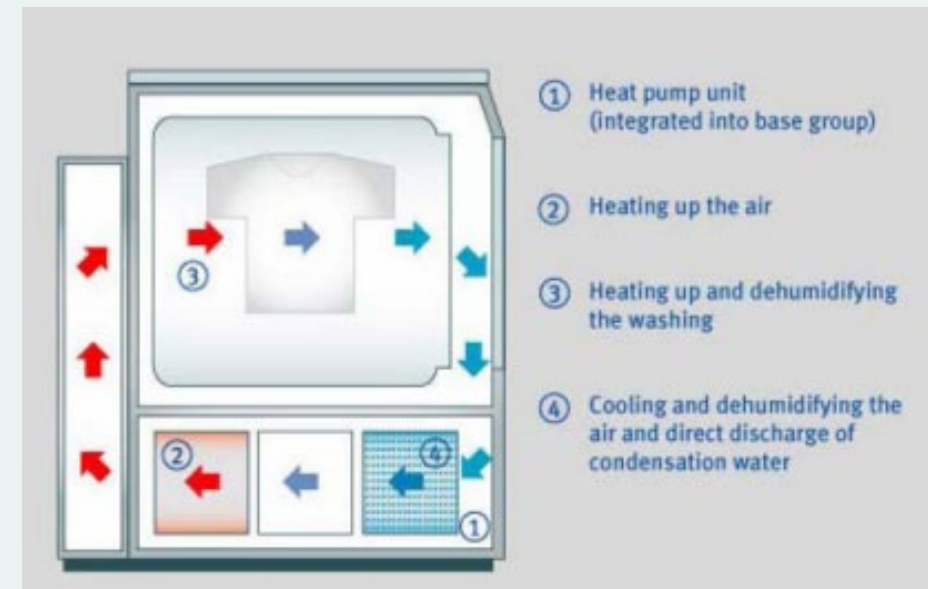


Image courtesy of OSTI.gov

Heat Pump Incentivization

C406.1.1 is modified to require C406.2 – More Efficient HVAC Equipment Performance to achieve additional efficiency credits

- Buildings that are low energy per C402.1.1 and buildings where >50% of peak space and water heating is served by heat pumps shall obtain **10 credits** to comply with C406 requirements.
- All other buildings need to obtain **15 credits** through C406.2 and other selected efficiency credit options.

Essentially rewards designs employing heat pumps and requires greater efficiency from projects that don't. (~3% additional efficiency)



Image courtesy of DOE

Performance Path Modification

This amendment will add a new Appendix CF.

Used to convert ASHRAE 90.1 Appendix G performance compliance from an **energy cost intensity** to an **energy use intensity**.

Also modifies the IECC performance path to use **energy use intensity**.



Existing Building Substantial Improvement

Adds definition for “replacement cost” – cost to replace entire building at current market rates

Defines “**substantial improvement**” – any repair, reconstruction, alteration, addition or other improvement that **exceeds 50% of the building replacement cost**.

Exception: minimum repair projects to correct life-safety code violations and alterations to historic structures that maintain historic structure designation.

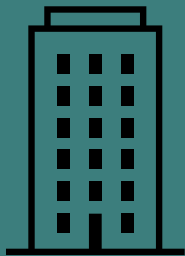


Image courtesy of energy.gov

Existing Building Substantial Improvement

Existing buildings undergoing substantial improvements shall comply with C402.5 and C405.17 and meet site EUI per ASHRAE 100 Table 7-2a

Exception for Group-R occupancies achieving ERI score of 80 or less without on-site renewables for each dwelling unit



Major renovations present best opportunity to improve efficiency of existing building stock.

Building Type	4A	5A
Admin/Professional Office	46	48
Gov't Office	57	60
Grocery/Food Market	138	149
Fire/Police Station	71	77
Library	67	72
Dormitory	58	65
Assisted Living/Nursing Home	91	99

Excerpts from ASHRAE 100-2018 Table 7-2a

Existing Building Addition Efficiency Credits

C502.3.7 added to Additions section of IECC

Additions shall comply with C406.2 and C406.3 to achieve **≥75% of required efficiency credits** from Table C406.1.1 based on climate zone and occupancy group.

