2021 Model Energy Code Key Changes and the Wisconsin Uniform Dwelling Code

This document provides an overview of the key provisions of the 2021 International Energy Conservation Code (2021 IECC). It highlights key differences between the current Wisconsin Uniform Dwelling Code (UDC), which was adopted by Wisconsin in December 2015 (effective January 1, 2026). The Wisconsin UDC is equivalent to the 2009 International Energy Conservation Code, with Wisconsin-specific amendments.

The International Code Council published the 2021 IECC in January 2021. The energy code is updated every three years. The 2024 IECC is currently available for adoption. An overview of fundamental 2024 changes will soon be available at www.slipstreaminc.org/codes

STATEWIDE ENERGY SAVINGS AND EMISSION REDUCTION

The 2021 International Energy Conservation Code (IECC) model code is approximately 30% more energy efficient and delivers 36% energy cost savings compared to the 2009 IECC model code. Compared to the Wisconsin Uniform Dwelling Code (UDC), based on the 2009 IECC with amendments, the 2021 IECC, when adopted and implemented, is estimated to have the following Statewide impact for Wisconsin:

ENERGY and EMISSIONS		
Statewide Impact	**First Year**	**30 Year Cumulative**
Energy Cost Savings $	**$1,831,000**	**$592,300,000**
CO_2 emission reduction, Metric Tons	**12,510**	**5,742,000**

HOME BUYER SAVINGS

The 2021 IECC could provide[1] :

- An average life cycle (30 year) savings of $12,411
- Net annual average home energy savings in the first year of $632
- First-year average energy cost savings (percent) 21.6%
- Simple payback average of 7.3 years

WORKFORCE

In addition to saving energy and utility costs, the 2021 IECC is expected to increase the demand for construction and energy professionals, particularly Energy Raters to conduct energy and code diagnostic testing.

DOE estimates that adopting the 2021 IECC compared to the 2009 IECC may result in approximately 400 jobs within its first year of adoption and nearly 10,000 jobs over 30 years for Wisconsin.[2]

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2021 IECC RESIDENTIAL CHANGES

The following information is intended to overview key 2021 IECC residential changes. It is a parts code. The full 2021 IECC residential provisions can be viewed here: 2021 IECC. This document is not intended for code compliance.

2021 Climate Zone and Compliance Pathways

CLIMATE ZONES

2021 IECC Climate Zone (CZ) for Wisconsin is 5A/6A (see additional information in *Figure 1*)

COMPLIANCE PATHWAYS

- **2021 Pathways:** Prescriptive, Performance, Simulated Performance Alternative, ERI.
- The 2021 IECC removes the terms "prescriptive" and "mandatory" in provision labels.
- The code has been restructured so that each compliance path has its section, and the mandatory provisions for each are identified.

2021 Prescriptive Path

The prescriptive path lists minimum requirements for building components, such as insulation, windows, lighting, and HVAC systems. It requires each building component to meet a minimum energy savings value. Compliance is demonstrated through a checklist approach. The Prescriptive Path is the least flexible. However, trade-offs (UA trade-offs) are possible and offer some flexibility in complying with the Prescriptive Path.

AIR LEAKAGE REQUIREMENTS

- All new homes are required to be blower door tested
- Baseline for envelope leakage ≤3.0 ACH50 (2009 IECC ≤ 7ACH)
- For the Performance and ERI paths, envelope leakage to ≤5.0 ACH50 losses accounted for w/ Backstop
- Small units (<1500 sq. ft.) may be tested to ≤0.30 cfm/ sq. ft.
- Additional Efficiency Options (AOE) measured air leakage rate ≤3.0 ACH50 plus HRV/ERV
- No sampling allowed