Exceptions:

- 1. Groups U, S, F and H (Utility, Misc, Storage, Factory and High-Hazard facilities)*
- 2. Additions <1,000 sf AND <50% of existing floor area*
- 3. Additions that do not require addition or replacement of DHW or HVAC equipment*
- 4. Additions without conditioned space*
- 5. Where addition alone or addition + existing comply with C407*
- 6. Where 50% of peak heating + DHW load served by heat pumps, **only need to achieve ≥50% efficiency credits***

Fenestration Orientation

Either total east and west facing fenestration shall be less than 25% of fenestration area each
i.e. **$AW \leq AT/4$ and $AE \leq AT/4$**

OR

The area-weighted average east and west SHGC shall be 20% less than the Table C402.5 fenestration requirements
i.e. **$AW \times SHGCW \leq (AT \times SHGCC)/5$ and $AE \times SHGCE \leq (AT \times SHGCC)/5$**

Exception: if 75% of east/west fenestration is shaded by permanent structures/topography



Image EIU Renewable Energy Center

Residential Stretch Code Details

2023 Residential Stretch Code Summary

Based on 2021 IECC with additions from 2024 IECC and IL amendments

1. Allows compliance through PHIUS, PHI and Appendix RC, and Zero Energy Appendix
2. Two prescriptive paths: EITHER requires heat pumps for heating & DHW and have airtight envelopes (2 ACH50+ERV) OR achieve 24-29 (final value TBD) efficiency credits from 2024 IECC credit table R408
3. Mixed-fuel residences required to be electric ready (appliances, EV, and solar)
4. Demand response-capable thermostats and DHW (Does not require participation in DR program)
5. Revises ERI pathway to align with CEJA requirements
6. Existing building requirements ported from 2024 IECC (efficiency credits, duct testing, HVAC right-sizing and controls)

Alternative Compliance Paths

Stretch code adds the following compliance pathways to 2021 IECC

- PHIUS
 - Appendix RC – Zero Energy Residential
 - Removes 2009 IECC floor compliance for envelope and SHGC and requires compliance with current code version requirements.
 - Also amends the prescriptive path to require additional efficiency requirements in Section R408
 - Building must have heat pumps with COP at 5F of ≥ 1.75 and capacity at 5F that is $\geq 70\%$ of capacity at 47F
 - Must have heat pump water heater
 - Must have 2.0 ACH50 with ERV with SRE of 70%+ at 32F
- OR
- Must achieve higher level of additional efficiency credits

Modified 2024 IECC Efficiency Credits

Description	CZ 4	CZ 5	Description	CZ 4	CZ 5	Description	CZ 4	CZ 5
≥2.5% UA Reduction	1	1	≥5.0% UA Reduction	2	3	≥7.5% UA Reduction	2	3
0.22 U-factor fenestration	3	4	HE Cooling Option 1	3	3	HE Cooling Option 2	3	2
HE Gas Heat Option 1	5	7	HE Gas Heat Option 2	4	5	HE Heat Pump Option 1	21	31
HE Heat Pump Option 2	22	32	GSHP	23	33	Fossil Fuel DHW	3	2
HE HPWH Option 1	8	6	HE HPWH Option 2	8	6	Solar Water Heating	6	6
Compact DHW Dist.	2	2	Efficient Dist. System	10	12	100% Ducts in Conditioned Space	12	15
Reduced Duct Leakage	1	1	2 ACH50 w/ ERV	10	13	2 ACH50 w/ Balanced Vent	4	5
1.5 ACH50 w/ ERV	12	15	1 ACH50 w/ ERV	14	17	Efficient Appliances	7	5

Electrification Measures

New residential 1 and 2-family dwellings shall have at least 1 parking space that is EV-ready

Multi-family parking lots must meet commercial EV-readiness requirements

- Outlet/enclosure within 6ft of each EV-ready space
- Sized for EV charging load of 7.2 kVA
- Electric panel provided reserved and labeled spaces for EVSE
- Shared or managed circuits shall meet NFPA 70 requirements

Note: Requirements added as mandatory for performance and ERI paths.