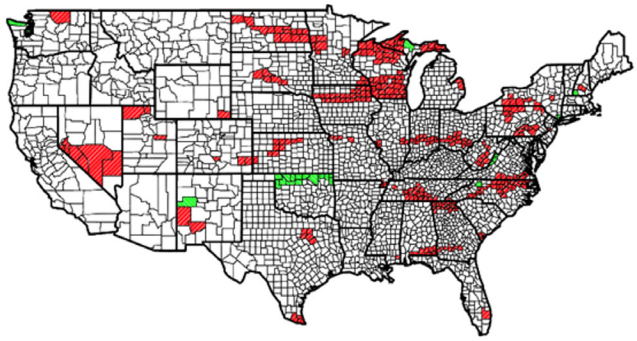
Figure 1: 2021 IECC Climate Zone Changes

Climate zones (CZ) are significant to the IECC as they prescribe many building envelope energy efficiency measures that a building must include. Climate zones are defined at the county level based on temperature, humidity, and rainfall.

In 2020 the climate zone map changed and was significant 2021 IECC change, the first change in nearly 20 years. Based on research from weather data over a 25-year period, about 10 percent of counties nationally were assigned a new climate zone. In most cases, the shift was to a warmer (lower) climate zone. [3]

Counties moving to warmer zones (requirements generally get less stringent)

Counties moving to cooler zones (requirements generally get more stringent)



State	Fraction of New Floor Area in State Reclassified to a New Climate Zone (percent)
Wisconsin	82.68
North Carolina	
North Dakota	
Tennessee	
Indiana	
Ohio	
Texas	
Wyoming	
Pennsylvania	
Virginia	

Table 2 Top ten counties with the most floor space (ft2) reclassified into new climate zones

County, State	Shift in Climate Zone	Floor Area, ft² ('000s)	Fraction of Floor Space in State from County (percent)
Dallas, TX	Down (3A to 2A)	109769	14.12
Palm Beach, FL	Down (2A to 1A)	69206	7.77
Tarrant, TX	Down (3A to 2A)	65159	8.38
Franklin, OH	Down (5A to 4A)	47549	18.01
Marion, IN	Down (5A to 4A)	34518	17.51
Wake, NC	Down (4A to 3A)	33504	14.03
Davidson, TN	Down (4A to 3A)	28054	15.93
Milwaukee, WI	Down (6A to 5A)	27292	21.26
Dane, WI	Down (6A to 5A)	24081	18.76
Hidalgo, TX	Down (2A to 1A)	19596	2.52

These changes highly impact Wisconsin. 82.68 percent of the state's floor area was reclassified, the highest percentage in the country, and Milwaukee and Dane Counties are among the top ten counties nationally reclassified. In the 2009 IECC, Wisconsin was CZ6/7; in the 2021 IECC, Wisconsin is in warmer CZ 5A/6A.[4]

2021 Prescriptive Path—*continued*

MECHANICAL SYSTEMS

- Clarification on duct location and duct insulation requirements
- Removed exception for duct testing in conditioned spaces
- New mechanical ventilation system testing requirements
- Mechanical ventilation is required for all buildings

ELECTRICAL POWER AND LIGHTING SYSTEMS

- ≥70 lumens/watt (100 percent of permanent lighting)
- New interior and exterior lighting requirements
  - Maximum leakage limit for all systems: ≤8.0 cfm/sq.ft.
- Supply and return ducts not entirely in the building thermal envelope must be insulated to not less than R-6

DUCT TESTING REQUIREMENTS

- 2021: Requirement to test ducts. There is no exception for ducts/air handler inside conditioned space
- Testing per ANSI/RESNET/ICC 380 or ASTM E1554
- Maximum leakage allowable for systems located inside conditioned space AND maximum trade-off for duct leakage is ≤8.0 cfm/100 sq.ft.
- Prescriptive requirement and baseline for performance path trade-offs is ≤4.0 cfm/100 sq.ft. or ≤3.0 cfm/100 sq.ft. If an air handler is not installed
- No sampling allowed

TRADE-OFF BACKSTOPS*

- Sets envelope backstop to 2009 IECC
- Envelope Air Leakage
  - ≤3.0 ACH 50
  - Small units (<1500 sq. ft.) ≤0.30 cfm/sq.ft. enclosure area
- Duct Tightness
  - Maximum leakage limit for all systems: ≤8.0 cfm/sq.ft.
- Supply and return ducts not entirely in the building thermal envelope must be insulated to not less than R-6

*Energy code trade-off backstops, also known as "hard limits" or "trade-off limits," are requirements that limit how much a building's envelope can be traded off for better-performing mechanical systems. The objective is to improve the building's overall performance by guaranteeing that the envelope meets a minimum level of performance.[5]

2021 Prescriptive Path Insulation and Fenestration

Prescriptive path insulation and fenestration (windows, doors) values are building energy code requirements for insulation and openings in a building's facade that must be met to comply with the code.

Table 1 shows various building component's R-values (insulation values). It compares the WI UDC to the model 2009 IECC to the model 2021 IECC. The 2021 IECC R-Values are generally more stringent or equivalent to the UDC and model 2009 IECC, with a few exceptions.

Table 1: **Residential R-Values and Fenestration**

CODE	Climate Zone	Glazed Fenestration SHGC	Ceiling	Wood Frame Wall	Floor	Basement Wall	Slab R-Value and Depth	Crawl Space
2009	6A	NR	49	20 or 13+5	30	15/19	10, 4ft	10/13
	7		49	21	38	15/19	10, 4ft	10/13
WI UDC*	6A	NR	49	21	30	15/19	10/20	15/19
	7		49	19+5	38	15/19	10/20	15/19
2021	5A	0.4	60	30 or 20+5 or 0+20	30	15 or 19 or 13+5	10, 4ft	15/19 or 13&5
	6A	NR	60		30		10, 4ft	

2021 Prescriptive Residential U-Factor

Table 2 shows the U-factor required by the WI UDC, model 2009 IECC, and model 2021 IECC for various building components.

The U-factor measures how well a window insulates. U-factor values generally range from 0.20 to 1.20 for windows. The lower the U-factor, the more insulative the window. The SHGC measures how much of the sun's heat comes through the window. It can range in value from 0 to 1.

WISCONSIN UDC PRESCRIPTIVE U-FACTOR COMPARED TO THE 2021 IECC MODEL CODE

Fenestration U-factor (.30) matches 2021(.30)

Basement Wall (.045) exceeds 2021(.050)

Crawl Space (.045) exceeds 2021 (.055)

Slab equivalent 2009 CZ 6/7 (.033), matches 2021 CZ 5/6 (.033/.033)

Table 2: **Residential U-Factor**

CODE	Climate Zone	Fenestration	Basement Wall	Crawl Space Wall	Slab
2009	6A	0.35	0.050	0.065	0.033
	7	0.35	0.050	0.065	0.028
WI UDC*	6A	0.30	0.045	0.045	0.033
	7	0.30	0.045	0.045	0.033
2021	5A	0.30	0.050	0.055	0.033
	6A	0.30	0.050	0.055	0.033

Simulated Building Performance Compliance Pathway

The performance path section R405 requires meeting the same values in the prescriptive path tables (see above), as demonstrated through modeling and calculations. The performance path is the most flexible compliance path, and various trade-offs are permitted. However, this path is complex to document. Designers must document input to computer models, and code officials must verify that inputs match the requirements of code tables.

Like the prescriptive path, it also requires achieving a five percent additional increase in energy efficiency through one of the five AEOs or by demonstrating an annual energy cost less than or equal to 95 of the annual energy cost of the standard referenced design calculated through modeling.

Regardless of how the project achieves the additional five percent in energy efficiency, performance-based projects must meet the minimum thermal envelope requirements of the 2009 IECC as a backstop. Trade-offs and backstops are designed to provide flexibility in meeting code requirements while requiring that efficiency stays within certain levels.