Image from energy.gov

More Electrification Measures

Electric-Ready Homes

- Where fossil fuels used for cooking, heating, laundry, and/or DHW
 - Cooking appliance 40 A, 250V branch with outlet within 3 ft of gas appliance
 - Clothes dryers 30 A, 240 V branch with outlet within 3 ft of gas appliance
 - Water heaters 30 A, 240 V branch with outlet within 3 ft of gas appliance
 - Adequate space reserved (7' x 3' x 3', volume 700cu.ft. or more) or adequate air circulation
 - Space heating equipment shall have exterior location with condensate drainage and dedicated branch circuit provided

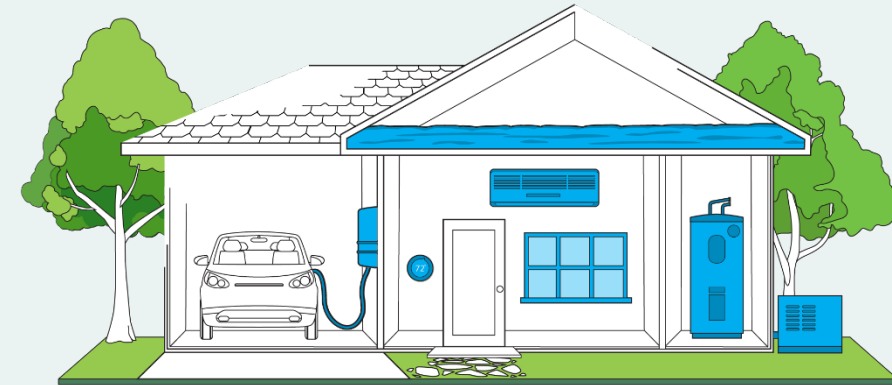


Image from energystar.gov

Solar-Ready Requirements

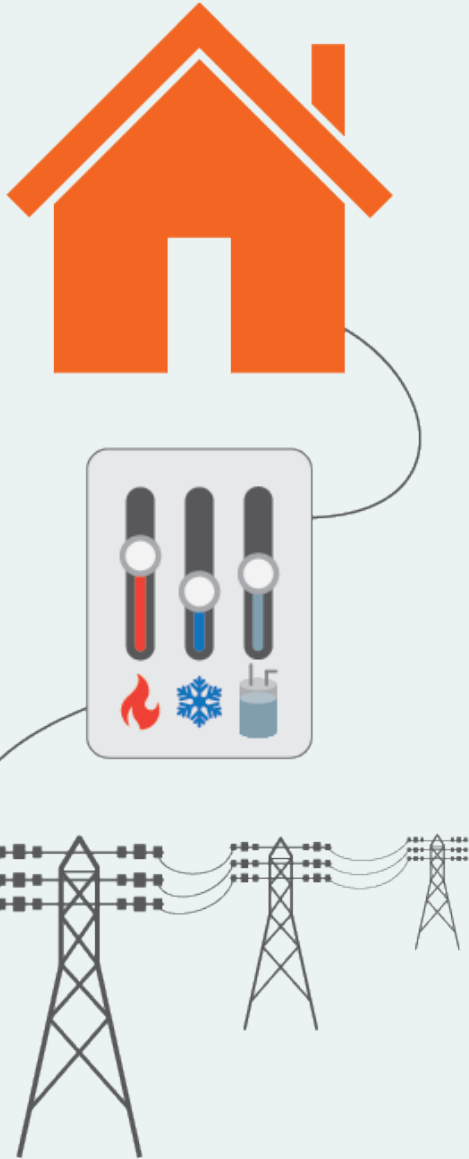
R404.6 added to cover renewable energy infrastructure requirements