The performance pathway includes the same mandatory measures in the prescriptive path, such as floor, basement, slab insulation, air sealing, duct testing, mechanical ventilation, and interior and exterior lighting.

2021 PERFORMANCE PATH MANDATORY MEASURES (see 2021 IECC Table R405.2)

- Includes improvements in prescriptive tables, lighting efficiency, etc.
- Requires compliance with Additional Efficiency Options or 5% improvement over Standard Reference

TRADE-OFFS AND BACKSTOPS

- Flexibility in air tightness (up to 5.0 ACH50)
- New backstop on duct tightness (8.0 cfm/100sq.ft.)
- New thermal envelope backstop (2009 IECC)
- No equipment trade-offs
- No onsite power trade-offs

Simulated Building Performance Compliance Pathway—*continued*

ADDITIONAL EFFICIENCY OPTIONS

PICK ONE:

- 5% improved envelope UA and SHGC
- Improved heating and cooling equipment
- Improved water heating equipment
- Ducts inside conditioned space
- Air leakage ≤3 ACH50 + ERV/HRV

OR:

- Demonstrate a 5% improvement over the standard reference design

Energy Rating Index (ERI) Compliance Path

The Energy Rating Index (ERI) Compliance Alternative is an optional method for builders to comply with IECC.

The Energy Rating Index (ERI) measures total building energy performance on a scale from 0 to 100. Zero is a zero-energy home, and 100 is a house built to 2006 IECC levels. The lower the ERI value, the more energy-efficient the building.

The ERI pathway was introduced in the 2015 IECC to allow more flexibility in how a builder or contractor meets code requirements.

Like the prescriptive and performance pathways, the ERI pathway also requires achieving a five percent additional increase in energy efficiency. However, instead of the AEOs from the prescriptive or performance pathway, ERI requires meeting an ERI value of at least five percent less than the ERI base level.

The ERI pathway represents the most flexible option available to builders, given that it is a whole-building approach rather than a provisional approach.

The ERI pathway requires energy modeling analyses by third-party Home Energy Rating System (HERS) Rater verification for energy code compliance. ERI is determined in accordance with ANSI/RESNET/ICC 301.

The ERI path caps renewable energy trade-off credit at 5% of total energy use to ensure homes are built to the appropriate efficiency level.

Energy Rating Index (ERI)

Climate Zone	2009 / 2021 Baseline	Baseline + 5% Efficiency
5	82 / 55	52
6	83 / 54	51

Trade-Off Backstop*	2021 IECC ERI
Envelope Air Leakage	Mandatory trade-off maximum: ≤5.0 ACH50 for all CZ
Duct Tightness	Maximum Leakage limit for all systems ≤8.0 cfm/sq.ft.
	Maximum trade-off for duct leakage ≤8.0 cfm/sq.ft.
Envelope Efficiency (no onsite power production)	Total UA of 2021 IECC X 1.15
Envelope Efficiency (including onsite power production)	2018 IECC Prescriptive Table
Onsite power production	Limited to 5% credit for onsite power production

*Energy code trade-off backstops, also known as “hard limits” or “trade-off limits,” are requirements that limit how much a building’s envelope can be traded off for better-performing mechanical systems. The objective is to improve the building’s overall performance by guaranteeing that the envelope meets a minimum level of performance.

Additional Efficiency Package Options (AEO)

A new 2021 IECC provision requires additional efficiency options for all compliance pathways.

Prescriptive Path AEO

CHOOSE ONE OF THE FIVE OPTIONS BELOW TO ACHIEVE COMPLIANCE.

1) 5% IMPROVED ENVELOPE UA AND SHGC

2) DUCTS INSIDE CONDITIONED SPACE

- 100% ducts/air handler entirely within the thermal envelope
- 100% ductless system or hydronic system entirely within a thermal envelope
- 100% thermal distribution system inside conditioned space (per R403.3.7)

3) IMPROVED HEATING AND COOLING EQUIPMENT

- ≥ 95 AFUE nat. gas + 16 SEER air conditioner
- ≥ 10 HSPF/16 SEER air source heat pump
- ≥ 3.5 COP ground source heat pump

4) IMPROVED WATER HEATING EQUIPMENT

- ≥ .82 EF fossil fuel water heater
- ≥ 2.0 EF electric water heater
- ≥ 0.4 SF solar water heater

5) AIR LEAKAGE ≤3 ACH50 + ERV/HRV

- Air Leakage less than 3 ACH50
- Install Energy Recovery Ventilation or Heat Recovery Ventilation

Performance Path AEO: Either through one of the same five options (above) or by demonstrating an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design calculated through modeling.

ERI AEO: This requires achieving five percent additional energy efficiency, which is achieved by meeting an ERI that is at least five percent less than the ERI values in the 2021 IECC. For example, an ERI baseline of 53 would require achieving an ERI of 50.

Above Code Programs

The 2021 IECC allows builders to utilize an above-code programs as an alternative compliance option. Programs such as ICC/ASHRAE700, DOE Energy Star, and LEED are options. However, the project must comply with all the 2021 mandatory provisions, and the envelope efficiency must meet the 2009 IECC prescriptive table.

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EXISTING BUILDINGS IECC CHAPTER 5

Chapter 5 of the 2021 IECC pertains to the alteration, repair, addition, and change of occupancy of existing buildings and structures. Each type of existing building work has specific compliance requirements covered by Chapter 5. The Existing Buildings chapter also addresses historic buildings.

2021 IECC APPENDICES (OPTIONAL STATE/JURISDICTIONAL ADOPTION)

Solar Ready Provisions—Appendix RB

The Solar Ready Provisions are voluntary guidelines for identifying areas on a roof that can be used for future solar panel installation. They are intended to save time and money when installing a renewable energy system during construction or later.

The Solar Ready Provisions apply to detached one- and two-family dwellings and townhouses. They do not require any specific orientation, changes to the roof design, or changes to building plans, and they do not apply to additions or alterations.

Zero Energy Residential Building Provisions—Appendix RC

The Zero Energy Home Appendix allows states and cities to adopt a net zero code. If adopted, the appendix will result in residential buildings having net zero energy consumption over a year. A net-zero-energy home will produce as much energy as it consumes, achieving zero energy usage.

The appendix utilizes the 2021 IECC Energy Rating Index (ERI) per RESNET/ICC 301. To comply, the home must achieve a specified ERI value, which ensures high energy-efficiency performance. The remaining energy use is met with onsite or offsite power generation annually.

Note: There are many definitions of "zero-energy buildings." They may also be referred to as "zero net energy," "net zero energy," "energy zero," or "zero energy."

CZ	2021 Baseline	Baseline + 5% Efficiency	Net Zero Appx w/o OPP*	Net Zero Appx w/ OPP*
5	55	52	47	0
6	54	51	46	0

***OPP**—Onsite Power Production

END NOTES

1 Cost-Effectiveness of the 2021 IECC for Residential Buildings in Wisconsin, July 2021, https://www.energycodes.gov/sites/default/files/2021-07/WisconsinResidentialCostEffectiveness_2021_0.pdf

2 Ibid

3 2021 IECC Climate Zones and Implications for ENERGY STAR Updates. June 29, 2022 https://theber.com/iecc-climate-zone-updates/

4 IMPACT OF ASHRAE STANDARD 169-2013 ON BUILDING ENERGY CODES AND ENERGY EFFICIENCY Rahul Athalye1 , Todd Taylor1 , and Bing Liu1 1 Pacific Northwest National Laboratory, Richland, WA, August 2016 https://publications.ibpsa.org/proceedings/simbuild/2016/papers/simbuild2016_C057.pdf

5 https://codes.iccsafe.org/content/THPOTIRC2021P1/chapter-11-re-energy-efficiency