For 1- and 2-family dwellings and townhouses

- Total area of solar-ready zone shall be 250sf plus and have areas of no less than 5.5ft in one direction and 80sf exclusive access or setback area
 - Dwellings 2,000sf or less can have solar-ready zone of 150sf
- SR-zones shall be free of obstructions (vents, chimneys and other roof-mounted equipment)
- Space reserved in panel for electrical service, labeled, and located at opposite (load) end of bus bar from service line
- Junction box within 24 inches of main panel connected to capped roof sleeve or space in attic within 3ft of SR-Zone.



Demand Response Requirements



R403.1 Controls revised to include demand response subsection requirements

- R403.1.1 Thermostat controlling primary heating/cooling equipment shall be capable of demand response using Virtual End Node communication. Provides homeowner ability to voluntarily participate in demand-response programs with utility.
 - Automatically increase cooling setpoint by 1, 2, 3, or 4F
 - Automatically decrease heating setpoint by same values.
- R403.5.5 demand responsive water heating required on electric storage water heaters 40gal to 120 gal with input rating 12kW or less.

Performance Path Compliance Updates

- The envelope performance floor is updated to require total UA to be **no more than 10% worse** than the 2021 IECC prescriptive requirements.
- Additionally, site energy use intensity shall be **no more than 71% or 76%** of the standard reference design

Note, changed from site utility cost that is baseline for 2021 IECC.



Standard reference design



Performance design

ERI Compliance Path Updates

- Similar envelope total UA update to performance path
 - Total UA must be **no more than 10% worse** than 2021 IECC prescriptive UA.
- The ERI path requires modeling per ANSI/RESNET/ICC 301, which does not have the same ventilation requirements as the 2021 IECC
 - Models will have RESNET 301 ventilation, but actual home will need to meet 2021 IECC ventilation requirements
 - ERI targets vary depending if electrified vs combustion equipment home

Climate Zone	Electrified Home	Combustion Equipment Home
4	54	51
5	55	50

Existing Building Requirements

Adds requirements for “**substantial energy alterations**”

- Where repairs, alterations, additions replace **50% or more** of the following in a building (2 of more):
 - Interior or exterior wall coverings
 - Space heating or cooling input capacity
 - Domestic water heating capacity
 - Luminaires
- Additions must achieve at least **10 additional efficiency credits** from 2024 IECC
 - Alterations as a part of the addition can be used to contribute to credits
- “**Substantial alterations**” must achieve **at least 2 credits**
 - 1 Credit can be from R503.1.5.1 – high efficacy lighting
 - All hard-wired lighting meets 90lm/W lamp or 55lm/W fixture efficacy



Image from
<https://www.thinkwood.com>

Addition/Alteration Duct Systems

Pulled from the 2024 IECC and added to the 201 IECC for the Stretch Code

- New HVAC duct part of an addition must comply with duct testing requirements of R403
 - Does not apply to extension from an existing system
 - Also specifies HVAC equipment must meet sizing requirements of R403.7



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

Alteration Duct Systems

Pulled from the 2024 IECC and added to the 201 IECC for the Stretch Code

- Alterations to duct systems must achieve duct leakage of 12 cfm/100 sf of conditioned floor area or less when:
 - 25% of registers are relocated
 - 25% of total duct lengths are relocated
 - Ductwork entirely within conditioned envelope is excepted
 - New HVAC controls must comply with R403.1 and R403.2 demand requirements



Appendix RE: All-Electric Residences

Added as optional requirement that can be adopted by jurisdictions



- Requires residential buildings to have no combustion appliances or equipment
 - Also restricts installation of plumbing for potential future gas appliances
- Requires electric heat pumps for HVAC and service hot water

Note: Heat pumps allowed to have supplemental gas heating if controls limit supplemental heat to only those times when heat pump can't meet loads



Questions?

energycode@illinois.edu

800-214-7954